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COMPARATIVE STUDIES AND PHYTOCHEMICALS SCREENING OF SYZYGIUM AROMATICUM AND CINNAMOMUM VERUM IN DIFFERENT EXTRACTS AND ITS ANTIBACTERIAL PROPERTIES AGAINST DISEASE CAUSING PATHOGENS

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ABSTRACT

Spices are an important part of every meal and lifestyle of people in their everyday life in India since ancient time. The active phytochemicals present in the spices have holistic effect on human health. Spices are also rich source of bio-active antimicrobial and antioxidant compounds. Medicinal plants and spices remain an essential medicinal assistance in the treatment of human illnesses. The goal of this research was to determine the antibacterial activity of clove and cinnamon against bacteria, namely *Pseudomonas aeruginosa* and *Staphylococcus epidermidis*, using aqueous, 70% ethanol, and 70% chloroform extracts. The extract's antimicrobial activity was tested using the agar well diffusion technique with amoxicillin as a positive control. The antibacterial efficacy was tested against harmful bacterial strains, and aqueous extract had the best inhibitory activity against *Pseudomonas aeruginosa*, while ethanol extract had the highest inhibitory activity against *Staphylococcus epidermidis*. Extracts were also screened for phytochemical analysis in distilled water, ethanol and chloroform extracts. The presence of different phytochemicals like Alkaloids, terpenoids, saponins, anthraquinones, phlobatannins, phenolic compounds, resins, steroids, cardiac glycosides, tannins, and carbohydrates is confirmed by qualitative phytochemical examination of both the spice extracts. Clove and Cinnamon have antibacterial action against microorganisms and can be utilized to prevent drug-resistant microbial illness and because of the existence of many components that are essential for good health, the spices were tested for phytochemical ingredients and appeared to have the potential to operate as a source of helpful pharmaceuticals as well as to enhance the health

status of customers. While comparing the degree of antibacterial activity of these spices, clove is superior to cinnamon. The current study's findings are positive, since virtually clove and cinnamon showed antibacterial action against both *Pseudomonas aeruginosa* and *Staphylococcus epidermidis* infections.

KEYWORDS: Phytochemicals, Antimicrobial, Clove, Cinnamon, *P. aeruginosa, S. epidermidis, etc.*

INTRODUCTION

India is the most well-known country for the major production of spices, producing over 50 of the world's 86 spices, each with unique physiological and pharmacological qualities. A spice is a dried plant seed, flower, bark, root, or fruit, or a spice used in small amounts for flavour, colour, scent, additive, preservative, beauty care items, perfumery, bread kitchen commerce, food additives, and medicinal.[1] India is major exporter of spices which have a significant impact on our national economy. Spices are thought to be a good source of bioactive antimicrobial and also rich in antioxidant compounds.[2] The active phytochemicals present in the spices like Alkaloids, Anthraquinones, Anthocyanin, Coumarins, Phenols, Glycosides, Flavonoids, Phlobatannins, Terpenoids, Steroids, Tannins, Saponins, etc have holistic effect on human health. Spices have a variety of medical applications in our daily lives, many spices are used in the cuisine, and some of them have medicinal properties like expectorant, purgative, laxative, diuretic, carminative, and so forth. Especially in Ayurveda, spices contribute a major amount for the treatment of key disorders of the body. Homeopathic medication has been utilizing spices as one of the main fixings in the majority of their arrangements and preparations. In medical industry it has also determined its role in anti-diabetic, anti-hypercholesterolemia, anti-proliferative, and anti-inflammatory effect on health of human also help to cure cardiovascular disease, diabetes, arthritis cancer and AIDS. In both developing and developed countries, infectious illnesses continue to be a major source of morbidity and mortality.[3] Phytochemicals are plant-derived bioactive molecules that are classified as secondary metabolites since the plant that produces them may not require them. They are produced naturally in all regions of the plant's body.[4] Some common phytochemicals found in various medicinal plants and spices are Alkaloids, Anthocyanin, Flavonoids, Tannins, Phlobatannins, Saponins, Terpenoids, Quinones, Anthraquinones, Steroids, Phytosterols, Leucoanthocyanins, Phenols, Glycosides, Coumarins, Carbohydrates, Proteins and Amino acids, Carboxylic Acid, Diterpenes, Lignin, Carotenoids, Cholesterols,

