

Boswellia Serrata: Herbal Remedy to Reduce Inflammation

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<p>Received 20-01-2023</p>	<p>Abstract. Incense made from Boswellia resin has been used for centuries, along with the plant's essential oil, in alternative medical practises. Boswellia serrata, also known as Salai or Salai guggul, is a huge tree that spreads out over a wide area. It is native to the arid highlands of India, Northern Africa, and the Middle East. The incision in the tree trunk is tapped for oleo gum-resin, which is then kept in a bamboo basket to remove the oil content and harden. After extraction, gum-resin is sorted and categorised by taste, colour, form, and size. Boswellia serrata is mostly sourced from the Indian states of Andhra Pradesh, Gujarat, Madhya Pradesh, Jharkhand, and Chhattisgarh. It goes by a variety of names depending on where you are in the world. Thirty to sixty percent of oleo gum-resins are resin, five to ten percent are essential oils that are soluble in organic solvents, and the balance is polysaccharides. Boswellia serrata gum-resin extracts have a long history of usage in traditional medicine for the treatment of chronic inflammatory illnesses. The resinous portion of Boswellia serrata contains a wide variety of anti-inflammatory compounds. These compounds include monoterpenes, diterpenes, triterpenes, tetracyclic triterpenic acids, and four primary pentacyclic triterpenic acids. These primary acids are -boswellic acid, acetyl—boswellic acid, 11-keto—boswellic acid, and acety Inflammation is caused by an enzyme known as 5-lipoxygenase, and acetyl-11-keto-boswellic acid is the most efficient inhibitor of this enzyme.</p>	<p>Keywords: Herbal remedy, Anti-inflammatory, Boswellia serrata, Serratol, Thujene</p>
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INTRODUCTION:

Plants and plant products have provided humans with food, shelter, clothes, flavourings, scents, and vital components for medicines from the beginning of time. There has been significant use of natural resins in this regard. As coating materials, adhesives, ingredients in cosmetic preparations, scents in everyday rituals and religious rites, and for a variety of medicinal reasons, they have also been put to use. The ancient Hindus, Babylonians, Persians, Romans, Chinese, and Greeks, as well as the ancient Americans, used natural resins primarily for

embalming and its incense at cultural events. The ancient Americans also used natural resins for medicinal purposes. They thought that the smoke and aroma produced when these things were exposed to fire would not only appease their souls but also satisfy their gods. The ritualistic use of fire to consume these organic resins was deeply ingrained in their society. During sacrifice rites and everyday rituals, they burnt these resins to appease the gods, protect their souls from the power of bad spirits, and pay respect to the dead and the living¹⁻⁵.

Boswellia serrata, also known as Salai or Salai guggul, is a branching tree that grows to be anywhere from moderate to large in size and belongs to the family Burseraceae and the genus Boswellia. It may be found in the dry highland regions of India, Northern Africa, and the Middle East. There are around 17 plant genera and 600 plant species in the Burseraceae family, and they may be found in all tropical climates. Somewhere in the neighbourhood of twenty-five species make up the genus Boswellia, with the vast majority found in Arabia, the northeastern coast of Africa, and India. Three of these species have been known as "genuine Frankincense trees" since ancient times⁶⁻⁸.



Fig. 1: Boswellia serrata

Most of India's *Boswellia serrata* comes from the states of Andhra Pradesh, Gujarat, Madhya Pradesh, Jharkhand, and Chhattisgarh. It goes by a variety of names depending on where you are in the world. Salai, also known as oleo gum-resin, is an exudation from plants of the genus *Boswellia* (Family: Burseraceae). It's collected in a bamboo basket after being tapped from the tree's trunk. For over a month, the semi-solid gum-resin sits in the basket while its fluid component, locally known as ras, slowly seeps out. The remaining semi-solid to solid residue is the gum-resin, which progressively hardens into tear-shaped, amorphous, fragrant products. Then, the bark is removed manually and the material is broken up into smaller pieces using a wooden mallet or chopper. Gum-resin is then sorted by taste, colour, form, and size. There are typically four grades available: "Superfine," "Grade I," "Grade II," and "Grade III." The hot, pleasant-tasting, somewhat bitter fresh gum is derived from the tree. The ancient Egyptians, Greeks, and Romans all called this precious resin "frankincense," and they used it as a highly regarded incense, a fumigant, and a general-purpose aromatic. Powder and sticks of incense made from it are the most common end product⁹⁻¹¹.

