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# A Review on Extraction of Gingerol from Zingeber Officinale

Neethu .A[1], Padmajadevi M.S[2], Prasobh G.R[3]
*1B Pharm student, Sree Krishna College of Pharmacy and Research Centre, Parassala, Thiruvananthapuram, Kerala, India. 695502.*
*2 Associate professor Department of Pharmaceutical Chemistry and Analysis, Sree Krishna College of Pharmacy and Research Centre, Parassala, Thiruvananthapuram, Kerala, India. 695502.*
*3Principal,Sree Krishna College of Pharmacy and Research Centre, Parassala, Thiruvananthapuram, Kerala, India. 695502.*

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**ABSTRACT**
The purpose of the study was to investigate the extraction of Gingerole from Zingiberofficinale Roscoe. though the bioactive pathways are unconnected. It is normally found as a pungent yellow oil in the ginger rhizome, but can also form a lowmelting crystalline solid. This chemical compound is found in all members of the Zingiberaceae family plant and is high in concentrations in the grains of paradise as well as an African Ginger species. Traditional Chinese medicine believes that ZOR has effects of releasing exterior and dissipating cold, arresting vomiting, resolving phlegm, and relieving coughs and can be used to treat fish and crab poison, stomach colds and vomiting, and cold sputum cough [1]. Modern pharmacological studies have shown that ZOR can promote digestion, improve blood circulation, lower blood lipids, lower blood sugar, relieve vestibular stimulation, and provide anti-inflammatory, antitumor, antimicrobial, and antioxidant effects [2–5]. Due to its rich active constituents, ZOR has been used in cosmetics, toothpaste.

**KEY WORDS:**Extraction, Bioactive, Zingiber officinale

## I. INTRODUCTION

Zingiber officinale Roscoe (ZOR, also Shengjiang in Chinese) is a perennial herb from the Zingiberaceae family, native to the Pacific Islands. It can be found in the Chinese provinces of Shandong, Henan, Hubei, Yunnan, Guangdong, Sichuan, and Jiangsu. ZOR is the fresh root of ginger, which is not only an important condiment but also one of the most commonly used Chinese medicines in clinical practice. Modern pharmacological studies have shown that ZOR can promote digestion, improve blood circulation, lower blood lipids, lower blood sugar, relieve vestibular stimulation, and provide anti-inflammatory, antitumor, antimicrobial, and antioxidant effects [2–5]. Due to its rich active constituents, ZOR has been used in cosmetics [6], toothpaste [7], and health foods [8–10].

All development and utilization of ZOR are based on its material composition. The chemical composition of ZOR is complex, includes more than 300 types of species, and can be broadly divided into three categories: volatile oils, gingerol, and diarylheptanoids [11–13]. In this paper, the existing research literature of ZOR is systematically summarized, and each chemical composition and its chemical structure are listed in detail, with a view to providing references for quality control, cultivation production, and further development of ZOR.

**Seperation & Isolation Techniques Of Gingerol**
**Materials And Methods**

- **Chemical and Reagents**

FTIR Spectrophotometer (Perkin elmers), UV Spectrophotometer (SHIMADZU 1800), HPLC Waters 1650, all chemicals and solvents used.

- **Isolation of gingerol from ginger**

Dry ginger was crushed to a coarse powder and extracted with95% ethanol by simple maceration process. Solvent was evaporated by distillation to obtain thick pasty mass. The thick pasty mass was suspended in water. The Ginger resin precipitates in water which was removed by filtration and the residue obtained was dried under vacuum.

- **Standardization of gingerolfrom ginger:**The gingerol, active constituent of ginger rhizome extract was standardized by various methods specified in the compendias. The various tests such as TLC. HPLC, Identification test are

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performed to identify the gingerol present in extract.

