Department of pharmacognosy

Antibacterial effect of ginger oil

مشروع التخرج

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Introduction

Ginger the root of the plant *Zingiber officinale* roscoe that belongs to the family Zingiberaceae, is globally one of the most commonly used spice and medicinal agent.

Historical evidence indicates that the plant was originally indigenous to the South-East Asia but is today also found growing in other parts of the world.

During the medieval times, ginger was exported from India to other parts of the world. Today, ginger is cultivated in the other tropical countries like Nigeria, Sierra Leone, Indonesia, Bangladesh, Australia, Fiji, Jamaica, Nepal, Haiti, Mexico and Hawaii and today, India and China are the leading providers to the world market

Ginger is one of the most commonly used spice worldwide with medicinal value. It has been used extensively in various traditional and folk medicinal systems around the world.

Marinating or usage of ginger in food preparation is useful in maintenance of the health as well prevention of food spoilage and reports indicate that the antimicrobial effects contribute towards the observed effects.

The ginger oil as a very good antibacterial, antifungal property and prevents food borne diseases when used in food preparation. Ginger is also reported to prevent rancidity, thereby increasing the shelf life of lipid containing foods.

The phytochemicals in ginger oil also possess free radical scavenging, antioxidant and anti-peroxidative effects. These properties are attributed to the plethora of biologically active compounds present in the fresh as well dried ginger oils. The antioxidant and lipid peroxidation inhibition properties of ginger prevent peroxidative damage, indicating the benefits of ginger in prevention of microbial food spoilage, free radical-induced damage and rancidity.

Botanical description

Ginger is herbaceous rhizomatous perennial, reaching up to 90 cm in height under cultivation. Rhizomes are aromatic, thick lobed, pale yellowish, bearing simple alternate distichous narrow oblong lanceolate leaves. The herb develops several lateral shoots in clumps, which begin to dry when the plant matures. Leaves are long and 2 - 3 cm broad with sheathing bases, the blade gradually tapering to a point. Inflorescence solitary, lateral radical pedunculate oblongcylindrical spikes. Flowers are rare, rather small, calyx superior, gamosepalous, three toothed, open splitting on one side, corolla of three subequal oblong to lanceolate connate greenish segments

Active constituents

The active ingredients in *Zingiber officinale* are in volatile oil which comprising approximately 1 - 3% of its weight.
The concentrations of active ingredients vary with growing conditions. The active ingredients in ginger are thought to reside in its volatile oils, which comprise approximately 1 - 3% of its weight. The major active ingredients in ginger oil are the sesquiterpenes: bisapolene, zingiberene, and zingiberol (Connel D).

Ginger's active ingredients have a variety of physiologic Effects.
For example, the gingerols have analgesic, sedative, antipyretic and antibacterial effects *in vitro* and in animals . In rats, an intravenous (i.v.) bolus of gingerol had a half life of 7.23 min. 15; however its relation with pharmacokinetics is not clear after oral administration

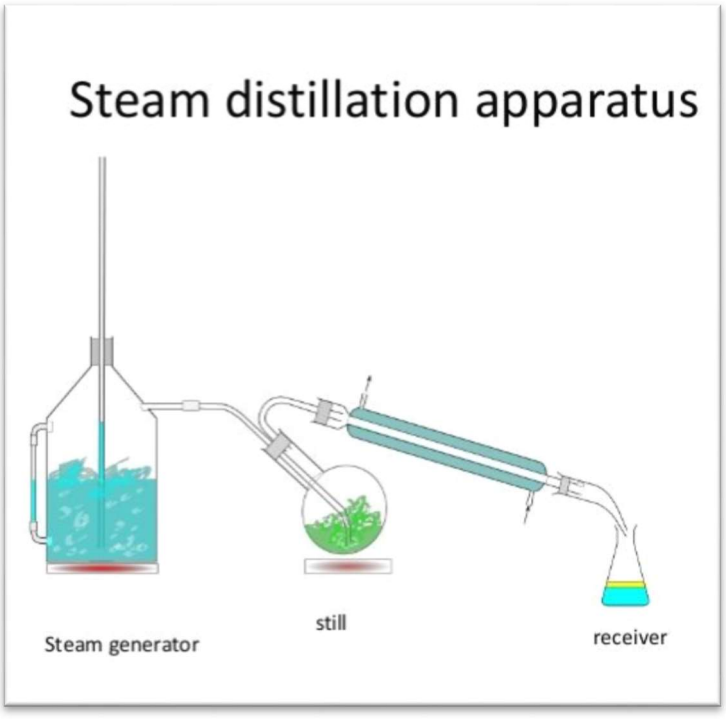
Toxicity

The toxicity of ginger is generally considered to be negligible. Oral LD 50 values in various animals of ginger *oil* exceed 5 gm/Kg. *In vitro* microbial assays have shown both mutagenicity and antimutagenicity for compounds isolated from ginger.
The adverse reaction profile of ginger is benign, consonant with its use as a common spice and food

Extraction of Essential Oils Using Steam Distillation Method:

