



Herbal antibiotics: A Review

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ABSTRACT

Medicinal plants having a big role in the rejuvenation of bad condition developed by the infection of microbes so medicinal plants can be treated as resources for the development of antibiotics agents because of their active constituent which having lots of therapeutic value. There are many plants and plants product as Garlic, Aloe Vera, medicinal volatile Oil, extract etc., used as natural antibiotics for getting relief in burns, respiratory tract infections, enhances immune system, lowers blood pressure etc. When our immune system is weak the microbes can infect and thrives inside or outside our body. Infections can cause by unwanted microbial activities of bacteria, fungi and another microorganism. Not all bacteria are harmful like *Escherichia coli* present in our intestine which help in digestion but various strain of the same bacteria cause diarrhoea and vomiting. Natural antibiotics are herbs and spices which obtained by the nature having desired properties which inhibit the function and spread microbes. In comparison to normal antibiotic medications the natural antibiotics having less side-effects. Herbal Medicine should be used as drugs not as complimentary food. If we advertised that herbal medicine obtained from nature so they have no toxin or side effects and patients can take for long time then it's totally misleading of patients. It should very clear to all that herbal medicinal or herbal products are mostly considered for low risk in comparisons to synthetic drugs; they are not completely free from the possibility of adverse effects. All effective drugs may have adverse effects; drug may be synthetic or herbal medicines. Medicine should be taken in proper dosage and proper course of treatment. Over dosage of any medicine can cause side effects.

Keywords: Natural antibiotics, Bacteria, Microbes, Antibacterial.

Received 11.08.2020

Revised 20.09.2020

Accepted 30.09.2020

INTRODUCTION

Medicinal plants are used throughout the world as the source of effective and powerful drugs. Because of the overuse of antibiotics in prescription it leads to the development of antibiotic-resistant strains of bacteria and then they become useless next time so experts are seeing with a hope towards natural and safe antibiotic as alternate. Medicines prepared from the natural herbs are relatively inexpensive and stored for long time at normal temperature. Herbal antibiotics having complex nature which are used to kill bacteria, cleanse blood, enhances immune system and functions of particular organ systems. They work by simply killing bacteria and recover imbalances of body [1].

Garlic

It is very powerful herb for the treatment of antibiotic-resistant disease. Allicin is the most important active constituent found in garlic which is more powerful than standard Penicillin. And has excellent antimicrobial functions.

There are different cultures in world recognized garlic as healer and preventive effects because of its antibacterial, antifungal and antiviral properties. Biofilms which act as defence mechanisms of bacteria's and fungus, the allicin inhibits the formation of biofilms because biofilms can makes the treatment of infections very difficult and other active ingredient exist in garlic known as Ajoene that was using in treatment of fungal infections by suppressing bacteria by inhibit the production of enzymes which are responsible for various role of the bacteria such as cell structure formation and energy production and survival of bacteria without energy is impossible. Extract of garlic can also be used for the cure of herpes viruses and influenza and many forms of bacteria like *Salmonella* and *Escherichia coli* (*E. coli*) as a very effective treatment [3]. Garlic is used to reduce blood pressure, enhance immune system, lung and digestive system infections. Garlic was used as antimicrobial agent to prevent gangrene during World

Wars [4]. 2.5% of fresh garlic used as a mouth wash and give excellent antimicrobial activity but having Bad breath and unpleasant taste in a recent clinical trial [5,6].

Honey

It not having only nutritional value but also having health benefits as a traditional medicine that are used in the curing of tuberculosis, eye diseases, throat infections, bronchial asthma, worm infestation, eczema, constipation, wounds, healing of ulcers [7]. From ancient time honey applied on wounds to heal and prevents infection as antibiotics and nowadays it useful in treating chronic wounds, burns, ulcers, skin sores. The antibacterial effects are due to its hydrogen peroxide content. Wounds infected with methicillin-resistant *Staphylococcus aureus* treated with honey very effectively by providing a protective coating. The character of honey like as glucose oxidase, hydrogen peroxide, low water acidity and honey prevent the growth of bacteria and yeast [8]. The minimum concentration of honey sufficient for complete inhibitory growth of bacteria. The antibacterial activity of honey is effective against many bacterial pathogens and fungi [9].