**Thin Layer Chromatography(TLC)**

Preparation of plates

Prepare a suspension of coating substance and spread a uniform layer of suspension, 0.25 to 0.30 mm thick, on flat glass plate of 20 cm long. Dried in air and heat at 100 to 1050 for atleast 1 hr. Store the plates protected from moisture, drythe plates at time of use if necessary

- Mobile phase :Hexane/Diethyl ether (30:70)

**Table 1:** Rf Values for ethanolic extract of Zingiber officinale by TLC

| Solution | Solvent Front Height (cm) | No. of spots | Spot height(cm) | Rf Value |
|---|---|---|---|---|
| Reference Solution | 5.5 | 1 | 5.4 | 0.98 |
| Test Solution | 6.2 | 1 | 6.0 | 0.97 |

- Test solution

Reflux 1 g of the coarsely powdered substance under examination with 25 ml of methanol for 15 minutes, cool and filter. Wash the residue with 10 ml of methanol. Combine all the filtrates and concentrate to 10 ml.

- Reference solution

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**Table 2:** Standard calibration curve of gingerol by HPLC

| Sr. No. | Conc. ug/ml of standard solution | Peak height % |
|---|---|---|
| 1 | 20 | 40.59 |
| 2 | 40 | 48.0 |
| 3 | 60 | 51.69 |
| 4 | 80 | 55.96 |
| 5 | 100 | 58.89 |

Reflux 0.5 g of coarsely powdered sunthi RS with 5 ml methanol for 15 minutes, cool and filter. Apply to the plate 10 µl of each solution as bands 10 mm by 2 mm.

- Result and discussion

Standardization of gingerol from zingiberofficinale rhizomeextact.

**TLC Method**

Gingerol is analysed for retention factor. Tlc plate showed result illustrated in figure 10 of tlc chromatogram. Clear spot observed from ethanolic extract when visualized by eye, however under uv lamp in long wavelength 365nm the spot colour were fluorescent blue.

**High Performance Liquid Chromatography Technique(HPLC)**

100 ml of methanolon a water–bath for 15 minutes cool and filter. Reflux the residue further with methanol till the last extract turns colourless, cool and filter. Combine all the filtrates and concentrate to 50.0 ml.

1) Reference solution:

A 0.1 % w/v solution of 6-gingerol RS in methanol.

2) Chromatographic system

A stainless steel column 25 cm x 4.6 mm packed with octadecylsilane bonded toPorous silica (5 µm)

3)Mobile phase: 55 volumes of acetonitrile and 45 volumes of water, flow rate. 1.3 ml per minute, spectrophotometer set at 278 nm, a 20 µl loop injector

4) Result & Discussion

**Standardization Of Gingerol From Zingiber Officinale Rhizome Extract**

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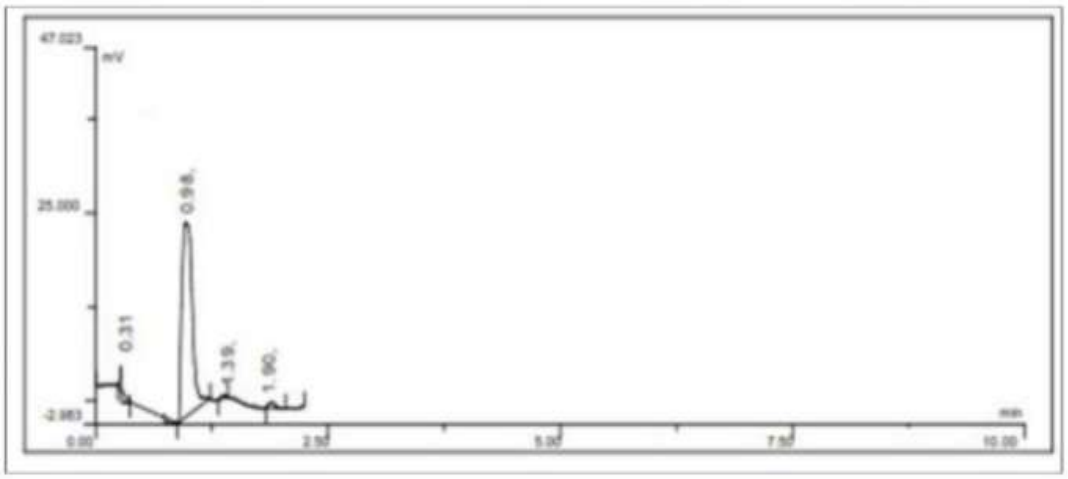
**HPLC Method:** The standard curve for the concentration Vs peak height was drawn and line of equation was originated. From the line of equation of standard drug y= 0.2228x + 37.658 and based on the calculations and findings, it wasconsequently found that 100 mg of extract would be consist of 18.276 mg i.e. 18.276% of active content.




