



Boswellia Serrata Biologically Active Compounds and It's Activities

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I.ABSTRACT

In recent days plant extracts are used in treating disease as it shows good activity against the diseases and they shows reduced ADR when administered. In this review we are discussing about the extract of plant *Boswellia serrata* belonging to the family of BURSERACEA. The major compound extracted from the oleoresin gum of *Boswellia serrata* is boswellic acid, which shows many biological activities. The plant resin from the bark is called as Salai Guggul, Indian Olinatum and Indian frankincense etc. It deals with many biological activities like Anti inflammatory, Anti Cancer, Hyperlipidaemic, Hypoglycaemic, Anti Asthmatic and Anti fungal activities.

INDEX TERMS: *Boswellia serrata*, Boswellic acid.

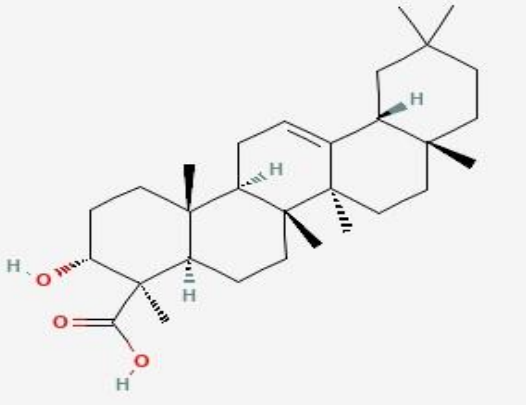
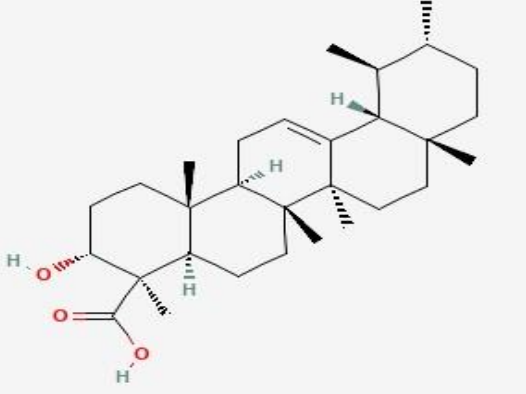
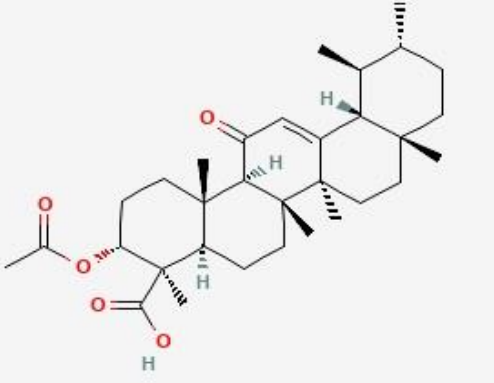
II.INTRODUCTION

