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Phytochemistry and Antibacterial Activity of Ginger (*Zingiber Officinale*) against Fish Bacterial Pathogens

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ABSTRACT
Fresh rhizomes of ginger extracted separately using distilled water as solvent of extraction. The extract was tested for antibacterial activity against fish pathogens isolated and biochemical test were in Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi, Klebsiella pneumoniae, Staphylococcus aureus. The antibacterial activity of ginger extract on test isolates was determine using disc diffusion methods. The qualitative phytochemical test indicates that the extract of Zingiber officinale (Ginger) constitutes antibacterial activity. This study shows that the extract of Zingiber Officinale possess antibacterial compounds against fish pathogens.
Keywords: *Ginger, Biochemical test, Fish bacterial pathogens, Phytochemical study, Antibacterial activity.*

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INTRODUCTION

Medicinal plants are important substances to study for their traditional uses through verification of pharmacological effects and may be sources of natural synthesis acting as novel anti-infectives. These spices have unique aromas and flavours that are derived from compounds known as phytochemicals or secondary metabolites. Phytochemicals are antibacterial substances found in spics that have the ability to attract kindness and repel harmful organisms; they also act as photoprotectors and respond to environmental changes [1-2].

Selective cytotoxic antibacterial agents are particularly useful as chemotherapeutic agents in the treatment of infectious diseases and may depend on the requirement of a specific receptor for drug binding or may depend on the inhibition of biochemical events that are essential for the pathogen but are independent of the host [3]. It has many uses including traditional spice, pharmacology including anti-inflammatory and antibacterial effects. Ginger and garlic have a common relationship as they help regulate blood sugar, blood pressure, lower cholesterol, and prevent hardening of the arteries. The medicinal value of garlic and ginger is attributed to the presence of many important phytochemicals such as allicin, allinin A, ajoene, diallylsulfide, enzymes, B vitamins, proteins, minerals, saponins and flavonoids, etc.

Ginger is used as an herb and also as a spice, especially in the East. Webbed ginger belongs to the family Zingiberaceae and the scientific name is *Zingiber officinale* [4] Ginger is composed of thick scaly rhizomes, fragrant, thickly lobed, branched, scaly, and fragrant. spicy lemon. Rhizomes contain both aromatic and pungent components [5]. Since ancient times, many countries have used ginger (*Zingiber officinale*) as medicine for many diseases such as arthritis, cramps, rheumatism, sprains, sore throat, muscle aches, aches, constipation, vomiting, high blood pressure, indigestion, fever madness[6]. Ginger has direct antibacterial activity and can therefore be used to treat bacterial infections [7].

Fresh ginger has been used for ailments caused by colds, nausea, asthma, cough, colic, heart palpitations, swelling, indigestion, loss of appetite and rheumatism, briefly for the same purpose as in Ancient China. Ginger rhizome is one of the most popular spices or flavour enhancers in the world. It has been used as an herbal remedy for centuries in Ayurvedic, TibbUnani, Chinese and Islamic herbal medicine.Foods that are treated with ginger include colds, arthritis, nausea, hypertension, migraines, and many others [8].

Ginger rhizome has been widely used in food industry and traditional medicine; Consumers increasingly prefer this vegetable product. However, the difference in antimicrobial results may be because ginger rhizomes are strongly influenced by ambient conditions that can alter the quality and quantity of the bioactive phytochemicals; Among these are abiotic stressors, including environmental stressors such as light, humidity, temperature, soil nutrients, and ozone, in addition to biotic stressors. such as herbivores,

insects, and microorganisms, and human factors such as the timing of harvest and handling of plant materials [9].

Antibiotic resistance (AMR) is the ability of microorganisms to resist the effects of drugs previously used to treat them. The extensive use of antibiotics has promoted the acquisition of resistance by microorganisms, which has become a hot spot [10]. The increase in multidrug resistance of pathogens makes it necessary to find alternative compounds to treat infectious diseases [11]. Many medicinal plants have been reported to have antibacterial activity such as ginger and garlic. In addition to cooking uses, garlic is also known for its medicinal value. In addition, garlic and ginger extracts kill pathogens and have antibacterial activity. In this study, the antibacterial activity of ginger extract against Gram-negative and Gram-positive microorganisms isolated from spoiled fish was aimed at finding alternative ways to treat bacterial infections caused by fish pathogens.

MATERIAL AND METHODS

Isolation and identification of bacterial pathogens from infected fish

For the microbiology analysis of fish pathogens, part of fish were selected like gut, stomach, and gills and homogenized. The homogenized tissues were stored at 5□C in refrigerator for the further studies. Sterile cotton swabs were prepared and various areas of fish as tested above were prepared and various areas of fish as started above were swabbed or spread on nutrient agar plate and kept for overnight incubation. After the appearance of bacterial colonies, each colony was analyses microscopically and further characterization was perfumed.

