

## A Review On: Herbal, Pharmacognostical and Pharmacological Studies on Guggulu

Radheshyam<sup>1\*</sup>, Jainul Basher<sup>2</sup>, Ruchi Singh<sup>3</sup>, Prabha Shankar Maurya<sup>4</sup>, Rajib Singh<sup>5</sup>

<sup>1,2</sup>Department of Pharmacology, Shakti College of Pharmacy, Balrampur, U.P, India

<sup>3</sup>Department of Pharmacognosy, Shakti College of Pharmacy, Balrampur, U.P, India

<sup>4,5</sup>Department of Pharmaceutical Chemistry, Shakti College of Pharmacy, Balrampur, U.P, India

### \*Corresponding author

Radheshyam, Department of Pharmacology, Shakti College of Pharmacy, Balrampur, U.P, India.

Submitted: 20 Dec 2021; Accepted: 05 Jan 2022; Published: 21 Feb 2022

**Citation:** Radheshyam, Jainul Basher, Ruchi Singh, Prabha Shankar Maurya, Rajib Singh. (2022). A Review On: Herbal, Pharmacognostical and Pharmacological Studies on Guggulu. *J Pharmaceut Res*, 7(1), 139-144.

### Abstract

Guggulu is an oleogum resin (oleo resin) that spontaneously emerges from the bark of *Commiphora mukul* Hook. ex Stocks, which belongs to the Burseraceae family. It has a long ethnomedicinal history and is a phytochemical repository of heuristic medical qualities. Guggulu is one of the constituents in several Ayurvedic formulations, the majority of which are titled with the suffix 'guggulu.' Guggulsterone is the principal active ingredient in gugulipid, a *C. mukul* extract used to treat a range of human illnesses. Massive work was expended in this review to assemble the data about guggulu and its undiscovered Ayurvedic formulations utilised in the Ayurvedic System of Medicines. Purified guggulu has been found to be useful in a variety of guggulu formulations for a variety of illness problems, with or without particular anupana. In Ayurveda, the formulation concept of guggulu is characterized by improved pharmacokinetic and polyvalent effects with multiple mechanisms of drug action. As a result, it is necessary in the modern period to undertake preclinical and clinical trials to validate the medicinal effectiveness of Guggulu formulations referenced in ancient literatures.

**Keywords:** Guggulu, *Commiphora Mukul*, Guggulsteroneis

### Introduction

Guggulu consists of oleo-gum resin obtained as an exudates from the tapping of stem and branches of *Commiphora wightii* (Arnott) Bhandari [syn. *Commiphora mukul* Eng]; *Balsamodendron mukul* [Family, Burseraceae]. The plant is commonly known as guggul tree and is found in arid areas of India, Bangladesh, and Pakistan. In India, it is found in Rajasthan, Gujarat, Assam, Madhya Pradesh, and Karnataka. It is a small, bushy tree with thorny branches and produces a yellowish gumresin (guggulu) in small ducts located throughout its bark. The trees are tapped by making an incision on the bark. The resin, which flows out, is allowed to harden before it is collected. The tree is tapped from November to January and the resin is collected through May to June. A guggul tree yields between 250 to 500 g of dry resin during each collection season [1, 2]. In Indian traditional system of medicine, guggulu has been used for thousands of years in the treatment of arthritis inflammation, gout, rheumatism, obesity, and disorders of lipids metabolism [3]. It is known by different names like guggula, guggul, guggal, gugar, and Indian bdellium [4]. Guggulu occurs in vermicular pieces of pale yellow or brown coloured mass with

aromatic odour and bitter astringent taste; when fresh it is viscid and golden coloured. It should produce not more than 5 percent of total ash and 1 percent of acid-insoluble ash. It yields not less than 27 percent of alcohol-soluble matter and not less than 53 percent of water soluble matter. The genuine samples of guggulu contain 1 percent of volatile oil and between 1.0 and 1.5 percent of guggulsterones (*Z* and *E*) [3].

