

## Healthy Joints™ Product Science – Boswellia Abstracts

*{Note: the underlined sections within the text of the abstracts is highlighted for emphasis by us, not the authors}*

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[Phytomedicine](#). 2008 Jun;15(6-7):400-7.

### **Boswellic acids: A leukotriene inhibitor also effective through topical application in inflammatory disorders.**

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Boswellic acids (BA), a natural mixture isolated from oleo gum resin of *Boswellia serrata* comprised of four major pentacyclic triterpene acids: beta-boswellic acid (the most abundant), 3-acetyl-beta-boswellic acid, 11-keto-beta-boswellic acid, and 3-acetyl-11-keto-beta-boswellic acid, is reported to be effective as anti-inflammatory, immunomodulatory, anti-tumor, anti-asthmatic and in Chron's disease. It inhibits pro-inflammatory mediators in the body, specifically leukotrienes via inhibition of 5-lipoxygenase, the key enzyme of leukotriene synthesis, is the scientifically proved mechanism for its anti-inflammatory/anti-arthritic activity. All previous work on BA for its biological activity has been done through the systemic application but no pre-clinical data reported for its anti-inflammatory activity by topical application. We here by report anti-inflammatory activity of BA through this route by applying different acute and chronic models of inflammation i.e., arachidonic acid and croton oil-induced mouse ear edema, carrageenan-induced rats paw edema and adjuvant-induced developing arthritis in rats. The results of the study revealed that the effect observed through this route is in accordance to the study conducted with the systemic route, thus establishing that BA when used through topical application is as effective as through the systemic route.

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[Bioorg Med Chem Lett.](#) 2007 Jul 1;17(13):3706-11.

**Boswellic acids and glucosamine show synergistic effect in preclinical anti-inflammatory study in rats.**

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The present study revealed the synergistic effect of boswellic acid mixture (BA) and glucosamine for anti-inflammatory and anti-arthritic activities in rats. Two studies were conducted, that is, acute anti-inflammatory by carrageenan edema and chronic anti-arthritic by Mycobacterium-induced developing arthritis. Five groups of animals were included in each of the study: the vehicle control, positive control (ibuprofen 100mg/kg), boswellic acids (250 mg/kg), glucosamine (250 mg/kg) and a combination of boswellic acids (125 mg/kg) and glucosamine (125 mg/kg). BA when administered at 250 mg/kg in rats, carrageenan-induced paw edema and Mycobacterium-induced developing arthritis were significantly inhibited. In comparison to boswellic acids, glucosamine when administered at 250 mg/kg showed a mild effect in carrageenan-induced edema and moderate inhibition of paw swelling against developing arthritis. Although the combination of boswellic acids and glucosamine did not affect the acute inflammation to a greater extent yet a significant anti-arthritic activity was observed in rats. In conclusion, a synergistic effect was observed in chronic inflammatory conditions when two chemical entities were administered in combination in preclinical study.

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[Planta Med.](#) 2006 Oct;72(12):1100-16.

**Boswellic acids in chronic inflammatory diseases.**

**Ammon HP.**

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Oleogum resins from BOSWELLIA species are used in traditional medicine in India and African countries for the treatment of a variety of diseases. Animal experiments showed anti-inflammatory activity of the extract. The mechanism of this action is due to some boswellic acids. It is different from that of NSAID and is related to components of the immune system. The most evident action is the inhibition of 5-lipoxygenase. However, other factors such as cytokines (interleukins and TNF-alpha) and the complement system are also candidates. Moreover, leukocyte elastase and oxygen radicals are targets. Clinical studies, so far with pilot character, suggest efficacy in some autoimmune diseases including rheumatoid arthritis, Crohn's disease, ulcerative colitis and bronchial asthma. Side effects are not severe when compared to modern drugs used for the treatment of these diseases.

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[Planta Med.](#) 2006 May;72(6):507-13.

#### **Modulation of Pgp function by boswellic acids.**

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Boswellic acids, the main active ingredients of *Boswellia serrata*, are gaining more and more importance in the treatment of peritumoural oedema and chronic inflammatory diseases. They may be even considered as alternative drugs to corticosteroids in reducing cerebral peritumoural oedema. An important focus for drugs acting in the central nervous system is achieving a high extent of brain penetration. Today there is increasing evidence for the importance of transporters, especially P-glycoprotein (Pgp), for drug disposition and resulting clinical response. Pharmacokinetic studies revealed that the concentrations of the potent keto derivatives, the 11-keto-beta-boswellic acid (KBA) and the acetyl-11-keto-beta-boswellic acid (AKBA), in proportion to boswellic acids lacking a keto group, like the beta-boswellic acid, are much lower in plasma than in the orally administered extract. Moreover the brain/plasma ratio for KBA and AKBA

determined in preliminary experiments on rats was only about 0.51 and 0.81, respectively, in spite of their lipophilicity. Until now little is known about the cerebral pharmacokinetics of boswellic acids and how it may be influenced. Since many drugs are known to interact with Pgp at the level of the intestine and the blood-brain barrier the modulatory potencies of the *Boswellia serrata* extract of H15(R) and the major boswellic acids on the transport activity of Pgp have been determined in two in vitro assays. A human lymphocytic leukaemia cell line (VLB cells) expressing Pgp was chosen as model for human Pgp, and porcine brain capillary endothelial cells (PBCEC cells) were taken as model for the blood-brain barrier using calcein acetoxymethyl ester (calcein-AM) as Pgp substrate. It was found that the *Boswellia* extract, as well as the keto-boswellic acids inhibit the transport activity of Pgp in the micromolecular range in both cell types. No modulation was observed using those boswellic acids which have no keto group in their structure. The inhibition of Pgp at the blood-brain barrier by *Boswellia* extract is probably not relevant for the brain availability of other Pgp substrates, because of the low plasma levels determined for KBA and AKBA. However the presented data could not exclude the possibility of drug interactions caused by modulation of Pgp by extracts of *Boswellia serrata* on the gastrointestinal level.

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[Wien Med Wochenschr.](#) 2002;152(15-16):373-8.

**[Boswellic acids (components of frankincense) as the active principle in treatment of chronic inflammatory diseases]**

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Preparations from the gum resin of *Boswellia serrata* have been used as a traditional remedy in Ayurvedic medicine in India for the treatment of inflammatory diseases. Compounds from the gum with genuine antiinflammatory effects are pentacyclic triterpenes of the boswellic acid type. Boswellic acids inhibit the leukotriene biosynthesis in neutrophilic granulocytes by a non-

redox, noncompetitive inhibition of 5-lipoxygenase. The effect is triggered by boswellic acids binding to the enzyme. Moreover certain boswellic acids have been described to inhibit elastase in leukocytes, to inhibit proliferation, induce apoptosis and to inhibit topoisomerases of leukemia- and glioma cell lines. A series of chronic inflammatory diseases are thought to be perpetuated by leukotrienes. In clinical trials promising results were observed in patients with rheumatoid arthritis, chronic colitis, ulcerative colitis, Crohn's disease, bronchial asthma and peritumoral brain edemas.

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