Biochemical test:

The isolated organisms were analyzed biochemically by performing following test like IMViC, Urease, Catalase, Oxidase and TSI. The results were observed.

Preparation of ginger extract

Ginger rhizome weighing balance, 100g of ginger were measured. They were peeled using a sterile lancet washed properly in sterilized water and pounded with the aid of a sterile mortar and pestle. It was dissolved in 100 ml of distilled water and the extract was filtered using Whatman filter paper no.1 separately. 20 ml of the extract was obtained and kept in two test tubes 100 ml in each.

Antibacterial activity of ginger against fish pathogens

Filter paper discs (6mm) were prepared using a punch machine and the paper discs were sterilized in a dry heat sterilizer and kept in the refrigerator for further use. Using freshly subculture broth, a lawn of each bacterial isolate was formed on Muller Hinton Agar, and the culture was swabbed on plates with a sterile cotton swab. In the laminar air flow cabinet, MHA plates were dried for 15 minutes. The different concentrations of ginger extracts discs were placed on top of the dried MHA plates. Then, the plates were incubated for 24 hr at 37□ and observed the results**.**

Identification tests for active compounds

The test was done to find the presence of the active chemical constituents such as alkaloids, glycosides, terpenoids, flavonoids, reducing sugar, saponins and tannin by the following procedure [12]

Test for alkaloids

ml of extract was taken in a test tube and then 0.2ml dilute HCL was included followed by 1 ml of Meyer's reagent. A yellowish coloration indication alkaloid.

Test for glycosides

Crudeextract was mixed with 2ml of chloroform. Then 2 ml of concentration H_2So_4 was added carefully and shaken gently. The presence of reddish-brown color indicates the presence of steroidal ring.

Test for terpenoids

Crude extract was dissolved in 2 ml of chloroform and evaporated to dryness. To this 2 ml of concentrationH_2So_4 was added and heated for about 2 minutes. A grayish color indicated the presence of terpenoids.

Test for saponins

Crude extract was mixed with 5 ml of distilled water in a test tube and it was shaken vigorously. The formation of stable foam was taken as an indication for the presence of saponins.

Test for flavonoids

1 to 5 drops of concentrated hydrochloric acid (HCL) were added to little amount of ethanolic extract of the plant material. Immediate development of a red color indicates the presence of flavonoids.

Test for phenols

Crude extract was mixed with 2 ml of 5% solution of $FeCL_3$. A blue – green or black coloration indication the presence of phenols.

Test for Keller- Kilan

Crude extract was mixed with 2ml of glacial acetic containing 12 drops of 2% solution of $FeCL_3$. The mixture was then poured into another test tube containing 2ml of concentration H_2So_4. A brown ring at the interphase indicated the presence of cardiac glycosides.

Test for Quinones

A small amount of extract was treated with concentrated Hcl and observed to the formation of yellow color precipitate.

Test for Tannins

Crude extract was mixed with 2 ml of 5% solution of $FeCL_3$. A blue – green or black coloration indication the presence of tannins.

RESULTS AND DISCUSSION

The present study looked at the biochemistry of damaged fish bacterial infections. In ginger, phytochemical components known to suppress bacteria were discovered (*Zingiberofficinale*). With the isolation of contaminated spoiled fish pathogens was identified by biochemical test, ginger extract was found to have antibacterial action against gram -positive and gram-negative bacteria.The aqueous extract of ginger (*Zingiber officinale*) exhibited the greatest zone of inhibition on, according to the findings*Staphylococcus aureus* (22mm)*Escherichia coli* (19mm), *Klebsiellapneumonia* (16mm), *Salmonella typhi* (12mm), and *Pseudomonas aeruginosa* (0mm) were all some inhibited by a water extract of ginger (*Zingiber officinale*).

Table:1 Biochemical tests for conformation of spoiled bacterial fish pathogens

Biochemical tests	***Escherichia coli***	***Salmonella typhi***	**Pseudomonas aeruginosa**	**Klebsiella pneumoniae**	***Staphylococcus aureus***
Indole	Positive	Negative	Negative	Negative	Negative
Methyl red	Positive	Positive	Negative	Negative	Positive
Voges Proskauer	Negative	Negative	Negative	Negative	Positive
Citrate	Negative	Negative	Positive	Positive	Positive
Urease	Negative	Negative	Positive	Positive	Positive
TSI	A/a gas+ H_2S-	A/a/a/a, H_2S-gas	Alk/Alk, gas- H_2S-	Alk/a/a gas+ H_2S-	A/a, gas+ H_2S-
Motility	Motile	Motile	Motile	Motile	Non-Motile