These constituents are responsible for several pharmacological activities like anti-inflammatory, analgesic, cleaning of wound and healing due to its antibacterial action. *Guggulu* is a natural health product used primarily to reduce elevated blood cholesterol levels. It has been used for many years as a hypocholesterolaemic agent in India. *Guggulu* is one of the best rewarding herbs for Vata diseases. Various preparations of *Guggulu* used in sciatica, hemiplegia, gout, rheumatic diseases, facial paralysis etc. *Guggulu* is beneficial in cleansing and healing of wounds and to reduce oedema due to its anti-inflammatory and anti-septic properties. In digestive ailments also like anorexia, flatulence, worm infestations, piles etc, it works well.

## Botanical Description



Figure 1: Guggul Gum Resin

## Taxonomical Classification of *Commiphora Mukul*

Kingdom	:	Plantae
Subkingdom	:	Tracheobionta
Division	:	Magnoliophyta
Class	:	Spermatopsida
Sub Class	:	Maqnoliidae
Order	:	Sapindales
Family	:	Burseraceae
Genus	:	<i>Commiphora</i>
Species	:	<i>Mukul</i>

Table 1: Vernacular Names Alternate or Vernacular Names [5, 6]:

Common Name	Guggul
Hindi	Gogil, Gugal, Guggul, Mukul, Ranghanturb, Gugava, Gugavik,
Sanskrit	Bhavabhishta, Bhutahara, Devadhupa, Deveshta, Dhurta, Divya, Durga, Guggalu, Jatala, Jatayu, Kalaniriyasa, Kaushika, Kumbha, Kumli, Kumbholu, Kumbholu-Khalaka, Kunti, Pavandvishta, Pura, Puta, Rakshoha, Sarvasaha, Shambhava, Shiva, Uddipta, Ulukhalaka, Usha, Vayughna.
Tamil	Gukkulu, Mai shakshi, Kukkil, Gukkal, Guggal, Gugal, Gukkula, Maishakshim, Mahishaksh-Gugilamu, Cheetu-mahishashi.
English	Gum giggulu, Indian bdellium, Salativee, Bdellium, Guggulu, Borassaus, and Flabelliformis.
Marathi	Guggala, Gulag, Gugal, Guggal, Guggul, Hansaguggul, Kantguggul, Mahaishguggul.
Gujarati	Gugal, Gugali, Gugar, Guggul, Mukul, Ranghanturb, Gugul, Bhesaghgala, Gugara, Ranghanturb, Bhaisoguggul.
Bengali	Gugal, Guggul, Mukul, Ranghanturb, Guggulu, Guggal, Ranghanturb, Makal, Canarese.

## Macroscopic Characters

- **Branches:** spirally climbing spine little youthful parts resemble glandular, adolescent
- **Leaves:** 01-3 and foliate
- **Leaflets:** 0Sessile to sub sessile, deadly ones are the boss, rhomboid to praise in nature, unpredictably toothed edge leaves substitute, 1-3 foliate, applaud, serrate-toothed in the unrivalled parts sidelong handouts when they're just not exactly a large portion of the size of the fatal ones.
- **Flowers:** Small, earthy colored to pink, unisexual blossoms minuscule, caramel red, polygamous in fascicles
- **Calyx:** Glandular hairs, framing round and hollow cap
- **Petals:** Four to multiple times as long as sepal
- **Stigma:** 8 to 10, subtly bi-lobed
- **Stamens:** 8 to 10, then again long and short
- **Fruit:** Drupe, red praise, taper fit as a fiddle, with 2-celled-store, once in a while four-valve.

proven to be an abundant source of novel biological active compounds, many of which have been basis for the development of new lead chemicals for Pharmaceuticals for new drug discovery [7]. Chemical study of guggulu revealed that it is a complex mixture of steroids, diterpenoids, triterpenes, aliphatic esters, alcohols, carbohydrates, amino acids, cholesterol, guggulsterol, flavanoid and variety of inorganic compounds [8, 9].