Emodin, Gums and Mucilage, Resins, Volatile oils, etc. Spices' natural antioxidants aid in the reduction of oxidative stress and might be utilised to treat or prevent certain health problems.[5] In tryptone soya broth (TSB) and cheese, clove oil proved efficient against *S. enteritidis* and *L. monocytogenes*. The high quantities of eugenol in clove fundamental oil provide it with excellent biological and antibacterial properties. Clove oil at 2% concentration in potato-dextrose agar (PDA) completely inhibited the growth of seven mycotoxigenic moulds (*A. ochraceus, A. parasiticus, A. flavus, P. patulum, P. roqueforti, Penicillium sp. M46* and *P. citrinum*) for up to 21 days, as well as other microbes such as *Salmonella sp., Bacillus thermoacidurans, Lactobacillus sp., Clostridium botulinum, Pseudomonas striafaciens, Corynebacterium michiganense, Canninghamella sp., Aspergillus sp., Alternaria sp., Fusarium sp., Penicillium sp.*, and *Mucor sp.*[6] Cinnamon has antipyretic, astringent, antiseptic, body temperature reducing, inflammatory problem, stimulant, diaphoretic, fungicidal, carminative, and stomachic properties. Cinnamon bark powdered in water is used to treat headaches and neuralgia. Cinnamon and ginger are mixed to promote digestion and circulation. Cinnamon is also utilised to cure infectious illnesses by many people of Kashmiri heritage. It is said to be a folk treatment for spleen, breast, uterine, liver, and stomach indurations, as well as malignancies (especially of the abdomen, liver and sinews).[1] Each part of the plant has different phytochemicals that have great medical values. Cinnamaldehyde, a vasodilator and hypoglycaemic agent, is found in the bark. Both clove and cinnamon extracts have been found to have antioxidizing properties which eliminate free radicals from the body.[7]

MATERIAL AND METHODS

Clove and cinnamon used in the study was collected from the Agricultural Produce Market Committee (APMC) market in Navi Mumbai.

Bacterial strains: The microbes used in the study includes:

1. *Pseudomonas aeruginosa*
2. *Staphylococcus epidermidis*

Antibiotic: Amoxicillin

Solvents used for extraction: Distilled water, 75% Ethanol and 75% Chloroform each separately.

Preparation of spice extract

Three solvents**:** distilled water, 75% ethanol and 75% chloroform were used to extract phytochemicals from clove and cinnamon.

Distilled water-based extraction: To prepare 40 ml of aqueous extract (25 percent w/v), 10 g of powdered plant material was dissolved in sterile distilled water. The combination was kept undisturbed at room temperature for 24 hours in a sterile flask before being filtered using sterile Whatman no.1 filter paper. The extract was filtered and then evaporated in a water bath until just 25 ml remained in the container.[8]

Ethanol-based extraction (75%): To prepare 40 ml of ethanolic extract (25 percent w/v), 10 g of powdered plant material was dissolved in ethanol. The extraction method was similar to that of aqueous extract.[8]

Chloroform-based extraction (75%): Chloroform was used to extract 40 ml of chloroform extract (25 percent w/v) from 10 g of powdered plant material. The extraction procedure was similar to aqueous extract. The extracts' phytochemical and antibacterial properties were evaluated.[8]

Phytochemicals tests

1. Detection of alkaloids

Test:- Bouchardat's test

Procedure:-

- Take 500µl of plant extract in a test tube using a micro pipette.
- Add 500µl of ethanol (@60 °C)
- Add few drops of Bouchardat's reagent (dilute iodine solution).

Observation (Indicating positive test):- A reddish brown colour

2. Detection of flavonoids

Test:- Alkaline reagent test

Procedure:-

- Take 1ml of extract in a test tube.
- Add 2ml of 2% NaOH solution.
- Then add a few drops dil. HCl to the test tube.

Observation (Indicating positive test):- When diluted acid is added to a bright yellow colour, it turns colourless.

3. Detection of steroid

Test:- Salkowski's test

Procedure

- Take 500µl of spice extract in a test tube
- Add 500µl chloroform.
- Add 500µl conc. H_2SO_4.