Ginger

It is used as a natural antibiotic. Ginger having the ability to fight against bacteria and helpful in seasickness and nausea and to lower blood sugar levels. Chemical constituents like zingerone, gingerol, terpenoids, zerumbone, gingerdiol, shogaol and flavonoids which gives excellent antimicrobial properties by inhibiting the formation of biofilms. The ginger can normalize the production of acid in stomach so the activity of bacteria *H. pylori* bacteria grow in stomach in the presence of acid can be reduced acidity by ginger.

Clove

Water extract of clove effective against various kinds of bacteria including *E. coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*. Active constituents of clove, eugenol which having excellent antibacterial properties because of having the capacity to destroy the outer layer of bacterial cells by inhibit the production of protein synthesis and it results the inhibition of bacterial growth and in last death of bacteria. Eugenol has antibacterial activity against *S. typhi* [10].

Tulsi

Tulsi plant mostly leaf (dried or fresh) are used [11] and mainly three types are commonly found. *O. tenuiflorum* (or *O. sanctum* L.) contain two phytochemically and botanically different varieties like Rama tulsi (green leaves) and Shyamatulsi (purplish leaves) and *Ocimum gratissimum* is another variety of Tulsi called as Vanatulsi (dark green leaves) [12]. Tulsi having antibiotics activity against many bacteria like *Candida albicans*, *Staphylococcus aureus*, *Escherichia coli* because of presence of active constituents in it. *Ocimum sanctum* L. fixed oil having antibacterial activity in which found higher content of linoleic acid in against *Pseudomonas aeruginosa*, *S. aureus* and *Bacillus pumius*, the aqueous extract of *Ocimum sanctum* L. showed zones of inhibition against *Klebsiella*. Ursolic acid, Eugenol and carvacrol present in Tulsi possess antimicrobial activity against *Streptococcus mutans*. At the 4% concentration level these having maximum antimicrobial activity and enhances immunity and metabolic functions with lowering stress and possessing antioxidant property [13].

Turmeric

It is a very well-known Indian spice which having antimicrobial properties and flavour. The chemical constituent Curcumin derived from the rhizome of *C. longa* is an active constituent of turmeric which having very important role in treatment of UTI (Urinary Tract Infections), stomach inflammations as antibacterial as well as antibiofilm activity [14]. Curcumin works as amphipathic and lipophilic so its easily penetrate cell membrane bacteria which results in its leakage and disruption [15]. Due to modulation of gene expression and inhibition of quorum sensing antibiofilm effect shown. It inhibits biofilm and also down regulate many quorum sensing-dependent virulence factors as the production of motility, alginate and swarming [16].

Rosemary

It acts as effective natural antibiotic without side-effects in salmonella infections and staph infections and much effective in fighting quorum sensing bacteria. The Rosemary oil shown antibacterial activity of against *Bacillus cereus*, *E. coli*, *Staphylococcus aureus*, *Salmonella choleraesuis*, *Aeromonas hydrophila*, *Bacillus cereus*, *Staphylococcus aureus* and *Clostridium perfringens* [17]. Active constituents like isorosmanoleic, rosmarinic acid, carnosol, carnosic acid, rosmanol, epirosmanol and rosmaridiphenol work by interaction with the microbial cell membrane that caused change in hereditary material with changing the transport of electrons which results produced the loss of structure and its membrane functionality [18].

Black cumen

Nigella sativa is herbal plant which is also called black cumen. The seed or it oil also used as a carminative, diuretic, lactagogue and vermifuge from past. It also used in the cure of rheumatic diseases,

fever, warts, bites of snake and asthma. Thymoquinone and thymohydroquinone obtained from the Extraction and isolation of the volatile oil of *N. sativa* having suppressive activity against gram-negative and gram-positive bacteria. Diethyl ether extract of *N. sativa* having combining effect with gentamicin and streptomycin exhibit synergetic effect with tobramycin, spectinomycin, erythromycin, nalidixic acid, doxycycline, chloramphenicol, co-trimoxazole, lincomycin, and ampicillin [19]. *N. sativa* seeds contain oil, protein, saponin, arachidonic acid and carbohydrate. The fixed oil is composed of eicosadenoic acid, linoleic acid, almitoleic acid, palmitic acid, myristic acid, stearic acid, sterols, fiber and oleic acid whereas the essential oil of *N. sativa* entails nigellone, carvacrol, thymol, α - and β -pinene, p-cymene, d-limonene, d-citronellol thymoquinone and thymohydroquinone [20].