## Use of the Chemical Constituents

The steroids present in guggul were associated with the hypolipidemic and anti-inflammatory activity. *Commiphora wightii* ethanol extract of trunk was separated and gave an anti-fungal flavone known as Muscanone along with old known compound known as naringenin. They have found that Muscanone was active against *Candida albicans* in microbial assay [10]. Guggultetrol ferulate has been isolated from the cytotoxic fraction of Ethyl acetate extract of guggul.

## Chemical Constituents

The medicinal plants used in traditional medical system have

S.NO.	Active constituent	There effect	references
1.	E-Guggulsterone and Z-Guggulsterone (ketonic part)	has the property of lowering blood lipid (hypolipidemic activity)	11
2.	Naringenin	prevents the accumulation of lipoproteins and also acts as anti-bacterial, anti-inflammatory, anti-viral properties.	12
3.	Cembranoid	controls the gastrointestinal absorption of cholesterol and fat.	13
4.	Myrrhanol i.e. triterpenoid of guggul gum	m acts as antiinflammatory .and also used to reduce pain for osteo arthritis patients.	14
5.	Alpha pinene	acts as anti-fungal and also anti-microbial agent.	15
6.	Eugenol(mono terpenoid)	has the anti-oxidant property and it also plays a vital role in the cell proliferation in tumors. It also acts as anti-microbial agent.	16
7.	Mansumbinoic acid	also acts as anti-inflammatory and anti-bacterial agent 38.	17
8.	Alpha terpineol	has strong anti-microbial activity.	18
9.	Beta sitostero	inhibits the cholesterol <sup>40</sup> in the body and reduces the level of cholesterol.	19
10.	1,8-cineole	acts as anti-inflammatory and antinociceptive <sup>41</sup> agent.	20
11.	Quercetin	has the most effective inducer effect for the anticarcinogenic activity	21
12.	Diayangambin	has the immunomodulatory and antiinflammatory activity and also used to reduce the ear swelling.	22
13.	Ellagic acid	has the anti-mutagen, anti-inflammatory and anti-cancer activity. It binds with cancer cells and makes them inactive.	23
14.	L-Arabinose	does not have any biological use but it is a good source of sugar.	12

### Extraction and Isolation E- and Z- Guggulsterones from C. Mukul

The resin of C. mukul (13.3 g) was finely minced and extracted with EtOAc (ethylacetate) (130 mL) by using microwave irradiation (300 W, 80°C) under reflux condition for 1 h. After extraction, ole-gum resin was separated into two parts, gum and resin. The ethylacetate insoluble part of gum was chemically characterized as a carbohydrate gum (7.8 g) (belonging to the class of sugar). resin contains bioactive components, especially E- and Z-guggulsterones which are soluble in EtOAc. After filtration and evaporation of the solvent under reduced pressure, 5.5 g compounds are separated. Fractionated in petroleum ether, the steroidal compounds were isolated by dissolving in petroleum ether (40 - 60°C). For isolation of E- and Z- guggulsterones from the mixture of steroidal compounds, after being evaporated of the solvent, 2.5 g of this was dissolved in small amount of EtOAc and transferred on to a silica gel 60F-254 column chromatography as stationary phase and eluted with the mixtures of solvents, toluene / acetone (9:1), which resulted in 15 fractions of 20 mL. [24].

### Medical Use

#### Traditional Uses of Guggulu

Guggulu has a long history of use in Ayurveda. The Atharvaveda is the earliest reference containing its medicinal and therapeutic properties [25]. Detailed description regarding its actions, uses,