Observation (Indicating positive test):- The layer of chloroform shows the greenish yellow fluorescence

4. Detection of tannins

Test:- Braymer's test

Procedure

- Take 500µl of spice extract in a test tube.
- Add few drops 5% Ferric chloride solution.

Observation (Indicating positive test):- Blue-green colour

5. Detection of saponins

Test:- $NaHCO_3$ test

Procedure

- Take the spice extract in a test tube.
- Add 2 ml sodium bicarbonate solution.
- Then add distilled water in the test tube and shake vigorously.

Observation (Indicating positive test):- Stable honeycomb like froth

6. Detection of phlobatannins

Test:- HCl test

Procedure

- Take 500µl of spice extract in a test tube.
- Add 500µl of 1% HCl (boiled).

Observation (Indicating positive test):- A red precipitate

7. Detection of phenolic compounds

Test:- Ferric chloride test

Procedure

- Take spice extract in a test tube.
- Add few drops 5% ferric chloride solution in a test tube.

Observation (Indicating positive test):- Dark green/bluish black colour

8. Detection of cardiac glycosides

Test:- Keller-Killani test

Procedure

- Take 1ml of spice extract in a test tube.
- Add 1.5ml glacial acetic acid.
- Add 1 drop of 5% ferric chloride after that.
- Along the side of the test tube, add conc. H_2SO_4.

Observation (Indicating positive test):- A solution of blue colour (in acetic acid layer)

9. Detection of carbohydrates

Test:- Fehling's test

Procedure

- Take 1ml of spice extract in a test tube.
- Add 1ml each of Fehling's solution A & B. (**Solution A:** To generate a final volume of 100ml, mix 34.66gm copper sulphate in distilled water (100 ml). **Solution B:** To prepare 100ml, mix 173g potassium sodium tartrate with 50g sodium hydroxide in distilled water (100 ml)).
- Boil in water bath.

Observation (Indicating positive test):- A red precipitate

10. Detection of proteins

Test:- Biuret test

Procedure

- Take 2ml of spice extract in a test tube.
- Add 1 drop of 2% Copper sulphate solution.
- Then add 1ml of 95% ethanol.
- Add KOH pellets in the test tube.

Observation (Indicating positive test):- A pink coloured sol. (in ethanolic layer)

11. Detection of terpenoids

Procedure

- Take 500 µl of spice extract.
- Add 200 µl chloroform in a test tube.
- Then add 300 µl conc. H_2SO_4.

Observation (Indicating positive test):- At the intersection of two solutions, a reddish brown film forms.

12. Detection of anthocyanins

Test:- HCl test

Procedure

- Take 2ml of spice extract in a test tube.
- Add 2ml of 2N HCl.
- Then add few ml of ammonia.

  Observation (Indicating positive test):- After adding ammonia, the pink-red solution becomes blue-violet.

13. Detection of anthraquinones

Test:- Borntrager's test

Procedure

- Take 2ml of 10% ammonia solution in a test tube.
- Add few ml of spice extract and shake vigorously for 30 sec.

  Observation (Indicating positive test):- A pink, violet, or red coloured solution

14. Detection of coumarins

Test:- NaOH paper test

Procedure

- Take 0.5 gm moistened extract in a test tube.
- Place 1N NaOH-treated filter paper over the mouth of the test tube.
- Then heat the test tube for few minutes in water bath.

Observation (Indicating positive test):- Under UV light, paper fluoresces yellow.

15. Detection of resins

Test:- Turbidity test

Procedure

- Take 0.5 ml of spice extract in a test tube.
- Add 0.5 ml Acetone and Distilled water to it.

  Observation (Indicating positive test):- Turbidity in the solution indicated the presence of resin.

Phytochemicals quantitative analysis

Carbohydrates

Theory:- The DNS method is used to calculate reducing sugar. Many reagents can be reduced by reducing sugars, including 3,5-dinitro salicylic acid, which in alkaline solution is reduced to 3 amino 5 nitro salicylic acid (Table:1).