Mango

Mangifera indica commonly known as mango belonging to family Anacardiaceae is the most popular fruit bearing trees in the world. It is a good source of vitamin A. The main active constituents are the polyphenolics, flavonoids, triterpenoids. Mangiferin a xanthone glycoside major bio-active constituent, Seed kernel extract of mango showing inhibitory effect against *coliform* and *E. coli*. Trituration of mango kernel or its extract is being used in food products or cosmetics because of its bacteriostatic and antibacterial properties. Acetone leaf extract of mango show antibacterial activity against *S. typhi*. [21]. The acetone and methanolic extracts reduced the growth of gram-positive bacteria. Bioactive components present in this plant are thermostable. The application of these plant materials requires boiling for long periods but does not affect its efficacy. Temperature stability by plant extracts had earlier been reported in studies [22].

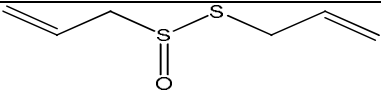
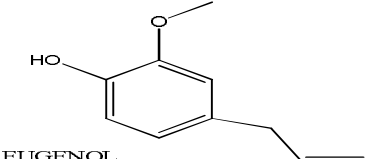
Onion

Allium cepa is also called as bulb onion or garden onion, and is the widely grown species of the genus *Allium*. It having powerful flavonoids that have antibiotic effects and contain therapeutic sulfur compounds called cysteine sulphoxides and also having proteins, carbohydrates and phosphorus. If we eat white onion as raw regularly it showed its antioxidant and anti-inflammatory properties. Raw onion is also helpful in reducing swelling from bee stings and onion extract are used in the treatment of topical scars; onion used to treat intestinal infections from ancient time and antibacterial activity was evaluated against *V. cholerae*. By using disc diffusion method its revealed that *Allium sativum* was viricidal and had MIC of its aqueous extract is obtained to be 5–15 mg/dl and with acetone extract it was obtained to be 2.5–5 mg/dl [23]. *Allium* extract considered as a natural preservative or food additive. In addition to its nutritional values it also having the antibacterial activities against lots of both gram-negative and gram-positive bacteria including *Bacillus subtilis*, *Salmonella*, and *E. coli* and this inhibiting action also noted on *Staphylococcus aureus* and results a complete inhibition of all strains tested at a concentration of 6.5 mg/ml. Effectiveness in antibacterial activity was depending on the type of onions and extracts concentration. Mostly extracts of onion in concentrations of 50% and it shown excellent antibacterial activity above 50% [24].

Persian cumin

Carum carvi is also called as Persian cumin belongs to family Apiaceae, mostly contain volatile oil carvone and limonene. The fruits can be used as whole with pungent or anise-like flavor and aroma because of essential oils present in it. *C. Carvi* is used as antispasmodic, carminative and appetite enhancing agents. *C. Carvi* essential oils controlled the Gram-positive and Gram-negative bacteria [25]. Caraway essential oil showed the maximum effect on *Acinetobacter spp*, *E. coli*, *staphylococcus aureus*, *Proteus spp*. and minimum effect on *Pseudomonas aeruginosa* [26].

TABLE 1: HERBAL SOURCES WITH ANTIBIOTIC ACTIVITY

Botanical name (Common name)	Family	Part used	Chemical Constituents	Activity
<i>Allium sativum</i> (Garlic) [3]	Amaryllidaceae	Bulb	 ALLICIN	Antibiotic
<i>Syzygium aromaticum</i> (Clove) [10]	Myrtaceae	Bud	 EUGENOL	Antibiotic

