GINGEROL: A REVIEW
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Abstract
Ginger is a medicinal plant that has been widely used in Chinese, Ayurvedic and Tibb-Unani herbal medicines all over the world and has a long history of use in traditional systems of medicine. Ginger, the rhizome of Zingiber officinale, is one of the most widely used species of the ginger family (Zingiberaceae) and is a common condiment for various foods and beverages. Ginger has a long history of medicinal use dating back 2,500 years in China and India for conditions such as headaches, nausea, rheumatism, and colds. Ginger, the rhizome of the Zingiber officinale has shown therapeutic role in the health management since ancient time and considered as potential chemopreventive agent. Numerous studies based on clinical trials and animal model has shown that ginger and its constituents shows significant role in the prevention of diseases via modulation of genetic and metabolic activities. They are reported to demonstrate various activities such as antiemetic, antipyretic, analgesic, antiarthritic, and anti-inflammatory activities. Antibacterial, antidiabetic and antioxidant activity and in present review Ginger extract with the ingredients such as Gingerols will emphasize on Antibacterial, antidiabetic and antioxidant activity. It was revealed that these differences in the range of gingerol content suggest that there must be different exogenous and endogenous factors affecting the quality and purity of the drug. Herbal drugs have been used since ancient times as medicines for the treatment of a range of diseases.[1] It is concluded that ginger and its bioactive components have the potential for development of modern medicine in the treatment of various diseases in near future.

Introduction Proper Use of Herbal Medicines
With the ever increasing use of herbal medicine worldwide, safety in there use has become major concern to health authorities and general public alike. Inappropriate use of herbal medicine may distort national health policy, drain limited economic resources and encourage ineffective and harmful practices. Draft guidelines for proper use of traditional medicine by WHO have been circulated in may 2002. According to WHO (1996a and b, 1992), standardization and quality control of herbals is the process involved in the physicochemical evaluation of crude drug covering aspects, such as selection and handling of crude material, safety, efficacy and stability assessment of finished product, documentation of safety and risk based on experience, provision of product information to consumer and product promotion.

Gingerol
Ginger contains a number of pungent constituents and active ingredients. The major pungent compounds in ginger, from studies of lipophilic rhizome extracts, have yielded potentially active gingerols. The characteristic odor and flavor of ginger is caused by a mixture of gingerol and shogaol. The pungent taste of ginger is due to The chemopreventive potentials of 6-gingerol present a promising future alternative to expensive and toxic therapeutic agents, non volatile phenyl propanoid-derived compounds, particularly gingerols.
Investigations have shown gingerol and shogoals to be mutagenic. The standardization of drug is based on pungent principles of plant. \( \tau \) max of gingerol was 280-284 nm.
Pharmacological activity of gingerol is Antitussive, analgesic, Antipyretic, antiemetic, antipyretic, analgesic, antiarthritic, antiinflammatory activities, Antibacterial, antidiabetic and antioxidant activity.

**Chemical structures of gingerol**

![Chemical structures of gingerol](image)

**Antibacterial**

*In vitro data*: Ginger extracts have antibacterial effects against both gram positive and gram negative bacteria such as *Clostridium, Listeria, Enterococcus, and Staphylococcus* species, but some of this effect is destroyed by heating (eg.,cooking).\(^{(7,8,9)}\)

Drug resistance is increasing worldwide and it is consider as a main culprit in the failure of treatment. The use of antibiotics against bacteria/microorganism is effective mode of treatment but also causes adverse complications. Earlier investigators have shown that, ginger and its constituents play a vital role in the prevention of microbial growth or acts as anti-microbial agents. An important study in the favors of ginger as anti-microbial activity showed that ginger has antimicrobial activity against *Ecoli, Salmonella typhi* and *Bacillus subtilis* and ethanolic extract of ginger showed widest zone of inhibition against *Salmonella typhi*.\(^{(10)}\)
Ginger rhizome contains several constituents which have antibacterial and antifungal effects. The gingerol and shagelol are identified as more active agents\(^\text{11}\). Earlier studies have shown that, ginger has broad anti-bacterial activity and the ethanolic extract of ginger powder has pronounced inhibitory activities against *Candida albicans* (\(\text{12,13,14}\)) and other report also showed that antifungal properties of ginger extract, Gingerol.\(^\text{15}\) Chief constituents such as [6]-gingerol and [12]-gingerol, isolated from ginger rhizome, showed antibacterial activity against period on bacteria (\(\text{16}\)) and [10]-gingerol has been reported.

**Anti-diabetic activity**

Diabetes is a metabolic disorder and major global health problem worldwide. It is caused by abnormality of carbohydrate metabolism which is related to low blood insulin level or insensitivity of target organs to insulin (\(\text{17}\)). As per estimation, one person is detected with diabetes every iv second in the world where as some one dies of it every 10 second. (\(\text{18}\)) Ginger and their constituents showed pivotal role in the control of diabetes and its complications via antihyperglycemic effect. The exact mechanism of action of ginger in diabetes control is not fully understood but it might be due to the inhibition of oxidative stress and anti-inflammatory process.