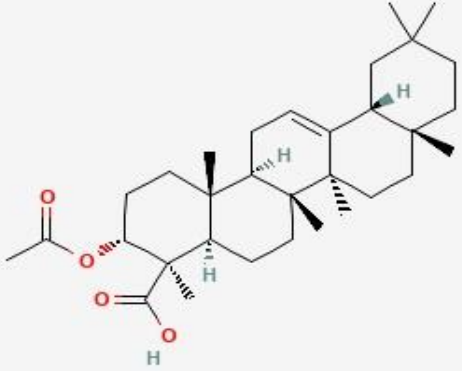
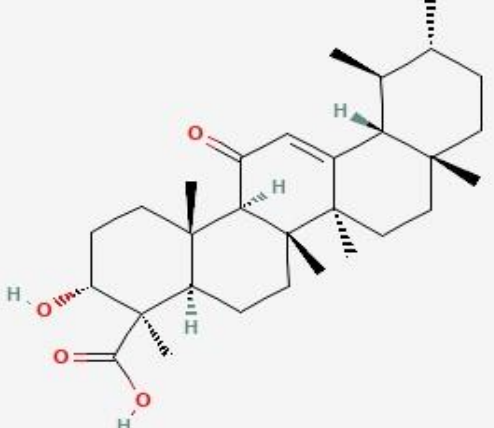
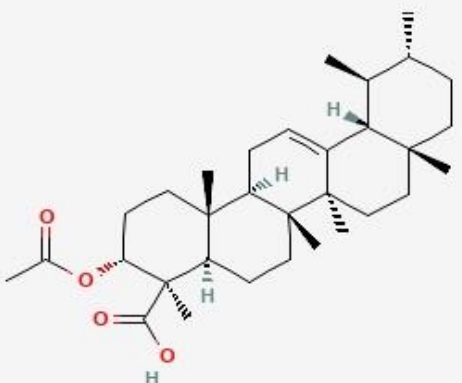
The *Boswellia* genus, which includes *Boswellia serrata* and *Boswellia sacra*, has been used in traditional medicine for centuries and is commonly grow in Oman, Yemen and Saudi Arabia as well as in some parts of India and Africa. The Oleo-gum-resin from the bark of *Boswellia serrata* tree known as salia guggul or Indian Frankincense is used in Ayurveda to treat various inflammatory disease including asthma and bronchitis. The resin contains Boswellic acid a pentacyclic triterpenes acid that has been shown to have Anti inflammatory effects and may be useful in managing chronic inflammatory disease such as ulcerative colitis and rheumatoid arthritis. It is observed that *Boswellia serrata* shows more than 45% of anti inflammatory activity [1,2]. Chronic inflammation will cause severe health issues such as cardiovascular disease, neurodegenerative disorder, cancer and diabetes, but research has shown that certain dietary poly phenols such as those found in olive, green tea and turmeric have anti inflammatory properties and many reduce the risk of these disease. The plant LIBRA [Levels of Intake, Benefits and Risk Assessment, Conducted by European commission] project aims to evaluate the health benefits and risk of plant food supplements, including those with anti-inflammatory properties, and promotes science based decision making in the regulation of these supplements [3]. Nile tilapia is a popularly cultured species in many tropical countries, and the use of *Boswellia Serrata* resin extract as a feed additives could potentially improve its growth performance, immune response, disease resistance and anti oxidant status according to a new study [4]. Recent findings suggest that inhibition of inflammatory pathway constitutes a new therapeutic strategy for Osteoarthritis which is a most common type arthritis in adults and characterised by excessive degradation of the extracellular matrix leading to pain in the affected joints. This loss of aggrecan, an increase in matrix metalloproteinases and the involvement of inflammatory component induced symptoms are closely associated with OA (osteoarthritis). MMP's (matrix metalloproteinases) are endogenous proteolytic enzymes induced by proinflammatory cytokines, which can contribute to the pathogenesis of several condition including arthritis, tumour invasion and metastasis, suppression of proinflammatory cytokines and MMP's (matrix metalloproteinases) therefore may be valid approach to OA (osteoarthritis) treatment [5]. *Boswellia serrata*, commonly known as Sallai or frankincense is a highly effective herbal drug extracted from the oleogum resin of *Boswellia* trees. This extract rich in boswellic acid and pentacyclic triterpene, has been found to be effective in

treating inflammatory disorder such as chron's disease and colitis ulcerations as well as being used as antiseptic in mouth washing and asthma with cough care [1].

III.CHEMISTRY

Boswellia serrata contains extract from its essential oils which contains α -pinene as a major compounds ,some monoterpenoids are also identified which includes β - pinene ,cis-verbenol , trans-pinocarveol ,borneal ,myrcene ,verbenone ,limonene ,thuja ,p-cymene and sesquiterpene like α -copane also identified. The major component found in *Boswellia serrata* shown the presence of many types of boswellic acid which are mentioned in Table1. [6].