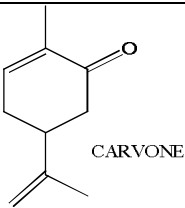
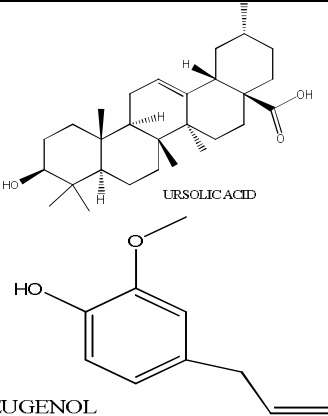
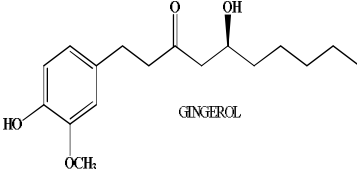
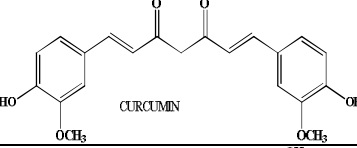
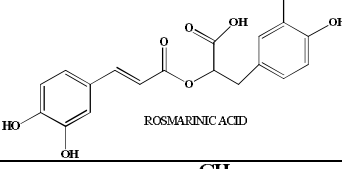
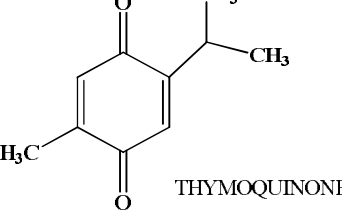
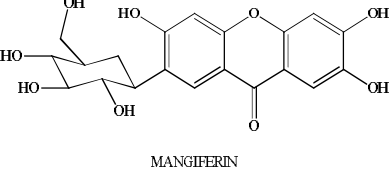
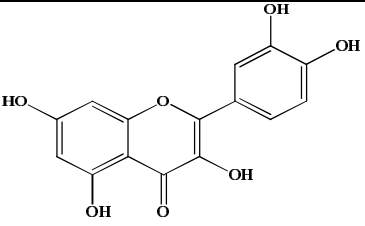
<i>Cuminum cyminum</i> (Cumin) [26]	Apiaceae	Fruit	 CARVONE	Antibiotic
<i>Ocimum sanctum</i> (Tulsi) [12,13]	Labiatae	Leaves	 URSOLIC ACID EUGENOL	Antibiotic
<i>Zingiber officinale</i> (Ginger) [10]	Zingiberaceae	Rhizome	 GINGEROL	Antibiotic
<i>Curcuma longa</i> (Turmeric) [14]	Zingiberaceae	Rhizome	 CURCUMIN	Antibiotic
<i>Rosmarinus officinalis</i> (Rosemary) [17,18]	Lamiaceae	Leaves	 ROSMARINIC ACID	Antibiotic
<i>Nigella sativa</i> (black cumen) [19]	Ranunculaceae	Seed	 THYMOQUINONE	Antibiotic
<i>Mangifera indica</i> (Mango) [22]	Anacardiaceae	Fruits, seeds, flowers	 MANGIFERIN	Antibiotic
<i>Allium cepa</i> (Onion) [23, 24]	Amaryllidaceae	Bulb	 QUERCETIN	Antibiotic

TABLE: MARKETED PRODUCTS OF CRUDE DRUGS AND THEIR MANUFACTURER [30-32]

Crude drugs	Marketed Product	Manufacturer
<i>Allium sativum</i> (Garlic)	Lasuna	Himalaya drug
	Lashunadi bati	Baidyanath
<i>Syzygium aromaticum</i> (Clove)	Himsagar tail	Dabur
	Dabur red paste	
<i>Cuminum cyminum</i> (Cumin)	Lukol	Himalaya drug
	Hajmola	Dabur
<i>Ocimum sanctum</i> (Tulsi)	Shri tulsi	International Manufacturing Corporation Ltd.
	Diokof, Koflet	Himalaya drug
	Nomarks	Nyle herbals
	Kofol syrup	Charak pharma
<i>Zingiber officinale</i> (Ginger)	Gasex	Himalaya drug
	Strepsil	Boots piramil
	Sage massage oil	Sage herbal
<i>Curcuma longa</i> (Turmeric)	J.P. Nikhar oil	Jamuna pharma
	Purian	Himalaya drug
	Respinova	Lupin lab.
<i>Rosmarinus officinalis</i> (Rosemary)	Anti-Dandruff oil	Himalaya drug
	Erina plus	
<i>Nigella sativa</i> (Black cumen)	Anti-Dandruff shampoo	Himalaya drug
	Kankayan gutika	Dabur
<i>Mangifera indica</i> (Mango)	Ethosomal Gel	Merck india Ltd
<i>Allium cepa</i> (Onion)	Allium Cepa	Homeopathic
	Allium Cepa Plex	Seroyal Genestra UNDA
	Allium Cepa 30C	Health Chemist