and indications and the varieties of guggul have been described in numerous Ayurvedic treatises including Charaka Samhita (1000 B.C.), Sushruta Samhita (600 B.C.) and Vagbhata (7th century A.D.). In addition, various medical lesions were written between the 12th and 14th centuries A.D. [26]. Guggulu has been used to treat obesity, osteoarthritis, rheumatoid arthritis, gout, facial paralysis, sciatica, constipation, haemorrhoids, liver disorders, inflammation, cyst, cervical lymphadenitis, coronary thrombosis, anaemia, diabetes, urinary calculus, increased frequency and turbidity of urine, and skin diseases [27, 28]. It has a wide range of usefulness in indigenous medicine. It is astringent and antiseptic and acts as a bitter, stomachic, and carminative when taken internally. Like all oleo resins, it causes increase in number of leucocytes and stimulates phagocytosis. It acts as a diaphoretic, expectorant, diuretic, uterine stimulant, and emmenagogue. The resin is used in the form of lotion for indolent ulcers and as a gargle in caries, spongy gums, pyorrhea, chronic tonsillitis, and ulcerated throat. Inhalation of the fumes from burnt guggulu is recommended in hay fever, acute and chronic nasal catarrh, chronic laryngitis, chronic bronchitis, and phthisis. It is an ingredient of ointment for ulcers [29].

### Pharmacological Action

#### Hypolipidemic Activity

The lipid lowering effect of guggulu with special reference to atherosclerosis and obesity (medoraga) was first reported in a doc-

torate thesis submitted to the Banaras Hindu University (BHU) in January 1966. Earlier to this work, guggulu was well known as an Ayurvedic drug for the treatment of various types of arthritis. This work was inspired by a rather obscure shloka in Sanskrit in the well-known Ayurvedic treatise SushrutaSamhita. The shloka deals in an extraordinarily lucid and scientific manner, with the etiology, pathogenesis, and treatment of obesity and associated lipid disorders and their complications. The hypolipidemic activity was shown in animals as well as in patients of obesity and hypercholesterolemia [30].

### Antiatherosclerotic Activity

LDL has been found to accumulate in atherosclerotic lesions and is the major source of the cholesterol accumulation in human foam cells. There is evidence that LDL oxidation is essential for atherogenesis and the antioxidants that prevent this oxidation may either slow down or prevent atherogenesis. Guggulsterones, the lipid-lowering components of guggulu, effectively inhibited in vitro LDL oxidation (as discussed under antioxidant action). Thus, the combination of antioxidant and lipid-lowering properties of guggulu makes it especially beneficial against atherogenesis [31].

### Cardioprotective Activity

Guggulsterones are shown to be effective cardioprotectives. Myocardial necrosis induced by isoproterenol in rats caused marked increase in serum creatine phosphokinase and glutamate pyruvate transaminase. Phospholipids, xanthine oxidase, and lipid peroxides were simultaneously enhanced in ischemic heart following depletion of glycogen, phospholipids, and cholesterol. Treatment with guggulsterone at a dose of 50 mg/kg significantly protected cardiac damage as assessed by the reversal of blood and heart biochemical parameters in ischemic rats [32].

### Antifertility Activity

Guggulu administered orally (2 and 20 mg/100 g body weight) to female rats decreased the weight of the uterus, ovaries, and cervix, whereas glycogen and sialic acid levels in these organs increased. This suggested that guggulu may be useful as an antifertility agent [33].

### Thyroid Stimulatory Effect

Thyroid performs a critical role in regulating the metabolic rate and further stimulation of the liver to metabolize LDL cholesterol (Jain and Gupta, 2006). Several studies have reported that guggulsterone particularly Zguggulsterone revived the thyroid activity and increase the uptake of iodine by the thyroid, activities of thyroid peroxidase and protease [34]. However, some clinical studies have shown no alteration with the usage of guggul [35]. A study in 21 patients found that guggulipid was as effective as tetracycline in the treatment. The patients with oily faces responded better to the guggulipid treatment [36].

### Antimicrobial Activity

The volatile oil of *C. mukul* was found to be highly effective against *Rhizopertha dominica* which suggested its role as a fumigant. The ethanolic extract of *C. mukul* exhibited best antibacterial activity at 5 mg/ mL against multidrug-resistant *Klebsiella pneumoniae*. An active compound, 5(1-methyl,1-aminoethyl)-5-methyl-2-octanone, of the methanolic extract of guggulu gum possessed significant antibacterial activity against Gram-positive bacteria and moderate activity against Gram-negative bacteria [37-39].