About 30–60 percent of oleo gum-resins are resin, 5–10 percent are essential oils that are soluble in organic solvents, and the rest 65–70 percent are polysaccharides that are soluble in water (65 percent arabinose, galactose, xylose). Resin makes up about 30–60 percent of oleo gum-resins. The inclusion of essential oils gives the resins their pleasant scent, which contributes to their economic value. Gum-resin essential oil is one of the most popular oils for use in aromatherapy, paintings, and varnishes. Oleo gum-resin that is 100% pure and has been harvested at the right time of year will solidify very gradually, maintaining its golden colour and clarity. The colour may range from a light golden brown to a dark greenish brown according on the location, time of year, tree size, wound surface, collecting method, and length of time the wood

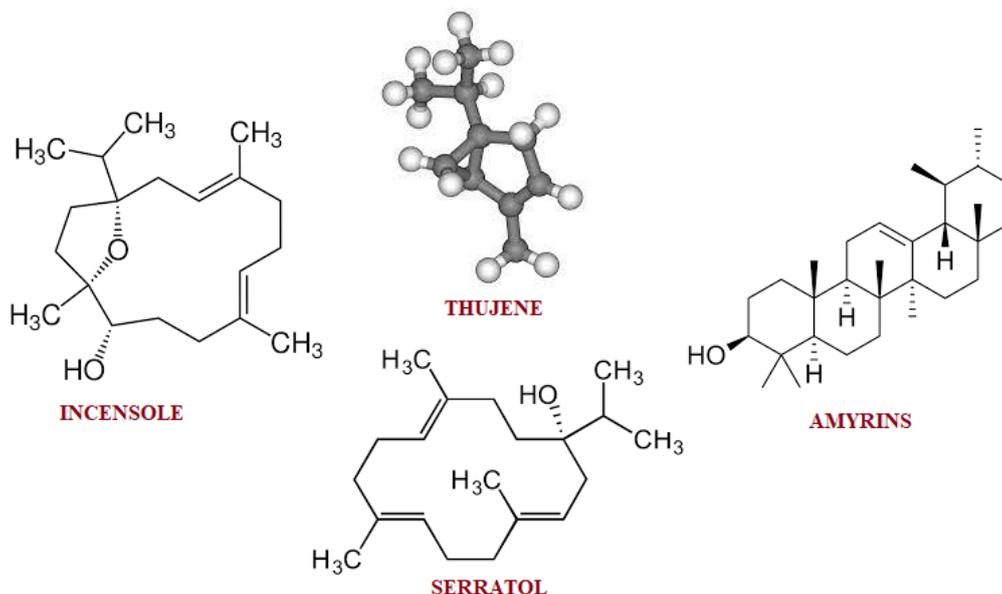
has been stored. Additionally, autoxidation, polymerization, and enzymatic processes all contribute to the darkening of the resin's colour. Once the tree has been damaged in March or April, the resin is often collected throughout the summer and fall. The *Boswellia* tree has a three-year window in which it may generate high-quality exudates. The obtained resin is of much lower grade beyond this time frame. So, after the harvesting season, the tree has to rest for a while^{12, 13}.

Traditional Applications:

There are few plants more revered in Ayurveda than *Boswellia serrata*, which has been used for thousands of years. One Sanskrit name for *Boswellia*, "Gajabhakshya," says that elephants like to include this plant in their diet. The antirheumatic (antiarthritis) action of gugguls, the gum-resins of trees, is described in the first two pillars of Ayurveda. Traditional Ayurvedic and Unani texts note that in addition to its beneficial use for arthritis, this gummy resin is also an effective remedy for diarrhoea, dysentery, ringworm, boils, fevers (antipyretic), skin and blood diseases, cardiovascular diseases, mouth sores, bad throat, bronchitis, asthma, cough, vaginal discharges, hair loss, jaundice, haemorrhoids, syphilitic diseases, and In addition to this, it possesses qualities that are stimulating, diaphoretic, astringent, and diuretic, and it causes the body to experience an internal stimulation. It has been shown to be effective as an anti-arthritic, anti-inflammatory, anti-hyperlipidemic, anti-atherosclerotic, analgesic, and hepatoprotective drug, according to both clinical and experimental findings (protects the liver)¹⁴⁻¹⁶.