Reagents required

- Sodium potassium tartrate- 45g sodium potassium tartrate dissolved in 75ml distilled water
- 3,5-dinitro salicylic acid- dissolve 1.5g of DNS reagent in 30ml of 2M NaOH.
- 2M NaOH - 80g of NaOH dissolved in a litre of water.
- DNS reagent– Prepare fresh by mixing the reagent 1 and 2, make up the volume to 150ml of water.
- Stock standard solution- 1mg/ml

- **Stock standard sugar solution:** 250mg of glucose in water and make up to the volume to 100ml
- **Working standard solution:** Take 10ml from this stock solution and make up the volume to 100ml

Table 1: Quantitative carbohydrates test.

Tube	Distilled water (ml)	Sample (ml)	DNS reagent (ml)	Incubation in boiling water for 5 minutes and allow to cool	Take OD at 540 nm
Blank	3	0	2		
T1	2.9	0.1	2		
T2	2.5	0.5	2		
T3	2	1	2		
T4	1.5	1.5	2		
T5	1	2	2		
Clove (Aqueous Extract)	2.5	0.5	2		
Clove (Ethanol Extract)	2.5	0.5	2		
Clove (Chloroform Extract)	2.5	0.5	2		
Cinnamon (Aqueous Extract)	2.5	0.5	2		

Cinnamon (Ethanol Extract)	2.5	0.5	2		
Cinnamon (Chloroform Extract)	2.5	0.5	2		

Phenolic compounds

Principle:- The Folin Ciocalteu reagent, commonly known as the gallic equivalence technique, is a combination of phosphomolybdate and phosphor tungstate that is used for colorimetric phenolic *in vitro* assays (**Table: 2**).

Reagents required

Gallic acid solution (1mg/ml) – 100 mg of gallic acid was dissolved in 100ml of distilled water in volumetric flask.

FC reagent:- 0 2N, 1ml in 10 ml

Sodium carbonate: - 15g of sodium carbonate in 200ml of distilled water.

Table 2: Quantitative phenolic compounds test.

Tube	Distilled water (µl.)	Gallic acid/ Sample (µl)	FC Reagent (ml.)	Incubation at room temperature for 10 minutes.	7.5% Na2CO3 (ml)	Incubation in dark for 1 hour.	Take OD at 765 nm
Blank	500	0	2.5		2		
T1	499	1	2.5		2		
T2	490	10	2.5		2		
T3	480	20	2.5		2		
T4	470	30	2.5		2		
T5	460	40	2.5		2		
Clove (Aqueous Extract)	450	50	2.5		2		
Clove (Ethanol Extract)	450	50	2.5		2		
Clove (Chloroform Extract)	450	50	2.5		2		
Cinnamon (Aqueous Extract)	450	50	2.5		2		
Cinnamon (Ethanol Extract)	450	50	2.5		2		
Cinnamon (Chloroform Extract)	450	50	2.5		2		

Agar well diffusion method

The well diffusion method was used to test the extracts' antibacterial properties. On Muller Hinton Agar (MHA) medium, the bacterial suspension was spread throughout. To make a well in the nutrient agar, a sterile 8 mm cork borer was used.[8] Clove and cinnamon extracts

at concentrations of 35µl, 45µl, and 55µl were poured into each well. As a positive control, one standard antibiotic, Amoxicillin, was poured into one well and tested against these bacteria.[7] The evident growth-inhibition zone surrounding the well was after 24 hours of incubation at 37°C, the infected plates were evaluated.[8]

Procedure

- In a Laminar air flow, NA media is prepared, sterilised, and placed into petri plates under aseptic conditions.
- The petri plates were kept for a while to establish the medium.
- The petri plates were set aside for a while.
- With a sterile swab, the test organisms were now swabbed on the petri plates.
- In petri plates, wells were now constructed in specific areas.
- The antibiotic solution is put into the wells with the use of a micropipette.
- A volume of 35 to 55 µl is loaded to each well.
- These petri plates were now incubated at 37°C for 24 hours.
- After growth, the zone of inhibition (ZOI) around the well was recorded and measured using a ruler.
- The MIC and MBC were determined using extracts or antibiotics that showed the most inhibition.

Antibacterial test

Antibacterial tests were used to determine whether or not a sample has the ability to kill pathogenic organisms. This test was carried out on petri plates using the well diffusion method.