### Antioxidant Activity

Guggul has decreased the risk of coronary artery disease as it has preventive action on oxidation of cholesterol and further hardening of arteries and reduced the platelet stickiness. Guggulsterone combination with Fe<sup>2+</sup> and sodium ascorbate significantly stopped lipid peroxidation in liver microsomes, which is beneficial against atherogenesis [40].

### Skin Diseases

Guggulsterones have been found to be helpful for curing allergic dermatitis. Guggulipid with alcoholic fractions possessed two activities: anti sebum and antioxidant and it have been reported to control the sebum secretion with enhanced oil control. It led to improved skin color and provided the young appearance to the skin [41]. Nodulocystic acne, one of the skin diseases has been treated using guggulipid and it caused a significant reduction in lesions. Its therapeutic value is as equal as tetracycline [42].

### Conclusions

According to this review study, the resin of *Commiphora wightii*, guggulu, has emerged as a good source of traditional medicines for the treatment of inflammation, arthritis, obesity, microbial infection, wound, pain, fractures, tumour, and gastrointestinal problems. It is one of the oldest and most important herbs in Ayurvedic treatment. Guggulu is a versatile medication that, because to its paranormal qualities, is particularly useful in treating a wide range of diseases. Pharmacological studies have verified the use of this herb in traditional treatments. This plant includes a variety of bioactive compounds, including terpenoids, steroids, flavonoids, guggulipid, lignans, sugars, and amino acids. The main bioactive elements of this resin are guggulsterones E and Z, which have a high pharmacological value. These findings may open up new avenues for the usage of this herb in Ayurveda. This review unequivocally validates the Sanskrit meaning of guggul, which means "one who guards against illnesses." It is beautifully expressed and demonstrated by the numerous medical applications of this Ayurvedic medication. In vitro investigations and clinical trials aid in the advancement and improvement of medical services. They also help health care practitioners target resources to the methods and treatments that will be most effective for a certain type of sickness. Although the usage of guggulu at therapeutic levels appears to be safe and nontoxic, more and more such research should be undertaken to rule out any toxicity, if any exist, they can be ruled out. It has also been stated that when consuming guggulu, one should

avoid sour or bitter meals, alcohol, strenuous exercise, physical and mental strain, anger, and exposure to bright sunshine. Such results can only be validated if in vitro investigations are preferred over in vivo trials.