Chemical constituent:

The resin of the *Boswellia serrata* tree includes a variety of terpenes, including monoterpenes (-thujene), diterpenes (macrocyclic diterpenoids such as incensole, incensole oxide, iso-incensole oxide, a diterpene alcohol [serratol]), triterpenes (such as - and -amyrens), and pentacyclic (tirucall-8,24-dien-21-oic acids). The fundamental structures of the four pentacyclic triterpenic acids that may be discovered in their respective products (boswellic acids)^{17, 18}.



Previous studies:

Research has been performed in search of a medicine that would be effective against SARS-CoV-2. Most research efforts are directed on developing or improving upon existing pharmaceutical treatments (drug repurposing). Utilizing phytochemicals for therapeutic development may aid in the fight against COVID-19, since they have shown effectiveness in managing illnesses for millennia. This research concludes that the top five ligands, with the exception of -Amyrin, bind to the catalytic dyad amino acid residues of Mprovia distinct bonding interactions. The affinity of the top five ligands was determined by utilising AutoDock and PATCHDOCK in a comparative research. It was discovered that among these four receptors, Euphane is the most powerful inhibitor. Validating Euphane's potential as a therapeutic medication for the treatment of COVID-19 will need more in-vitro investigations¹⁹.

In disc diffusion, resazurin microtitre-plate, and micro-dilution broth susceptibility tests, the essential oil that was extracted at 150 and 180 degrees Celsius showed the highest levels of antibacterial and antifungal activity, respectively. It has been shown that using superheated steam to extract essential oil from oleo-gum-resin is an effective method that boosts the rate of essential oil recovery as well as the antibacterial activity¹⁷.

The pharmacological and clinical data suggests that *B. serrata* may be useful in treating people with COVID-19 who also suffer these symptoms. Because of their anti-inflammatory, immunomodulatory, cardioprotective, anti-platelet aggregation, antibacterial, antifungal, and extensive antiviral characteristics, boswellic acids and *B. serrata* extract may have therapeutic effects. Due to the restricted oral bioavailability and improvement in the cleanliness of the buccal and oral cavities, the traditional use of *B. serrata* gum, which consists of chewing the gum, may be an ideal and only alternative for persons living in poverty. It is possible that the bulk of the therapeutic advantages are the result of direct interaction with IB kinases and downregulation of nuclear factor kappa B-regulated gene expression. In addition to suppressing the synthesis of traditional 5-lipoxygenase products, more recent studies have shown that BA is also capable of switching production away from pro-inflammatory leukotrienes and toward anti-inflammatory LOX-isoform-selective modulators. This is an important finding. In the prior approach, it was hypothesised that BA solely worked to prevent the production of canonical 5-lipoxygenase products. In spite of the fact that these studies acknowledge boswellic acids and *B. serrata* extract as having the potential to be useful in the treatment of COVID-19, the data from the non-clinical studies suggest that additional clinical results are required to definitively determine

whether or not there is sufficient evidence of the benefits of these compounds against COVID-19. In spite of the fact that these studies acknowledge the advantages of boswellic acids and *B. serrata* extract, the conclusions shown here still stand²⁰.

This meta-analysis included evidence from randomised controlled studies comparing *Boswellia* or its extract to a placebo or standard medical care for OA patients. The visual analogue scale (VAS), the Western Ontario and McMaster Universities Disability Index (WOMAC) pain, WOMAC stiffness, and WOMAC function, as well as the lequesne index, were the primary instruments for collecting data²¹.

LI13019F1 was tested for acute and subchronic (28-day) toxicity in Wistar rats and for acute dermal and ocular irritation in New Zealand white rabbits in the current set of investigations. Bacterial and mouse bone marrow erythrocytes were used to test LI13019F1 for mutagenic and clastogenic effects, respectively. Research was conducted in accordance with standards set by the Organization for Economic Co-operation and Development. No deaths or toxicity symptoms were seen in Wistar rats given a maximum dosage of 2,000 mg/kg LI13019F1 in acute oral and acute dermal toxicity experiments. New Zealand white rabbits exposed to LI13019F1 showed no signs of skin or ocular discomfort. Wistar rats treated with LI13019F1 for 28 days showed no dose-related damage in terms of body weight, organ weight, or hematology/clinical chemistry parameters in a repeated-dose oral toxicity study. LI13019F1 had an estimated NOAEL of 1,000 mg/kg/day in both male and female rats. There was no evidence of mutagenesis or clastogenicity in either a bacterial reverse mutation test or a micronucleus assay in mouse bone marrow erythrocytes using LI13019F1. Taken together, these findings show that LI13019F1 is safe throughout a wide range of conditions²².