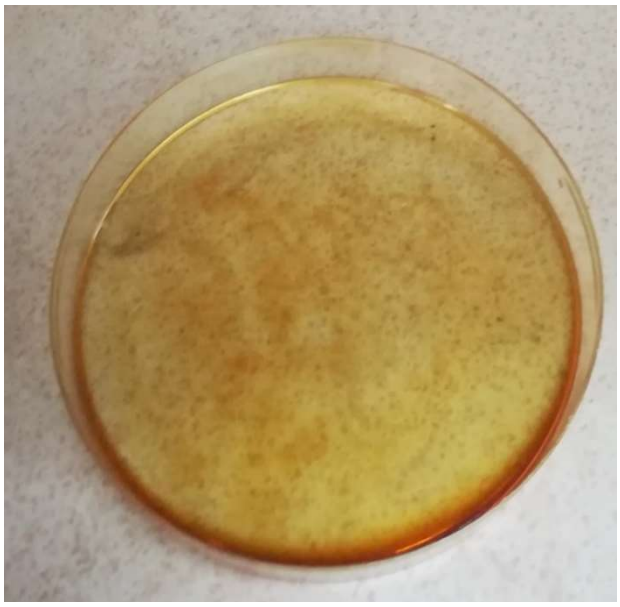
Steam distillation is a special type of distillation or a separation process for temperature sensitive materials like oils, resins, hydrocarbons, etc. which are insoluble in water and may decompose at their boiling point. The fundamental nature of steam distillation is that it enables a compound or mixture of compounds to be distilled at a temperature substantially below that of the boiling point(s) of the individual constituent(s). Essential oils contain substances with boiling points up to 200°C or higher temperatures. In the presence of steam or boiling water, however, these substances are volatilized at a temperature close to 100°C, at atmospheric pressure.

Fresh, or sometimes dried, botanical material is placed in the plant chamber of the still and the steam is allows to pass through the herb material under pressure which softens the cells and allows the Essential Oil to escape in vapor form. The temperature of the steam must be high enough to vaporize the oil present, yet not so high that it destroys the plants or burns the Essential Oils. Besides the steam tiny droplets of Essential Oil evaporates and travel through a tube into the still's condensation chamber. Here Essential Oil vapors condense with the steam. The essential oil forms a film on the surface of the water. To separate the Essential Oil from the water, the film is then decanted or skimmed off the top. The remaining water, a byproduct of distillation, is called floral water, distillate, or hydrosol. It retains many of the therapeutic properties of the plant, making it valuable in skin care for facial mists and toners .



Result of extraction

During the steam distillation process, steam passes through the plant material. The combination of heated steam and gentle pressure causes the essential oil to be released from microscopic protective sacs. As the vapor mixture flows through a condenser and cools, it yields a layer of oil and a layer of water. The essential oil rises to the top and is separated from water and collected .After collection of products we get very small amount to be tested for antibacterial activity



Antibacterial assay

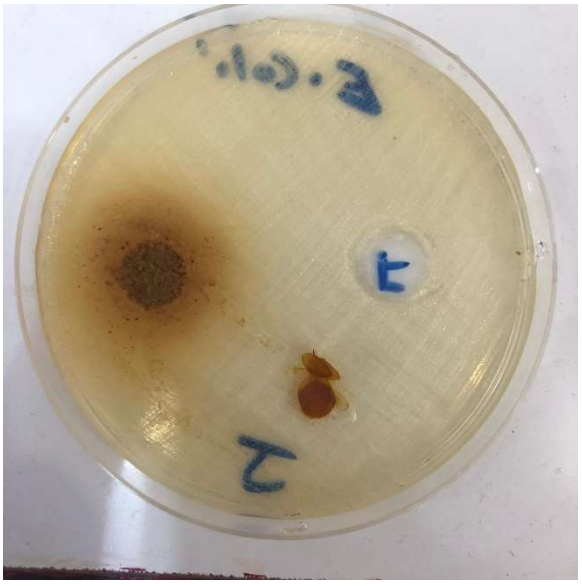
The antimicrobial assay of ginger extract was performed by deep-well agar diffusion method using Mueller Hinton agar. The Mueller Hinton agar were inoculated separately with 107CFU of each test bacterial culture and evenly spread on entire surface of each plate. The agar was carefully punched using a cork-borer (5mm diameter) and the extracts were dispensed into the well's agar wells seeded with bacterial culture.

The plates were left then for incubated at 37°C for 18- 24 hours and observed for zone of inhibition. The diameter of inhibition zones was measured in millimeters.

Result of assay

The resultant of essential oil tested for antibacterial activity on Escherichia coli and Staphylococcus aureus as example of gram negative and gram positive respectively

Inhibition zone	*S. aureus*	*E. coli*
	18 mm	17 mm



discussion

From the result we can see the activity of ginger oil on Gmve+ more than Gmve- because the difference in the nature of cell wall . Structure of the **Gram-negative cell wall**. The **wall** is relatively thin and contains much less peptidoglycan than the **Gram-positive wall**. Also, teichoic acids are absent. However, the **Gram negative cell wall** consists of an outer **membrane** that is outside of the peptidoglycan layer. Cell wall of Gmve+ bacteria is easy effected by many agent such as lysosyme and antibiotics After digestion of Peptidoglycan layer, Gram positive bacteria become **protoplast.** Cells whose walls have been completely remove and are incapable of normal growth and division, while Gmve- it's not contain just peptidoglycan .

Because large protein molecule cannot penetrate the LPS layer. After digestion of Peptidoglycan layer, Gram negative bacteria become **spheroplasts**.

Spheroplasts: Gram negative bacteria with intact cytoplasmic membrane of the protoplast plus the outer membrane (LPS layer) of the cell wall , after peptidoglycan layer is destroyed by lysozyme or its synthesis inhibited by antibiotics.

Factor effect antibacterial result of ginger

1-ginger rhizome greatly affected by the surrounding conditions which could alter the quality and quantity of the bioactive phytochemical compounds

including

the environmental stress factors like light, moisture,

temperature, soil nutrients and ozone,

the biotic stress factors such as herbivores, insects, microorganisms

the human factor such as timing in harvesting and

handling the plant material

2- the method of extraction, the solvent used, the bacteria tested and the source from which these bacteria are collected could play an important role in differences of antibacterial results of ginger rhizome.

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