## References

1. Satyavati, G. V. (1966). Effect of an indigenous drug on disorders of lipid metabolism with special reference to atherosclerosis and obesity (Medoroga) MD thesis (Doctor of Ayurvedic Medicine). Banaras Hindu University, Varanasi.
2. Sastry, V. V. (1976). History of Guggulu based on Ayurvedic literature. Bulletin of the Indian Institute of History of Medicine (Hyderabad), 6(2), 102-116.
3. Urizar, N. L., & Moore, D. D. (2003). GUGULIPID: a natural cholesterol-lowering agent. Annual review of nutrition, 23(1), 303-313.
4. *Pharmacopoeia, I. (1996). Controller of publications. New Delhi, 2, 764.*
5. Singh, D. C., Dhyani, S., & Kaur, G. (2015). A critical review on Guggulu [*Commiphora wightii* (Arn.) Bhand.] & its miraculous medicinal uses. International Journal of Ayurveda and Pharma Research, 3(1), 1-9.
6. Sharma, S., & Kumar, A. (2012). Traditional uses of herbal medicinal plants of Rajasthan: Guggal. International journal of life science and pharma research, 2(4), 77-82.
7. Palombo, E. A. (2006). Phytochemicals from traditional medicinal plants used in the treatment of diarrhoea: modes of action and effects on intestinal function. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives, 20(9), 717-724.
8. Saxena, V. K., & Sharma, R. N. (1998). Constituents of the essential oil from *Commiphora mukul* gum resin. J Med Arom Plant Sci, 20, 55-56.
9. Sharma, P. C., Yelne, M. B., Dennis, T. J., Joshi, A., & Billore, K. V. (2000). Database on medicinal plants used in Ayurveda.
10. Sarup, P., Bala, S., & Kamboj, S. (2015). Pharmacology and phytochemistry of oleo-gum resin of *Commiphora wightii* (Guggulu). Scientifica, 2015.
11. Macha, M. A., Matta, A., Chauhan, S. S., Siu, K. W., & Ralhan, R. (2010). 14-3-3 zeta is a molecular target in guggulsterone induced apoptosis in head and neck cancer cells. BMC cancer, 10(1), 1-12.
12. Kay, M. A. (1996). Healing with plants in the American and Mexican West. University of Arizona Press.
13. Yu, B. Z., Kaimal, R., Bai, S., El Sayed, K. A., Tatulian, S. A., Apitz, R. J., ... & Berg, O. G. (2009). Effect of guggulsterone and cembranoids of *Commiphora mukul* on pancreatic phospholipase A2: role in hypocholesterolemia. Journal of natural products, 72(1), 24-28.
14. Kimura, I., Yoshikawa, M., Kobayashi, S., Sugihara, Y., Suzuki, M., Oominami, H., ... & Doiphode, V. V. (2001). New triterpenes, myrrhanol A and myrrhanone A, from guggul-gum resins, and their potent anti-inflammatory effect on adjuvant-induced air-pouch granuloma of mice. Bioorganic & Medicinal Chemistry Letters, 11(8), 985-989.
15. Jasuja, N. D., Choudhary, J., Sharama, P., Sharma, N., & Joshi, S. C. (2012). A review on bioactive compounds and medicinal uses of *Commiphora mukul*. Journal of Plant Sciences, 7(4), 113.
16. Nagababu, E., & Lakshmaiah, N. (1992). Inhibitory effect of eugenol on non-enzymatic lipid peroxidation in rat liver mitochondria. Biochemical pharmacology, 43(11), 2393-2400.
17. Duwiewja, M., Zeitlin, I. J., Waterman, P. G., Chapman, J., Mhango, G. J., & Provan, G. J. (1993). Anti-inflammatory activity of resins from some species of the plant family Burseraceae. Planta medica, 59(01), 12-16.
18. Park, S. N., Lim, Y. K., Freire, M. O., Cho, E., Jin, D., & Kook, J. K. (2012). Antimicrobial effect of linalool and  $\alpha$ -terpineol against periodontopathic and cariogenic bacteria. Anaerobe, 18(3), 369-372.
19. Žák, A., Vecka, M., Tvrzicka, E., Hrubý, M., Novak, F., Pa-pežová, H., ... & Staňková, B. (2005). Composition of plasma fatty acids and non-cholesterol sterols in anorexia nervosa. Physiol Res, 54, 443-51.
20. Santos, F. A., & Rao, V. S. N. (2000). Antiinflammatory and antinociceptive effects of 1, 8-cineole a terpenoid oxide present in many plant essential oils. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives, 14(4), 240-244.
21. Ghosh, B. (1999). Quercetin inhibits LPS-induced nitric oxide and tumor necrosis factor- $\alpha$  production in murine macrophages. International journal of immunopharmacology, 21(7), 435-443.
22. De León, E. J., Olmedo, D. A., Solís, P. N., Gupta, M. P., & Terencio, M. C. (2002). Diayangambin exerts immunosuppressive and anti-inflammatory effects in vitro and in vivo. Planta medica, 68(12), 1128-1131.
23. Thresiamma, K. C., George, J., & Kuttan, R. (1996). Protective effect of curcumin, ellagic acid and bixin on radiation induced toxicity. Indian journal of experimental biology, 34(9), 845-847.
24. Agrawal, H., Kaul, N., Paradkar, A. R., & Mahadik, K. R. (2004). HPTLC method for guggulsterone: I. Quantitative determination of E-and Z-guggulsterone in herbal extract and pharmaceutical dosage form. Journal of pharmaceutical and biomedical analysis, 36(1), 33-41.
25. Samhita, S. (1954). chapter 15. Chowkamba Sanskrit Sirija, Varanasi, India.
26. Pandey G. Dravyaguna. (2004). Vijnana. 2nd. Varanasi, India: Chaukhambha Orientalia.
27. Dev, S. (1987). A modern look at an age old Ayurvedic drug Guggul. Science Age, 5, 13-18.
28. Anurekha, J., & VB, G. (2006). Chemistry and pharmacological profile of guggul-A review.

