



Review Article

A REVIEW ON *GUGGULU [COMMIPHORA WIGHTII (ARN.) BHAND.]*, ITS PHYTOCHEMICAL CONSTITUTION & MODE OF ACTION

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ABSTRACT

The history of human medicine goes back theoretically to the sheer onset of civilizations and evolved with the corresponding circumstances. Natural ingredients, that are plant based, animal based or mineral based have been incorporated since ages in the management of health and disease. The presently popular and universally accepted modern medicine has developed slowly and methodically, over generations of scientists with their application of scientific studies and an enormous amount of research. The popularity and acceptance of modern medicine may be huge today; however, the base of its research and resources stay put in traditional system of medicine itself. Even today the future of medicine in general has a tremendous scope for natural product-based drug and formulations and hopefully will prove to be more holistic, customized with a wise amalgamation of ancient and modern medicinal fundamentals and skills so as to give maximum benefit to the present and future human generations. Ayurveda, translated as the "Science of Life", the ancient medicinal system of the Indian subcontinent, remains the oldest of all form of medications. Ayurveda incorporates a holistic approach to medicine and makes it highly personalized. There are around 45,000 species of plants with various medicinal properties attributed to them. This paper aims at understanding the composition, chemical constitution and exact mode of action of *Guggulu*.

INTRODUCTION

The WHO says, if the looks at the World populations, about 70–80% depend and believe on un-conventional, traditional, local or natural methods of medicine, which thereby form a concrete part of the healthcare structure throughout the world [1].

The popular and acclaimed Ayurveda clinical texts namely, the Atharva-veda (dated 1200 BC), Charaka Samhita and the Sushruta Samhita (dated 1000–500 BC) give detailed information of around 700-750 drugs [2,3].

As of now the Indian subcontinent happens to harbour, 45,000 species of plants; with several thousand being attributed to have varied medicinal properties [4].

Recent research work in Ayurvedic drug development has been found to be related to species of *Commiphora mukula* or *Guggulu*, *Picrorhiz kurroa* or *Kutki*, *Bacopa Moneiri* or *Brahmi*, *Curcuma Longa* or *Haridra* etc [5].

These drugs are procured through various sources of plant or animal origin etc. Categorically they are of the following types-

1. **Audbhida or the plant origin-** Plant parts like the roots/stems/fruits etc.
2. **Jangama or the animal origin-** Animal parts like musk, honey, milk, ghee, curd, etc. are used in the medications.
3. **Parthiva or the mineral origin-** Eg. Minerals like *Abhrak* (mica), *Parada* (mercury), *Gandhaka* (sulphur) etc are used in various formulations.

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4. Therefore, it is important to analyse the functioning of and mode of action of different parts of the herbal plant.

According to Charaka Samhita, Acharya Charaka has mentioned the following different parts of medicinal plants. They are

- a) *Mula*- the roots
- b) *Tvak*- the skin
- c) *Saara*- the core stem
- d) *Niryasa* – the exudate
- e) *Nala*- the stalk
- f) *Svarasa*- the extract
- g) *Pallava*- the tender leaves
- h) *Patra*- matured leaves
- i) *Ksara*- the alkali
- j) *Ksira*- the milky exudate
- k) *Phala*- fruits
- l) *Pushpa*- flowers
- m) *Bhasma*- the fine powder
- n) *Taila*- the plant oil
- o) *Kantaka*- the thorns
- p) *Kaanda*- the bulbous part and
- q) *Praroha*- the outer roots [6]

Guggul or *Guggulu*, is an herbal drug mentioned in the Ayurvedic texts thousands of years back with a potential background of medicinal benefits. It was mentioned first in *Atharva Veda* (2000 B.C). It was subsequently mentioned in the following clinical texts like Charaka Samhita and Sushruta Samhita in various pathologies as a single drug treatment or as a part of multi-drug formulation [7,8].

Guggul, is a gummy oleo-resin that is extracted from *Commiphora wightii* (Arnott.) Bhandari (syn. *Commiphora mukul*) and belongs to the family Burseraceae. The dry form of gum resin is derived from bark of the *Guggulu* tree. It is a conglomeration of active components like esters, diterpenes, steroids, sterols, and some higher alcohols.

Besides this, the other variants like *Commiphora agallocha*, *Commiphora stocksiana* Engl. Have exhibited some medicinal value. The distribution is mostly in the dry regions of Deccan, Mysore, Khandesh, Bellary, and Rajasthan's desert regions [8].