**[6]-gingerol and bioactive property analyses**

**[6]-gingerol content**

The contents of [6]-gingerol were analyzed by high performance liquid chromatography (HPLC1100, Agilent, Germany) equipped with a reversed phase column C18 (Hypersil ODS 250 mmmx 4.0mm.i.d.,5mic), Elution was isocraticus in a mixture of HPLC grade acetonitrile and water (55:45v/v) flow rate1.0ml/min,t emperature30°C.

A Variable Wavelength Detector (VWD) set at 282 nm was used.

The compounds were identified and quantified based on retention time using [6]-gingerol as HPLC external standard. 10g of cut ginger were blended with 50 ml methanol (HPLC grade) by electrical blender for 1 min and centrifuged at 5,000 rpm for 5 min. The supernatant was subsequently filtered through a 0.20μm Nylon membrane filter (Whatman, England). A20 μl ginger extract was then subjected to HPLC for the [6]-gingerol analysis.

**Antioxidant activities**

The antioxidant activities were determined with two radical scavenging assays: DPPH(1,1-Diphenyl picryl hydrazyl) radical scavenging assay and ABTS (2,2'-azinobis[3-ethylbenzothiazoline-6-sulfonicacid]) radical cations scavenging assay. DPPH assay was performed according to the method of Yamasaki et al. (1994). Results were expressed as EC50 (Efficient Concentration, the amount of sample (μg) needed for 50% decrease in the initial DPPH concentration per 1.0 ml of initial solution) and BHT was used as a standard (EC50=13.82μg/ml). ABTS (2,2'-azinobis [3-ethyl benzo thiazoline-6- sulfonic acid]) radical cation scavenging assay was conducted according to the method of Re et al. (1999), and compared with Trolox standards (final concentration 0-15μM) in ethanol. The high erthe value of μmol Trolox, the stronger the antioxidant activity. Results were expressed as μmol Trolox/g extract.

**Total phenolic content**

Total phenolic content was determined by the Folin–Ciocalteu method and gallic acid(final concentration 0-8μg/ml) was used as the standard. Results were expressed as mg gallic acid/g extract.

**Determination of [6]-gingerol content and bioactive properties of fresh and dried ginger**

The amounts of [6]-gingerol extracted from fresh and dried ginger are shown in Table [6]-gingerol was the major ginger oleoresin. Molecular structure of gingerol consisted of hydroxyl keto functional group which was thermally labile. The thermal degradation products of [6]-gingerol including shogaols and aldehydes possibly occurred during the drying process (\(\text{20,21}\)). As a result, the dried ginger had a smaller amount of [6]-gingerol compared to the fresh product.
### Chemical and bioactive properties of fresh and dried ginger.

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<tr>
<th>Chemical and bioactive properties</th>
<th>Materials</th>
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<tr>
<td>Moisture content (%)</td>
<td>Fresh ginger</td>
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<tr>
<td>[6]-gingerol content (mg/g dry weight basis)</td>
<td>94.17 ± 0.16^a</td>
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<tr>
<td>Total phenolic content (mg gallic acid/g extract)</td>
<td>21.15 ± 0.13^a</td>
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<tr>
<td>Extract</td>
<td>24.63 ± 0.43^b</td>
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<tr>
<td>EC50 (μg/ml)^1</td>
<td>64.60 ± 0.18^a</td>
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<tr>
<td>ABTS assay (μmol Trolox/g extract)</td>
<td>169.06 ± 3.96^b</td>
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^a,b means ± standard deviation in the same row with different letters is significantly different (P < 0.05)^1 Efficient Concentration: The amount sample (g) needed for 50% decreasing in the initial DPPH concentration per 1.0ml of initial solution.

### Conclusions
Concurrent mode of treatment based on synthetic drugs such as anti-bacterial, anti-inflammatory, anti-diabetic, chemotherapy and radiotherapy drugs for the treatment are effective but also shows adverse side effect. A safe, effective and inexpensive product is needed to control the diseases development via modulation of genetic, metabolic, anti-oxidant and other associated activity. Ginger shows an important effect in the suppression of NFkB, COX2, and LOX, induction of a apoptosis, activation of tumour suppress orgene and also modulates various biological activities. Ginger and their constituents create optimism towards then over therapeutic strategy. Future research should focus on clinical trials to investigate its effectiveness and their exact role in modulation of molecular path ways.

### References
4. Singh A. P. and Malhotra S.; “Medicinal properties of Ginger (Zingiber officinale Rosc.)’ Natural Product Radiance; Nov 2003 ,2(6), 296-301