Finally, we show that the same botanical species extracted in various ways (such as dry and hydroenzymatic extracts) has notably varied biological effects on endothelial cells. However, depending on the dose and formulation, cytotoxicity or proliferative stimulation may occur instead of a protective effect. *B. serrata* extracts have been shown to have anti-inflammatory activity on endothelial cells, which indicates a potential pharmaceutical application for cardiovascular health. When using these herbs for

human or animal phytotherapy, this should be given considerable thought²³.

It will be essential to conduct a more in-depth experiment on a larger case study before any definitive findings can be drawn. It is important to note, however, that the quality of commercial extracts may vary widely in terms of their chemical content, thus caution is warranted. These early results do recommend further investigation into frankincense because of its prospective capacity to interfere, maybe also via such regulatory mechanism, with immunological dysregulation characteristic of a wide range of immune illnesses²⁴.

Dosage:

Typically, people take *Boswellia* in the form of a pill, tablet, or a decoction made from the bark. Dosage advice is derived from standard practise or existing studies. It is still unclear what the ideal dosage is that strikes a balance between safety and effectiveness. *Boswellia* products are already difficult to standardise because of variations in production from one producer to the next. It's worth noting that different brands' products were utilised in different experiments, thus it's possible that the results may not be directly comparable²⁵.

Products sold under their own brand name that include *Boswellia serrata*:

Olibanum has been used as a fixative in many of the top-selling fragrances, soaps, creams, lotions, and detergents because of its distinctive, pleasantly oriental aroma. Pharmaceutical industries' involvement has resulted in a third market for olibanum. As a result of its antibacterial, anti-arthritic, and anti-inflammatory properties, it has been utilised in traditional medicine since ancient times. As a result, olibanum has been studied intensively over the last 20 years in an effort to better characterise its medical benefits and identify the ingredients responsible for these effects. Because of this, quickly determining how to discriminate between the various olibanum kinds and identifying their diagnostic indicators ought to be the major objective. The essential oil and phytopharmaceuticals made from the resin acids extracted from olibanum may both benefit from this sorting. This identification is important for customer happiness even from a monetary standpoint²⁶.

Boswellia serrata is found in a number of commercially accessible, branded formulations are:-

Sabinsa Corporation's Boswellin®, a trademark, first appeared on store shelves in the United States and Europe in 1991. Capsaicin may be used orally in the form of capsules or pills, or topically in the form of a pain-relieving cream. Boswellic acid products are typically used orally twice day, at dosages between 150 and 250 milligrammes per capsule or tablet. Himalayan Drug Company, Makali, Bangalore, as Licensed User of the Trade Mark held by MMI Corporation, produces Shallaki®, containing 125 mg Boswellia serrata in each capsule; this product has good anti-inflammatory and analgesic effects; it is helpful in reducing joint-pain. One pill, twice day, will set

you back Rs. 75/-. (Batch No. F297001G). Visit www.himalayahealthcare.com to learn more about Himalaya and its products²⁷.

Niltan® is a 15-gram tube of topical lotion. Dr. Reddy's Laboratories Limited of Hyderabad, India, created this blend of potent herbal extracts (boswellin, arbutin, liquorice extract and coriander seed oil in a cream base). Diminishes melanin synthesis by inhibiting the enzyme tyrosinase in the skin, which in turn lowers the creation of dark skin²⁸.

Two capsules of Rheumatic-X®, made by Sunrise Herbals in Varanasi (U.P., India), twice daily or as advised by a doctor for rheumatoid, gouty, osteoarthritis, and sciatic pain¹⁴.

Table 1: Marketed product of Boswellia serrata

S. no.	Brand name	Marketed by
1	Glucosamine HCL with Boswellia	Nutrilit
2	Cart Fit	Streamline Pharma Private Limited
3	Boswellia Serrata Extract	Ayurleaf Herbals
4	Boswellia	Phyto Drug Private Limited
5	Salai Guggul	Wilson Drugs & Pharmaceuticals Private Limited

CONCLUSIONS

In religious and cultural events across cultures and time, the resin of Boswellia species ('frankincense,' 'olibanum') has been burned as incense. In addition to its cosmetic value, it has long been appreciated for the benefits it provides in the medical field, particularly in the treatment of inflammatory illnesses, cancer, wound healing, and antibacterial activity. Boswellia has not been investigated extensively, and there are still information gaps between the traditional applications of the resin and the scientific facts accessible despite its historical, religious, cultural, and therapeutic significance.