Nomenclature: It has different names according to the regions.

- Common Name: Guggulu, gugul
- Hindi: Gugal, Mukula, Ranghanturba, Guggul, Gogil,
- Sanskrit: Bhutahara, Deveshta, Dhurt, Divyaa, Guggalu, Jatayu, Devadhupa, Vayughna. Durga, Kalaniriyasaa,
- Tamil: Gukkall, Gukkullu, Maishakshi
- Telugu: Gugull, Mabisaksha, Maishakshi
- Marathi: Guggala, Gulaga, guggul, dhoop
- Gujarati: Guggal, Guggali, Guggar, Guggul, Mukula, Ranghanturba.
- Bengali: Guugal, Guggul, Mukula, Ranghanturba.

Properties and action: The *Rasapanchak* (therapeutic actions and attributes of an Ayurvedic single drug) of *Guggulu* is given as below.

Properties of *Puran guggulu*: *Laghu* (lighter), *Ruksh* (dry), *Tikshna* (potent or strong), *Vishad* (cleansing), *Suksham*, *Sar* (lactagogue, makes secretions flow), *Sugandhi* (aromatic).

Properties of *Naveen guggulu*: *Snigdha* (moist), *Picshil* (unctuous or greasy)

Rasa: *Katu*, *Tikta*, *Kasaya*

Vipaka: *Katu*

Virya: *Ushna*

Prabhav: *Tridosh hara*

Karma: *Balya* (promotes strength), *Rasayana* (immunomodulator), *Varnya* (enhances complexion), *Vatabalasajit* (mitigates *Vata*), *Bhagnasandhanakrit* (heals fractures), *Medohara* (reduces fatty tissue) [10].

Phytochemistry

The *Guggulu* plant has many active ingredients.

- The plant constitutes of essential oils (0.37%), mainly myrecene, dimyrecene and polymyrecene, guggulosterones like Z-guggulosterone, E-guggulosterone, guugulosteron-I, guugulosteron-II, guugulosteron-III and guugulosteron -IV. These isolates are primarily responsible for its actions like rheumatism, arthritis, hyperlipidemia, obesity, inflammation, atherosclerosis, wrinkle, acne and other diseases.
- The ketonic fraction- The hypo-lipideamic action of the plant is mainly owing to the presence of ketonic fraction, a complex mixture of chemical compounds belonging to steroids.
- It also constitutes of aliphatic esters, triterpenoids, ferulates, longchain aliphatic tetrols, diterpenoids, lignans, and a variety of inorganic ions and carbohydrates, besides small amounts of sesamin[11].

These are few *Guggulu* formulations mentioned in the texts in Ayurveda.

1. ***Amrita guggulu*:** Useful in skin disorders, jaundice, anorexia, anal fistulas, nasal catarrh, splenic enlargement and other abdominal pathologies. Studies show, its effects in tubercular leprosy.
2. ***Panchatikta ghrta-guggulu*:** Useful in various skin disorders.
3. ***Triphala guggulu*:** Useful in abscesses, blood disorders, skin malignancies etc. useful in skin sloughs, foul discharge and the foetid-odor and painful abscesses and sores.
4. ***Saptavingcatika guggulu*:** Useful in anal fistulas, hemorrhoids, asthmatic conditions, chronic cough, hernias, elephantiasis, malignant boils, sinuses, leukoderma, calculi, STDs like gonorrhoea.

5. **Kanchanar guggulu:** Useful in tumours, growths, cystic growths, thyroid imbalances, obesity etc
6. **Navakarshika guggulu:** It cures fistulas, hemorrhoids, swellings and various kinds of growths and tumours [12,13].
7. **Gokshuradi guggulu:** Useful in urinary tract disorders, renal stones, swelling, oedema, anasarca etc

Here Are Few Studies Does to Evaluate Specific Pharmacological Activity of Guggulu

Hypolipidemic action of Guggulu

The studies suggested and gave enough data to prove the hypolipidemic activity as below-[14,15]

- a) Average reduction in cholesterol/triglycerides was found to be around 20%.
- b) There was an overall response observed in around 70-80% patients of all the patients registered for various trials.

The anti-lipid activity of *Guggul* attributed specifically to atherosclerotic changes & obesity (*Medoroga*) was studied and produced at the BHU (Banaras Hindu University) in thesis submitted in January 1966. Interestingly, before this, *Guggulu* was popularly used for the management of arthritis in Ayurveda by its clinicians [16].