HPLC chromatogram of *Ginger extract*

**Conventional Synthesis of (6)Gingerol**

The synthesis of gingerol 1 and related compounds 2–5 along with diarylheptanoids 6–8 has been accomplished using a Keck allylation, Crimmins' aldol reaction, aldehyde coupling with acetylene, and chelation controlled reductions as the key reactions. The absolute configuration of these molecules was confirmed by preparing their acetonide derivatives and by comparison of the NMR data with natural compounds.

## BIOACTIVITY OF ZINGIBER OFFICINALE

**Antioxidant Activity**

It has been known that overproduction of free radicals, such as reactive oxygen species (ROS), plays an important part in the development of many chronic diseases [17]. It has been reported that a variety of natural products possess antioxidant potential, such as vegetables, fruits, edible flowers, cereal grains, medicinal plants, and herbal infusions . Several studies have found that ginger also has high antioxidant activity .

The antioxidant activity of ginger has been evaluated in vitro via ferric-reducing antioxidant power (FRAP), 2,2-diphenyl-1-picrylhydrazyl (DPPH), and 2,2′-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) methods

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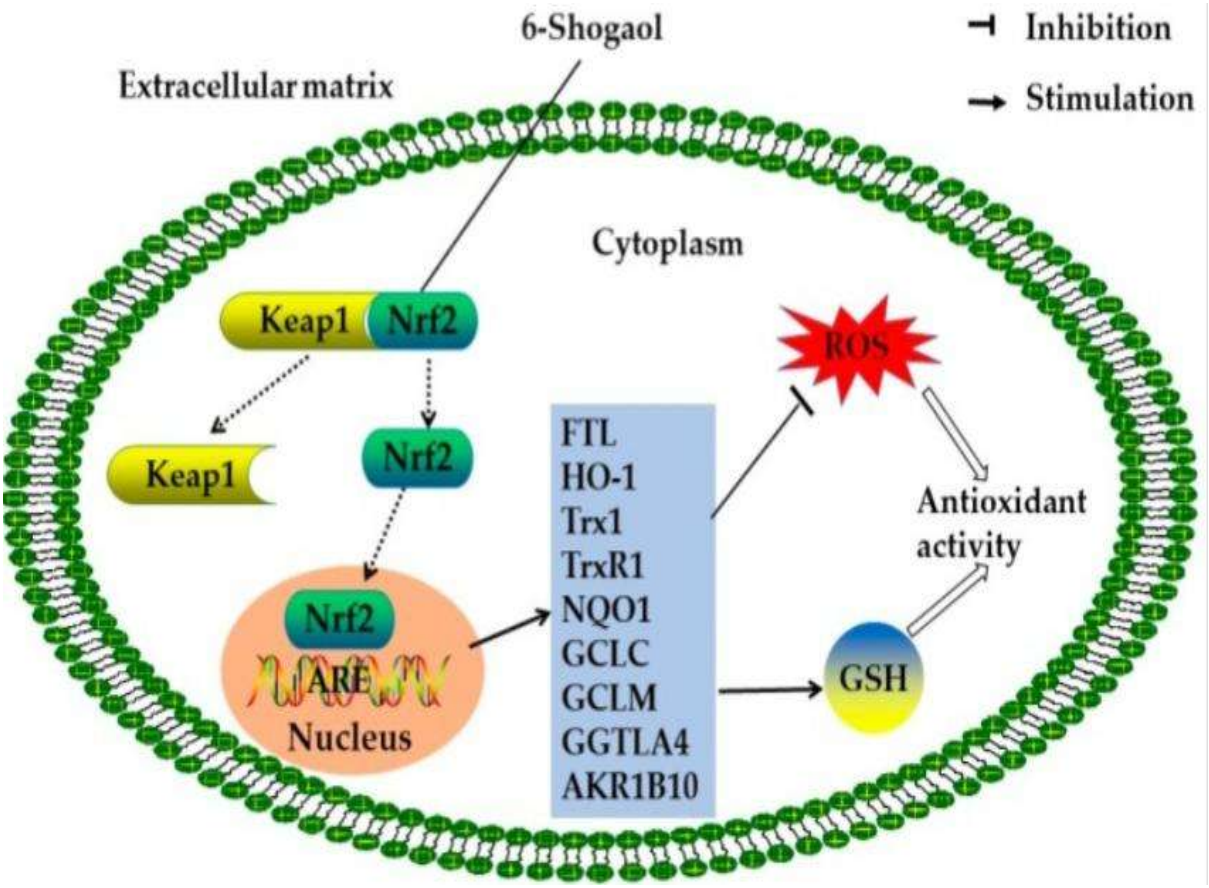