STRUCTURE	NAMES AND USES
	<p>alpha-Boswellic acid Other names: 1.(4R)-3alpha-Hydroxyolean-12-en-24-oic acid 2. 3alpha-Hydroxy-12-oleanen-24-oic acid</p> <p>Uses:</p> <ul style="list-style-type: none"> • Alzheimer's disease
	<p>beta-Boswellic acid Other names: 1.(4R)-3alpha-Hydroxyurs-12-en-24-oic acid</p> <p>Uses:</p> <ul style="list-style-type: none"> • Apoptosis of cancer cells
	<p>3-Acetyl-11-keto-beta-boswellic-acid Other names: 1.(4R)-3alpha-Hydroxyurs-12-en-24-oic acid 2.3-O-Acetyl-11-keto-beta-Boswellic Acid</p> <p>Uses:</p> <ul style="list-style-type: none"> • Cancer • Arthritis • chronic colitis, ulcerative colitis • Crohn's disease • bronchial asthma

	<p>3-alpha-O-acetyl-alpha-boswellic acid other names:</p> <ol style="list-style-type: none"> 1. 3-O-Acetyl-α-boswellic acid 2. Acetyl-α-boswellic acid <p>Uses :</p> <ul style="list-style-type: none"> • Strong anti inflammatory activity
	<p>11-Keto-beta-boswellic acid Other names:</p> <ol style="list-style-type: none"> 1.Keto-β-boswellic acid 2.11-Keto Boswellic Acid <p>USES:</p> <ul style="list-style-type: none"> • Cancer • Arthritis • Chrons disease
	<p>3-Acetyl-beta-boswellic acid other names :</p> <ol style="list-style-type: none"> 1.Acetyl-α-boswellic acid 2.Acetyl-β-boswellic acid <p>Uses:</p> <ul style="list-style-type: none"> • Anti Tumor • Anti inflammatory

IV.BIOLOGICAL ACTIVITIES

4.1_ANTI INFLAMMATORY ACTIVITY:

Various scientific studies support the assert that *Boswellia serrata* possesses powerful anti-inflammatory and anti-atherosclerotic properties have reported the analgesic and anti-inflammatory effects of BA in combination with Myrrha, a herbal gel containing Boswellia extract for the treatment of arthritis. It indicated that BA can directly inhibit 5-LO, suppressing the synthesis of 5-LO products in common in vitro models[7].Boswellic acid when used on a new method called papaya latex method inhibits inflammation by 35% this model is sensitive to slowly acting[8].

4.2 ANTI-CANCER ACTIVITY:

Numerous studies have documented the anticancer activity of BA. In colorectal cancerous cells, AKBA[Acetyl-11-keto-beta-boswellic acid] has been reported in [9], as a chemoprotective agent by modulating specific micro-RNA pathways. [10] have found a correlation between lupeolic and boswellic acid contents with TNF- α [Tumour necrosis factor α], IL-1 β [inter leucine-1 β], IL-6[inter leucine-6], IL-8[inter leucine-8], and IL-10[inter leucine-10] inhibition. They have also demonstrated toxicity against human triple-negative breast cancer cell lines MDA-MB-231[M.D. Anderson - Metastatic Breast 231], in vitro. In the Ehrlich tumor model, BA significantly inhibited the ascetic and solid tumours [11]. Treatment with BA at 25 mg/kg resulted in a decrease in VEGF[Vascular endothelial growth factor] and TNF- α [Tumournecrosis factor] levels, while the IL-12 levels were increased. BA treatment showed antiangiogenic potential by decreasing peritoneal angiogenesis and micro vessel density[7]. Application twice daily of Boswellin with 5nmol TPA topically for 16 weeks to previously treated mice with dimethyl-benzanthracene shows inhibition of tumours by 87-99%. Additionally, natural Boswellia extract compounds have been shown to exhibit anti-inflammatory properties in human peripheral mononuclear blood cells and mouse macrophages by inhibiting tumor necrosis factor[8].

4.3 HYPER LIPIDEMIC AND HYPOGLYCAEMIC ACTIVITY:

Boswellia serrata extract is solubilized in water and administered to rats on antherogenic diet that shown and increase in HDL and decrease in total cholesterol by 38-48%. *Boswellia serrata* oleo gum resin reported a good anti-diabetic activity in non insulin dependent diabetes mellitus[8]. When 2.5% cream of *Boswellia serrata* extract shows that the oral use has higher effect in reducing blood glucose level and also they well maintain the lipid profile. While coming to the Wound healing property it shows that taking *Boswellia serrata* extract in both oral and topical ways simultaneously shortens the time of wound healing[12]. Consumption of *BSE* 900mg daily will help to decrease the risk factors that are combined with type 2diabetic mellitus. Regular consumption of *Boswellia serrata* in the diet by individuals with diabetes may help in maintaining their Fructosamine levels, hepatic enzyme activities, and lipid profiles at normal levels[13].