If a patient has been helped by a particular complementary or alternative therapy in the past, they can decide to continue receiving that treatment. Interest in the use of plant materials as a source of medicines for a wide variety of human ailments is being fueled by a number of factors, including rapid population growth, an inadequate supply of branded medicines, an alarmingly prohibitive cost of treatment, the adverse side-effects of several allopathic drugs, and ever-increasing resistance to the drugs that are currently used to treat infectious diseases. Because of the reasons above mentioned, more and more people are turning to herbal medicines.

Environmental fluctuations, local cultural practises, diverse geographical distribution, rising labour costs, non-selection or improper selection of the suitable plant-stock, and pervasive exploitative practises by the pharmaceutical industry are all factors that contribute to making it difficult to ensure a constant and reliable supply of the source-materials. These factors all contribute to the fact that it is difficult to ensure a constant and reliable supply of the source-materials. It is necessary to maintain a constant focus on plant molecular biology, plant-tissue culture techniques, extensive and intensive research on the rationale and methodology of Ayurvedic practises, isolation of the active constituents, and the development of new therapeutics, standardisation, and validation of known herbal medicines, and other related aspects in order to cultivate, conserve, and preserve important plant species. In reality, now is the moment for tremendous advances in medicine to be made in order to preserve humanity from the growing number of diseases.

REFERENCES:

- [1]. Alam A. Herbs that heal spices: The hoard of natural remedies. *Ann Phytomed*. 2019;8(2):7-18.