figure: Antioxidant activity of 6- shagaol

**Anti-Inflammatory Activity**

A series of studies showed that ginger and its active constituents possessed anti-inflammatory activity which could protect against inflammation-related diseases such as colitis [4,36]. The anti-inflammatory effects were mainly related to phoshatidylinositol-3-kinase (PI3K), protein kinase B (Akt), and the nuclear factor kappa light chain-enhancer of activated B cells (NF-κB).In general, ginger and its active compounds have been found to be effective in alleviating inflammation, especially in inflammatory bowel diseases. The anti-inflammatory mechanisms of ginger are probably associated with the inhibition of Akt and NF-κB activation, an enhancement in anti-inflammatory cytokines, and a decline in proinflammatory cytokines.

**Antimicrobial Activity**

The spread of bacterial, fungal, and viral infectious diseases has been a major public threat due to antimicrobial resistance. Several herbs and spices have been developed into natural effective antimicrobial agents against many pathogenic microorganisms [43]. In recent years, ginger has been reported to show antibacterial, antifungal, and antiviral activities.Biofilm formation is an important part of infection and antimicrobial resistance. One result found that ginger inhibited the growth of a multidrug-resistant strain of Pseudomonas aeruginosa by affecting membrane integrity and inhibitingbiofilm formation.

**Cytotoxicity**

Cancer is documented to be a dominant cause of death, and there were approximately 9.6 million cases of death in 2018 [54]. Several research works have demonstrated that natural products such as fruits and medicinal plants possess anticancer activity [55,56]. Recently, ginger has been widely investigated for its anticancer properties against different cancer types, such as breast, cervical, colorectal, and prostate cancer .