4.4 ANTI ASTHMATIC ACTIVITY:

Salai guggul an alcoholic extract when administered improvement in chronic asthma improved for about 70% of the patient and they also shown improvement in their symptoms[8]. Boswellic acid significantly decreased the levels of Th2 cytokines and OVA-specific IgE, as well as inhibited the infiltration of airway inflammatory cells caused by allergens. This resulted in a decrease in the number of eosinophils and total inflammatory cells in the BALF. The effectiveness of Boswellic acid on airway inflammation was confirmed by lung histology. Based on these findings, it can be inferred that Boswellic acid can be considered as an anti asthmatic agent and may be beneficial in the treatment of allergic asthma[14].

4.5 ANTI FUNGAL ACTIVITY:

In this method the anti anti microbial activity is carried out with the help of anti bio film agent which acts against *candida species*. Now a days major fungal infections are caused because of the candida species and the given report of this work seems that the boswellic acids caused cut as antifungal drug against the suspension population of candida yeasts with antifungal drugs of their effects in combination should be studied in search of synergy that the Boswillus acid increases the release of cell [15].

4.6 ACTIVITY OF 5-LOXIN :

The study reveals that 5-loxin supplementation reducing OA[osteoarthritis] pain through the combined inhibition of pathogenic inflammatory and cartilage degeneration. More over 5-Loxin reduced the blood serum levels of MMP's including MMP2[Matrix Metellopeptidase-2] and MMP13[Matrix Metellopeptidase-13] both which are attached with degradation of cartilage during OA development, there by indicating that addition reduced pain, 5-Loxin could slow down the OA progression[4].

4.7 ACTIVITY ON WOMENS REPRODUCTIVE SYSTEM:

The symptoms of vulvovaginal candidiasis (VVC) showed significant improvement in both the intervention and control groups, with no notable difference between the two. *Boswellia serrata* Roxb. ex Colebr [Cosciniumfenestratum]. was demonstrated to be effective in managing VVC. However, to further reinforce scientific evidence, more research with a more rigorous design and wide range of sample is needed. The out come shows the following activities like changes with effectiveness of a treatment on several outcomes related to vulval itching

(pruritus), vaginal discharge, painful urination (dysuria), recurrent genital pain (dyspareunia), and quality of life (QoL). Additionally, the study measured mycological clearing through a potassium hydroxide (KOH) test as a secondary outcome measure.[16]

4.8 ACTIVITY AGAINST DIARRHOEA:

Boswellia serrata is used in a wide range for the treatment of Inflammatory Bowel Disorder the main mechanism in this is that the BSE will inhibit the 5-Lipoxygenase by increasing the Leukotriene synthesis this shows improvement in inflammatory bowel disease and also reduces the recovery time of diarrhoea[17]. CASP a tablet made from *Boswellia* Phytosomes which is a Lecithin-Based derivative has reduced the time interval in treatment of Diarrhoea by 1.5 days[18].

4.9 ACTIVITY AGAINST STRESS:

It's found that plasma corticosterone levels exhibited a diurnal variation and that the application of jojoba oil (vehicle) to control animals increased plasma corticosterone levels, indicating mild stress caused by the application procedure. The undiluted (1:1) frankincense essential oil was found to increase plasma levels of corticosterone, while 1:10 and 1:10' dilutions of the same reduced corticosterone levels .[19]