29. Anonymous. (2001). The Ayurvedic Pharmacopoeia of India.
30. Satyavati, G. V. (1988). Gum guggul (*Commiphora mukul*)--the success story of an ancient insight leading to a modern discovery. *The Indian journal of medical research*, 87, 327-335.
31. Wang, X., Greilberger, J., Ledinski, G., Kager, G., Paigen, B., & Jürgens, G. (2004). The hypolipidemic natural product *Commiphora mukul* and its component guggulsterone inhibit oxidative modification of LDL. *Atherosclerosis*, 172(2), 239-246.
32. Chander, R., Rizvi, F., Khanna, A. K., & Pratap, R. (2003). Cardioprotective activity of synthetic guggulsterone (E and Z-isomers) in isoproterenol induced myocardial ischemia in rats: a comparative study. *Indian Journal of Clinical Biochemistry*, 18(2), 71-79.
33. Amma, M. K., Malhotra, N., Suri, R. K., Arya, O. P., Dani, H. M., & Sareen, K. (1978). Effect of oleoresin of gum guggul (*Commiphora mukul*) on the reproductive organs of female rat. *Indian journal of experimental biology*, 16(9), 1021-1023.
34. Poonia, P., Mittal, S., Gupta, V., & Singh, J. (2014). Sweetly. Gum guggul: An Ayurvedic boom. *Int. J. Pharmacogn Phytochem Res*, 6, 347-354.
35. Rout, O. P., Acharya, R., & Mishra, S. K. (2012). Oleogum resin Guggulu: A review of the medicinal evidence for its therapeutic properties. *IJRAP*, 3(1), 15-21.
36. Thappa, D. M., & Dogra, J. (1994). Nodulocystic acne: oral gugulipid versus tetracycline. *The journal of Dermatology*, 21(10), 729-731.
37. Goyal, P., Chauhan, A., & Kaushik, P. (2010). Assessment of *Commiphora wightii* (Arn.) Bhandari (Guggul) as potential source for antibacterial agent. *Journal of Medicine and Medical Sciences*, 1(3), 71-75.
38. Ishnava, K. B., Mahida, Y. N., & Mohan, J. S. S. (2010). In vitro assessments of antibacterial potential of *Commiphora wightii* (Arn.) Bhandari. gum extract. *Journal of Pharmacognosy and Phytotherapy*, 2(7), 91-96.
39. Romero, C. D., Chopin, S. F., Buck, G., Martinez, E., Garcia, M., & Bixby, L. (2005). Antibacterial properties of common herbal remedies of the southwest. *Journal of ethnopharmacology*, 99(2), 253-257.
40. Wang, X., Greilberger, J., Ledinski, G., Kager, G., Paigen, B., & Jürgens, G. (2004). The hypolipidemic natural product *Commiphora mukul* and its component guggulsterone inhibit oxidative modification of LDL. *Atherosclerosis*, 172(2), 239-246.
41. Shishodia, S., & Aggarwal, B. B. (2004). Guggulsterone inhibits NF- $\kappa$ B and I $\kappa$ B $\alpha$  kinase activation, suppresses expression of anti-apoptotic gene products, and enhances apoptosis. *Journal of Biological Chemistry*, 279(45), 47148-47158.
42. Thappa, D. M., & Dogra, J. (1994). Nodulocystic acne: oral gugulipid versus tetracycline. *The journal of Dermatology*, 21(10), 729-731.

**Copyright:** ©2022 Radheshyam, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.