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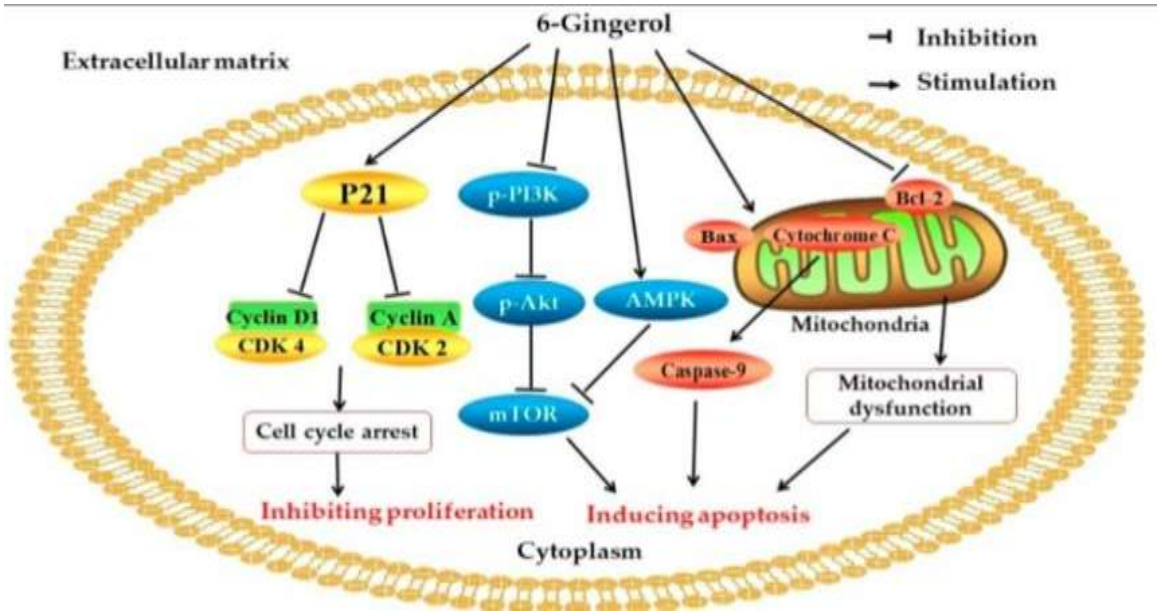


Figure : Cytotoxicity of 6- gingerol

**Neuroprotection**

Some individuals, especially elderly people, have a high risk for neurodegenerative diseases, such as Alzheimer's disease (AD) and Parkinson's disease (PD) [69]. Recently, many investigations have revealed that ginger positively affects memory function and exhibits anti-neuroinflammatory activity, which might contribute to the management and prevention of neurodegenerative diseases .

The studies found that ginger and its bioactive compounds, such as 10-gingerol, 6-shogaol, and 6-dehydrogingerdione, exhibited protective effects against AD and PD. The antioxidant and anti-inflammatory activities of ginger contributed to neuroprotection.

**Cardiovascular Protection**

Cardiovascular diseases have been considered to be a leading cause of premature death, and 17.9 million people die per year [75]. Dyslipidemia and hypertension are known to be risk factors for cardiovascular diseases, including stroke and coronary heart disease [8,76]. A series of studies has shown that ginger can decrease the levels of blood lipids and blood pressure [77,78], contributing to protection from cardiovascular diseases.

Generally, ginger has exhibited cardiovascular protective effects by attenuating hypertension and ameliorating dyslipidemia, such as in the improvement of HDL-C, TC, LDL, TG, and VLDL.

**Antidiabetic Activity**

Diabetes mellitus is known as a severe metabolic disorder caused by insulin deficiency and/or insulin resistance, resulting in an abnormal increase in blood glucose. Prolonged hyperglycemia could accelerate protein glycation and the formation of advanced glycation end products (AGEs) [87]. Many research works have evaluated the antidiabetic effect of ginger and its major active constituents.

## II. CONCLUSION

Zingiber officinalis extract solvents of various forms have more pharmacological values, because it contains alkaloids, saponins, tannins, glycosides, ter-Penoids, phlobatannin and other essential compounds. So it is considered to be a potential sourceOf medicinal herbs. We can extend research on its Properties

This study sought to characterize the presence of 6-Gingerol in different parts (in vivo and in vitro) of Zingiber officinale Rosco using thin layer Chromatography (TLC) and high performance liquid Chromatography (HPLC). 6-gingerol was detected in all Extracts of different parts of ginger derived from in vivo And in vitro

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culture conditions. TLC screening showed Spots having identical Rf value (0.15), according to the Synthetic standards of 6-gingerol in all samples extract. HPLC chromatogram demonstrates similar UV spectra Characteristics of 6-gingerol in synthetic standards, in Vivo rhizomes, and in vitro cultures of different ginger Parts. The quantity of 6-gingerol in rhizomes (in vivo And in vitro) and in vitro microrhizomes (45.37; 42.64;28.11 mg/g respectively), were showed a higher value Than that of in vitro call, shoots and roots (7.89; 7.46; 6.40 mg/g respectively).

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