An ethyl-acetate extract of *Guggulu*, *Gugulipid*, that is standardised and evaluated at CDRI (Central Drug Research Institute), was in the commercial market as a hypolipidemic agent in India since 1988. It consists of -guggulsterones & guggulsterones which are deemed to be compounds known for the anti-lipidemic action of *Guggul* compound [17].

Platelet Aggregation and Fibrinolytic Activity of Guggulu

In the studies conducted, the specific action of *guggulu* on platelet aggregation gave wonderful insight. The purified steroid mixture derived from isolated *Guggulu* compound was seen to completely inhibit platelet aggregation invoked by serotonin, ADP or adrenaline. There was no difference in the action of steroid and purified isolated guggulsterone. The action of guggulsterones showed similar to (inhibitory) effect of Clofibrate. This one particular finding is very significant therapeutically in the virtue of myocardial infarcts or thromboembolism. This highlights the effectiveness of *Guggulu* compounds in the overall management of cardio-vascular disorders [18,19].

The action of guggulsterones on the process of fibrinolysis, platelet adhesiveness in CVD (coronary vascular disease) was studied. In this particular study, *Guggulu* fraction A (pet ether extract) was administered every day in the dosage of 1g to (Group I) healthy individuals and to (Group II) pts of (CAD) coronary artery disease for a stipulated duration of thirty days. It was observed that the, Serum fibrinolytic

activity was found to be increased, while there was a decrease in the platelet adhesive index, which was observed to be significant in healthy individuals statistically and in the CAD patients. Conclusive to this study it can be safely understood that, the *guggulu* fraction A may be a efficient therapeutically in treatment of CAD (coronary arterial disease) [20].

Thyroid Related Activity

This particular study is an interesting one. Ethanolic extract of *Guggulu* administration of ethanol extract of *Guggul* was administered for 15 days to female albino mice. There was enhanced concentration of triiodothyronine (T3) and also the T3/T4 ratio, while there was no major change noticed in the concentration of Sr. Thyroxine (T4) [21].

Anti-arthritic Guggulu Activity

The conclusions of various researches do give enough evidence material about the anti-inflammatory actions in specific correspondence to inflammatory arthritis of various *guggulu* compounds [22-26]. For instance, in this study, 50 percent aqueous methanolic extract was introduced in mice suffering from induced granuloma. The methanolic extract exhibited a detailed anti-inflammatory effect on the granuloma. The methanolic extract also was seen to inhibit production of nitric oxide in the peritoneal macrophages of the mice which were lipopolysaccharide activated [19].

In another study, a crystallised *guggulu* steroid, isolated from petroleum ether extract was used for testing in some rats. It was tested for the inhibition of the inflammatory process brought in by the Freund's adjuvant. It was seen to inhibit the development adjuvant arthritis (primary lesions basically) and also were seen to reduce the intensity of secondary lesions in comparison to the control group of rats that was left untreated [27].

Studies on Antioxidant Activity of Guggul

In Ayurveda *guggulu* has been also widely mentioned as a *Rasayan* drug. *Rasayanas* are group of drugs exhibit protective, regenerative, anti-ageing and reparative properties. They are used as after-treatment management plan for convalescence or to promote anti-ageing. These actions of *Guggulu* were tried by many authors to be evaluated in various studies.

In this particular study, the antioxidant property of *Guggulu* brought in an arrest on the oxidation of cholesterol and thereby the subsequent thickening or hardening that happens in the arterial vessels. There were also changes like reduction in the stickiness of the platelets, and thereby significantly lowering the proximity towards having CAD (coronary artery disease) [28-30].

Studies on Anti-atherosclerotic Activity

Atherosclerotic changes that subsequently happen in the patients of hyperlipidaemia are owing to

the accumulation of LDL molecules in the atherosclerotic plaque that form and is prime contributor of the cholesterol pile up in foam cells.

There is enough evidence suggesting the need of LDL oxidation for atherogenesis and the particular antioxidants preventing the the process of oxidation may either arrest completely if not reduce the severity of atherogenesis. Guggulsterones compounds, the fat-busting constituents of guggul, have shown effective inhibition of LDL oxidation in-vitro (as mentioned earlier under the antioxidant activity of guggul). Therefore, the amalgamation of these antioxidant properties and lipid-lowering properties of guggul proves it to be beneficial in arresting atherogenesis [11, 13- 16,31- 36].