Table: 2 Phytochemical Compounds Present in the Extract of *Zingiber officinale*

S.NO	**PHYTOCHEMICAL TEST**	**RESULTS**
1.	Saponins test	+
2.	Tannins test	-
3.	Keller Kiliani test(cardiac glycoside)	-
4.	Flavonoids test	-
5.	Alkaloids test	-
6.	Phenol test	-
7.	Reducing sugar test	+
8.	Quinones test	+
9.	Terpenoids test	-

Table: 3 Antibacterial activities of aqueous extracts of ginger (*Zingiber officinale*) against spoiled fish pathogens

S.No	**Fish Pathogens**	**Zone of inhibition (mm)**
1.	*Escherichia coli*	19mm
2.	*Klebsiella pneumonia*	16mm
3.	*Staphylococcus aureus*	22mm
4.	*Salmonella typhi*	12mm
5.	*Pseudomonas aeruginosa*	-

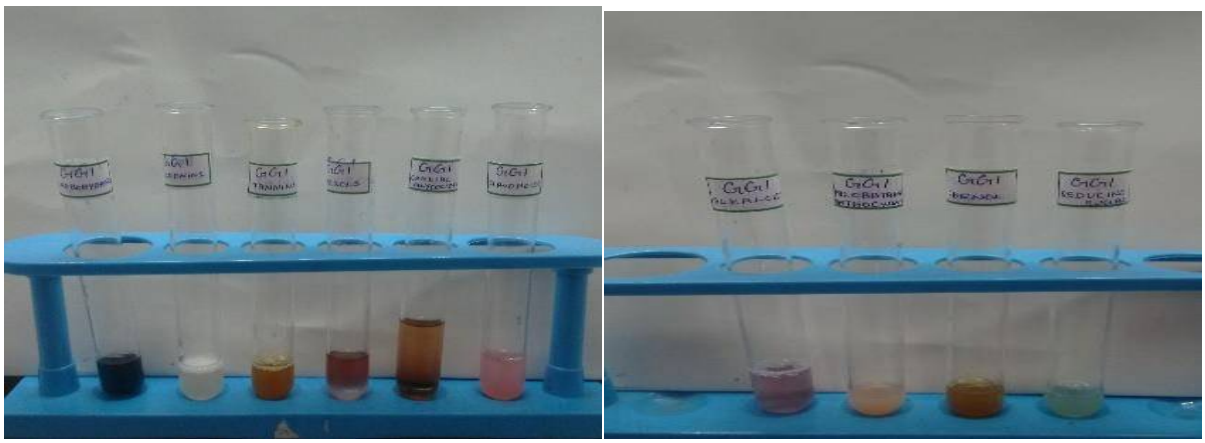

Figure 1: Phytochemical analysis of ginger (*Zingiber officinale*)

A medicinal plant is any plant in which one or more of its parts contain substances that can be used for medicinal purposes, as precursors for the synthesis of useful drugs. Raw or purified extracts of the plant have been used medicinally and cosmetically [13]. The medicinal value of these plants lies in their bioactive phytochemical components that induce a certain physiological action on the human body [14]. Ginger (*Zingiberofficinale*) is used as a spice in many Asian cuisines, especially in Indian cuisine, along with ginger. Several researchers have studied the antibacterial activity of ginger [15]. Ginger plays an important medicinal role due to the presence of several components such as gingerol, Paradol, Shogoal, Zingerone, Zerumbone, terpenoids and flavonoids in ginger [19]. Ginger against tested foodborne pathogens *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Vibrio cholerae*, *Klebsiella* spp, *Salmonella* spp. [16]. Ginger and garlic preparations have been shown to have broad antibacterial activity against Gram-negative and Gram-positive bacteria causing *Escherichia coli*, *Salmonella, Staphylococcus, Streptococcus, Klebsiella, Proteus, Bacillu*s and *Clostridium* species [17-21].
After testing, it was noted that the effectiveness of different ginger extracts was demonstrated against different types of bacteria, but the bacteria were not shown to be sensitive to the extracts. garlic. At different concentrations of 100%, 50% and 25% ginger, the zone of inhibition was 20, 50, and 13 mm for E. coli and 15, 12 and 10 mm for Staphylococcus, respectively [22].The results of the experiment clearly showed that as the ginger concentration decreased, the zone diameter also decreased for the two bacteria used in the experiment. The results also indicated that E. coli was more sensitive than Staphylococcus in the case of different ginger extracts [23].

CONCLUSION

This study included biochemical data on spoilage fish pathogens such as Staphylococcus aureus, E. coli, Klebsiella pneumoniae, Salmonella typhi, and *Pseudomonas aeruginosa*. A qualitative phytochemical analysis revealed alkaloids, glycosides, terpenoids, steroids, flavonoids, tannins, and reducing sugar. Using the disc diffusion method, the antibacterial effectiveness of juice extracts from various medicinal herbs, including Zingiberofficinale (Ginger), was studied against fish bacterial pathogens.

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