4.10 NEURODEGENERATIVE ACTIVITY:

Due to the lack of effective therapy for neurodegenerative disorders. The interest in this subject is increasing exploring natural products which have pharmacological activity and exhibit neuroprotective effects. *Boswellia*, a genus of plants, has been identified as a potential candidate in treatment in loss of nervous system cells because it targets various molecular pathways involved in their pathogenesis. These plants are found to regulate neurotrophic factors as follows BDNF[Brain derived Neurotropic factor], apoptotic proteins like pro-apoptotic caspase-3 and anti-apoptotic bcl-2, and redox status. They also have been shown to be effective at controlling inflammatory and cholinergic systems, which are important in preventing and treating neurodegenerative diseases. While the evidence is promising, further studies and clinical trials on *Boswellia* and its constituents are needed to fully understand their potential in treating neurodegenerative diseases.[20]

4.1 GUT MICROBIOME ACTIVITY:

The study aimed to investigate the impact of Acetyl-11-keto- β -boswellicacid , a compound found in *Boswellia serrata*, on Gut microbiome of an healthy mice. Results showed differing effects of Acetyl-11-keto β -boswellic acid consumption on the gut microbiomes in female and male mice, and also indicated effects on blood metabolites. The study observed that AKBA[Acetyl-11-keto-beta-boswellic acid] suppressed the growth of Akkermansiahaveless effect on Bifidobacterium. Further research is necessary to determine the direct effect of on different bacteria and the gut microbiome, as well as the underlying mechanisms of action.[21]

4.12 ACTIVITY AGAINST ABDOMINAL BLOATING:

Boswellia Serrata lecithin based derivatives has successfully treated abdominal bloating in subjects with small bowel dysbiosis and IBS through the use of a combination of *Curcuma longa* and *Boswellia serrata* extracts (in the form of curcumin *Boswellia* phytosome) and a low FODMAP [fermentable oligosaccharides, disaccharides, monosaccharides and polyols] diet (LFD). This study is noteworthy for its primary endpoint evaluation of abdominal bloating in IBS patients, and for being one of the few studies to test the efficacy of LFD in treating IBS in a Mediterranean country.[22]

V.SAFETY AND BIOAVAILABILITY ENHANCEMENT OF FRANKICSE :

Different studies have shown that administering *Boswellia serrata* to animals did not result in any mortality or adverse effects on their health. *Boswellia* is commonly consumed orally in the form of capsules, tablets, or decoctions made from its bark, and the appropriate dosage is based on historical experience or studies. Standardization of *Boswellia* products is complicated since production varies among different suppliers, and clinical results are therefore difficult to compare. The effectiveness of frankincense extracts is unclear whether LTB₄[Leukotriene B₄] can be produced in vivo because the levels of BAs in the bloodstream and brain are relatively low, and they cannot effectively suppress 5-LOX in whole blood. Researchers have attempted to increase BAs' bioavailability using various methods, including administering them with anionic drugs, incorporating them into lecithin delivery processes, and using nanoparticle delivery mechanisms such as liposomes, emulsions, and micelles. Synthetic derivatization of BAs has also been explored as a means to overcome the bioavailability problem.[1].

VI.RESULT AND DISCUSSION:

From this study we have found that the plant species of *Boswellia serrata* has contains major active compounds like α -Boswellimcacid, β -Boswellic acid, Acetyl-11-keto-beta-boswellic, Acetyl α Boswellicacid, Acetyl β -*Boswellic acid*, 11-Keto- β -boswellic Acid and it contains some other compounds that are extracted from Boswellic acid such as α -pinene as a major compounds, some monoterpenoids are also identified which includes β - pinene, cis-verbenol, trans-pinocarveol, borneol, myrcene, verbenone, limonene, thuja, p-cymene and sesquiterpene like α -copane also identified [1] Now coming to the activity they shows various activities like Anti-inflammatory, Anti-Cancer, Hyper lipedeamic, Hypoglycemic, antiasthmatic, Anti-Fungal and they also shows activity of 5-loxin in anti inflammatory, recently studies shown that they also shows activities against Vulvovaginal Candidiasis, Diarrhoea, Stress, Abdominal blotting and also Gut Microbial activity and Neurodegenerative activity. Further researches on *Boswellia Serrata* species are required to find more activities which will be helpful in future.

VII.ACKNOWLEDGEMENT:

“Milestones in life are achieved not by individual efforts but by blessings and guidance of elders, near and dear ones”

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