Studies on Cardioprotective Activity

As seen even in the previously discussed studies Guggulsterone compounds have exhibited effective cardioprotective action. In this study it was observed that, myocardial necrosis that was pre-induced in rats by using iso-protenelol, caused significant rise in the blood serum levels of creatine phosphokinase and SGPT (glutamate pyruvate transaminase).

Also, the other parameters like phospholipase, lipid peroxides and xanthine oxidase, were increased too simultaneously in the pathological display of ischemic cardiac condition following severe lowering in the levels of cholesterol, phospholipids, and glycogen. Oral management with guggulsterone compounds (50 mg/kg) significantly prevented damage to the cardio-vascular apparatus as understood by the process of reversal of blood flow and biochemical cardiac parameters in rats with pre-induced ischemia [37,38].

Studies on Cytotoxic Activity of Guggul

The Ferulate compounds, are known to be the important bioactive constituents isolated from guggul. These derivatives were studied for their role in cellular toxicity. The in vitro study on cytotoxicity proved to be critical [12]. The Ethyl acetate extract of guggulu showed significant role in reducing in vitro cytotoxicity [39].

The Antifertility Activity of Guggulu

Ayurveda prohibited the long term or unwarranted usage of *Guggul* clinically owing to its various potent effects on over-dose. *Shukraghna* is one of the various actions of *Guggulu*. It is known to induce infertility. In a study *Guggul* by itself administered to female rats orally was shown to decrease the weight and size of the uterus including the cervix and the ovaries, and whereas sialic acid, glycogen levels in these organs were seen to be increased. This interestingly, indicated that *Guggul* may (?) be useful and fruitful as an antifertility entity. Also opening up the domain to explore further in this regard [40].

Action on Skin Diseases

Ayurveda has widely used various formulations containing guggulu for the treatment and management of skin pathologies especially those exhibiting chronicity, itching, secretions and foul smell.

In a study guggulipid derivative was seen to benefit substantially while managing subjects of nodulocystic acne. A counteractive study with tetracycline proved the effects in 21 patients and was found the guggulipid was actually as efficient as tetracycline itself here. Interestingly, those patients who had oily/sebaceous faces were found to be responding better to the protocol of management with the guggulipid compound as opposed to the tetracycline batch [41].

Role in Diabetes and Antihyperglycemic Activity

Various formulations like *Chandraprabha vati*, *Gokshuradi guggulu*, *Triphala guggulu*, *Punarnava guggulu*, *Vidangadi loha* that contain *Guggulu* as one of the primary constituents are used widely in the management of *Prameha* or *Madhumeha* in Ayurveda. There have been many studies to study the overall effect of *Guggulu* on the metabolic syndrome including diabetes mellitus.

In such a study the alcohol-based extract of *Guggul/C. mukula* was administered with a dose of 200 mg/kg and was evaluated for 2 months. The result was reduction in the plasma glucose levels in diabetic rats brought about by streptozotocin [42]. Another study exhibiting the effect of guggulsterone derivative of *C. mukul* in a batch of diabetic rats was also observed wherein the rats were given with fatty diet. *Guggulu* therefore has exhibited positive activity in both hyperglycaemia and hyperlipidaemia, which can potentially manage type II diabetes mellites along with the associated metabolic syndrome as said earlier [36].

Antimicrobial Activity of Guggulu [42-45]

In this particular study, the volatile oil of *Guggulu/C mukul* was evaluated for its anti-microbial property. They found the extract to be very effective against- *Rhizopertha dominica* that suggested the role as a very potent fumigant.

In this study the ethanol-based extract of *Guggulu* displayed very effective anti-bacterial action at the dose of 5 mg/mL against the microbe that was studied (multidrug-resistant *Klebsiella pneumonia*).

CONCLUSION

Guggulu one of the traditional medicines with high therapeutic values. *Guggulu* is one of the nutraceuticals containing plant such as myrecene, dimyrecene and ploymyrecene, guggulosterones like Z-guggulsterone, Eguggulsterone, guggulsterone-I, guggulsterone-II, guggulsterone-III and guggulsterone-IV. These isolates are primarily responsible for its actions like rheumatism, arthritis, hyperlipidemia, obesity, inflammation, atherosclerosis, wrinkle, acne

and also in combating bacterial, viral and fungal diseases. Isolation and separation of phytochemical and authentic method development of extracted components is major challenge in front of researchers.

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