RISKS OF NATURAL ANTIBIOTICS

It is not necessary that anything that is natural is counted as safe. Its only depends on amounts and concentrations of active ingredients of drug taken. Taking garlic in high concentration may enhance the risk of bleeding so not suggested for people having surgery or taking blood thinners. There are lots of phyto-chemicals having antibacterial efficacy but they are not used as commercial antibiotics still. So, plants must be explored for getting proper recognition of their therapeutic values, safety & efficacy which results so herbal can replace & used as an alternate of synthetic drugs [27].

WHEN TO USE PRESCRIBED ANTIBIOTICS

Antibiotics prescribed for better recovery from illness and to prevent the spreading diseases. But currently drug-resistant diseases come in knowledge so doctors do not prescribe antibiotics if that are not much necessary. Antibiotics are given to inhibit the spread of very infectious diseases from having more harmful and give high recovery rate from illness. Antibiotic should be taken only when it prescribed and prescription should not be shared and neither should left-over before time even if feels better then completion of prescription prescribed. Medical expert tries their best to developed herbal antibiotics for antibacterial resistance because bacterial infection gives lots of threat to life [28].

WHY IS HERBAL ANTIBIOTICS NEEDED?

Antibiotics used during any bacterial infection causing lots of side effect by disturbing natural functions of the body and destruction of good bacteria. These unwanted effects of antibiotics can completely kill or inhibited by the replacing with natural antibiotics. Herbal antibiotics gives effect by not just as bactericidal, but also boosting the body's natural power or immunity for future to save from bacterial infections. Mostly drug resistance does not develop with herbals antibiotics which many times we seen in pharmaceutically produced antibiotics and natural antibiotics does not give the bactericidal effect against beneficial bacteria which lived in our bodies and help us in many ways.

MODE OF ACTION OF CRUDE DRUG

There are lots of crude drugs which having the antibacterial properties. The active constituents of the crude drugs like garlic, ginger, turmeric having approximately same mode of action on bacteria by reducing or inhibits the bio-films growth and rendering it so sensitive as antibacterial herbal drugs. The active constituents of clove and tulip also having the same pharmacological activity by blocking the production of genetic materials DNA and protein and inhibits the bacterial growth.

ANTIBACTERIAL SPECTRUM OF CRUDE DRUGS

There are two types of bacteria according to gram staining i.e. gram positive and gram negative. These drugs having the broad-spectrum antibiotics, mostly drugs are given positive results in both cases like gram positive and gram negative. Tulsi, Turmeric, *Carum carvi*, *Allium cepa*, *Nigella sativum* give their positive antibacterial properties on both type of bacteria like *Bacillus subtilis*, *Salmonella*, *E. Coli* and *Staphylococcus aureus*.

CONCLUSION

Herbal medicine is one of the most trusted aspects of complementary medicines. There are lots of studies which have been asserted the role of several herbs as antibiotics. Decrease in effectiveness with the enhance of toxicity of allopathic or synthetic drugs is increasing the problem so research personals move towards herbal as a hope because herbal crude drugs play an important significance in the development of herbal drugs to have more effective therapeutics. There is an urgent need to help the herbal drugs development to minimize the different cases of drug resistant microbes. The proper utilization of herbal drugs as medicines is improving the herbal drug development. There are lots of reasons to utilization of herbal crude drugs as medicines like in several cases a specific herbal drug to treat a specific disease and the use of herbal drugs as medicine have much power to give biocompatible, cheaper and effective herbal solutions and will increase the chance of the discovery of new medicines [29].

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CITATION OF THIS ARTICLE

Reena Gupta, Sharad Sharma. Herbal antibiotics: A Review. Bull. Env. Pharmacol. Life Sci., Vol 9[11] October 2020 : 154-160