- [2]. Zabihi O, Ahmadi M, Nikafshar S, Preyeswary KC, Naebe M. A technical review on epoxy-clay nanocomposites: Structure, properties, and their applications in fiber reinforced composites. *Composites part b: engineering*. 2018 Feb 15;135:1-24.
- [3]. Yadav VK, Choudhary N, Heena Khan S, Khayal A, Ravi RK, Kumar P, Modi S, Gnanamoorthy G. Incense and incense sticks: types, components, origin and their religious beliefs and importance among different religions. *J. Bio Innov*. 2020;9:1420-39.
- [4]. Balick M. *Rodale's 21st-century Herbal: A Practical Guide for Healthy Living Using Nature's Most Powerful Plants*. Rodale Books; 2014 Apr 29.
- [5]. Johnson D. *God is watching you: How the fear of God makes us human*. Oxford University Press, USA; 2016.
- [6]. Kumar SS, Bhosle D, Janghel A, Deo S, Raut P, Verma C, Agrawal M, Amit N, Sharma M, Giri T, Tripathi DK. Indian medicinal plants used for treatment of rheumatoid arthritis. *Research Journal of Pharmacy and Technology*. 2015;8(5):597-610.
- [7]. Van Wyk BE. A family-level floristic inventory and analysis of medicinal plants used in Traditional African Medicine. *Journal of ethnopharmacology*. 2020 Mar 1;249:112351.
- [8]. Spengler III RN. *Fruit from the sands: the Silk Road origins of the foods we eat*. Univ of California Press; 2019 Jul 23.
- [9]. Siddiqui MZ. *Boswellia serrata*, a potential antiinflammatory agent: an overview. *Indian journal of pharmaceutical sciences*. 2011 May;73(3):255.
- [10]. Warriar K, Muthupandiyar S. *Boswellia serrata Roxb. Ex Coleb.: A Threatened Tree*. *International Journal of Plant & Soil Science*. 2022 Dec 29;34(24):527-34.
- [11]. Srivastava AK, Gupta D, Tiwari C, Kumar S, Rajput BS. *Buchananialanzanspreng.(chironji)* a potential wild fruit tree of peninsula India: A review. *Journal of Progressive Agriculture*. 2021;12(1):1-8.
- [12]. Alamgir AN, Alamgir AN. Secondary metabolites: Secondary metabolic products consisting of C and H; C, H, and O; N, S, and P elements; and O/N heterocycles. *Therapeutic Use of Medicinal Plants and their Extracts: Volume 2: Phytochemistry and Bioactive Compounds*. 2018:165-309.
- [13]. Batiha GE, Wasef L, Teibo JO, Shaheen HM, Zakariya AM, Akinfe OA, Teibo TK, Al-Kuraishy HM, Al-Garbee AI, Alexiou A, Papadakis M. *Commiphora myrrh: a phytochemical and pharmacological update*. *Naunyn-Schmiedeberg's Archives of Pharmacology*. 2022 Nov 18:1-6.
- [14]. Mishra SU, Bishnoi RS, Maurya RA, Jain DE. *Boswellia Serrata ROXB.-a Bioactive Herb with Various Pharmacological Activities*. *Asian J. Pharm. Clin. Res*. 2020 Nov 7;13(11):33-9.
- [15]. Shah S. *Ayurveda: The conventional Indian medicine system and its global practice*. *Himalayan Journal of Health Sciences*. 2019 Jan 26:13-33.
- [16]. Sara BB, Sailaja AK. A review on polyherbal formulations used in the treatment of autoimmune disease like rheumatoid arthritis. *Res. Rev*. 2019;8:11-6.
- [17]. Ayub MA, Hanif MA, Blanchfield J, Zubair M, Abid MA, Saleh MT. Chemical composition and antimicrobial activity of *Boswellia serrata* oleo-gum-resin essential oil extracted by superheated steam. *Natural Product Research*. 2022 Feb 17:1-6.
- [18]. Suchita W, Raman DM, Kaur CD. A Review on phytochemistry and pharmacological activities of *Boswellia serrata*: A natural remedy. *Int. J. Pharmacogn*. 2021;8:454-61.
- [19]. Roy A, Menon T. Evaluation of bioactive compounds from *Boswellia serrata* against SARS-CoV-2. *Vegetos*. 2022 Jun;35(2):404-14.
- [20]. Gomaa AA, Mohamed HS, Abd-Ellatif RB, Gomaa MA. *Boswellic acids/Boswellia serrata* extract as a potential COVID-19 therapeutic agent in the elderly. *Inflammopharmacology*. 2021 Aug;29:1033-48.
- [21]. Yu G, Xiang W, Zhang T, Zeng L, Yang K, Li J. Effectiveness of *Boswellia* and *Boswellia* extract for osteoarthritis patients: a systematic review and meta-analysis. *BMC complementary medicine and therapies*. 2020 Dec;20(1):1-6.
- [22]. Alluri VK, Dodda S, Kilari EK, Golakoti T, Sengupta K. Toxicological assessment of a standardized *Boswellia serrata* gum resin extract. *International Journal of Toxicology*. 2019 Sep;38(5):423-35.

- [23]. Bertocchi M, Isani G, Medici F, Andreani G, TubonUsca I, Roncada P, Forni M, Bernardini C. Anti-inflammatory activity of *Boswellia serrata* extracts: an in vitro study on porcine aortic endothelial cells. *Oxidative medicine and cellular longevity*. 2018 Jun 25;2018.
- [24]. Beghelli D, Isani G, Roncada P, Andreani G, Bistoni O, Bertocchi M, Lupidi G, Alunno A. Antioxidant and ex-vivo immune system regulatory properties of *Boswellia serrata* extracts. *Oxidative medicine and cellular longevity*. 2017 Jan 1;2017.
- [25]. Somasundaram SG, Oommen B. Antioxidant flavonoids for arthritis treatment: Human and animal models. *Bioactive Food as Dietary Interventions for Arthritis and Related Inflammatory Diseases: Bioactive Food in Chronic Disease States*. 2012 Oct 22:1.
- [26]. Karl B, Alkhatib Y, Beekmann U, Bellmann T, Blume G, Steiniger F, Thamm J, Werz O, Kralisch D, Fischer D. Development and characterization of bacterial nanocellulose loaded with *Boswellia serrata* extract containing nanoemulsions as natural dressing for skin diseases. *International Journal of Pharmaceutics*. 2020 Sep 25;587:119635.
- [27]. Kumar DS. Herbal bioactives and food fortification: extraction and formulation. CRC Press; 2015 Sep 25.
- [28]. Sawant O, Khan T. Management of periorbital hyperpigmentation: An overview of nature-based agents and alternative approaches. *Dermatologic Therapy*. 2020 Jul;33(4):e13717.