Well diffusion method

In this method, 5mm wells were created on the media, the plate was spread by bacteria, and a 35µl, 45µl and 55µl sample was put or seeded into the wells. NA medium is commonly used for testing in this technique.

Media used

NA medium was used in the well diffusion technique (**Table: 3**). The media was poured in a sterilised plate, and the plates with the media were then sterilised under UV light after

pouring. The surface of the plates was also sanitised with ethanol before being exposed to UV light before pouring.

Table 3: Composition of antibacterial media (NA).

Reagents	Concentration (g/l)
Peptone	5
Beef extract	3
Sodium chloride	5
Agar	20
pH	6.8

Procedure

1. 100 ml of distilled water was taken in a 250 ml beaker.
2. Using a weighing machine, the reagents to be used in NA medium were weighed and put into a beaker with 100ml distilled water.
3. The medium was autoclaved and till then the plates were cleaned and sterilised under the UV light.
4. After the medium has been autoclaved, it was placed in the laminar air flow and poured into the plates.
5. Poured medium was sterilised for 5 minutes under UV light before allowing it to set for 20 minutes.
6. With the help of a cotton swap, the bacteria were spread throughout the surface of the media in the plate.
7. Wells were made and filled each one with 35µl, 45µl and 55µl of samples.
8. One well was filled with a antibiotic amoxillin.
9. The plate was allowed to remain undisturbed in the incubator for 24 hours to ensure optimal activity and development.
10. The plates were observed how the samples reacted to the bacteria.

RESULTS

Phytochemicals screening test

The phytochemical screening of clove, was carried out in this study. The findings shows that some of the phytochemicals examined were present in extracts. Alkaloids, steroids, tannins, saponins, phlobatannins, phenolic compounds, cardiac glycosides, carbohydrates, terpenoids, anthraquinones and resins were present in aqueous extract of clove; Alkaloids, flavonoids, steroids, tannins, phenolic compounds, cardiac glycosides, carbohydrates, terpenoids and

coumarins were present in ethanol extract whereas, flavonoids and steroids were present in chloroform extract of clove (detail given in Table: 4).

Aqueous extract of Cinnamon had Alkaloids, steroids, tannins, saponins, phlobatannins, phenolic compounds, carbohydrates, terpenoids, anthraquinones and resins; ethanol extract of cinnamon had Alkaloids, steroids, tannins, phlobatannins, phenolic compounds, carbohydrates, terpenoids and anthraquinones while Alkaloids, phlobatannins, cardiac glycosides, carbohydrates and terpenoids were present in chloroform extract of cinnamon (detail given in Table: 4).

Table 4: Clove and Cinnamon extracts.

Sr. No	Phytochemicals	Aqueous		Ethanol		Chloroform	
		Clove	Cinnamon	Clove	Cinnamon	Clove	Cinnamon
1	Alkaloids	+	+	+	+	-	+
2	Flavonoids	-	-	+	-	+	-
3	Steroid	+	+	+	+	+	-
4	Tannins	+	+	+	+	-	-
5	Saponins	+	+	-	-	-	-
6	Phlobatannins	+	+	-	+	-	+
7	Phenolic compounds	+	+	+	+	-	-
8	Cardiac Glycosides	+	-	+	-	-	+
9	Carbohydrates	+	+	+	+	-	+
10	Proteins	-	-	-	-	-	-
11	Terpenoids	-	+	+	+	+	+
12	Anthocyanins	-	-	-	-	-	-
13	Anthraquinones	+	+	-	+	-	-
14	Coumarins	-	-	+	-	-	-
15	Resins	+	+	-	-	-	-

Quantitative analysis

Carbohydrates

Tube	Concentration (mg /ml)	Optical Density at 540nm
1	88.33	0.304
2	166.66	0.746
3	250	1.111
4	333.33	1.475
5	416.66	1.642

Clove	Aqueous	Ethanol	Chloroform
Absorbance of Unknown Sample	1.445	1.46	0.803
Concentration of Unknown Sample (mg/ml)	347.80	351.46	191.22

Cinnamon	Aqueous	Ethanol	Chloroform
Absorbance of Unknown Sample	1.453	1.453	1.44
Concentration of Unknown Sample (mg/ml)	349.76	349.76	346.59

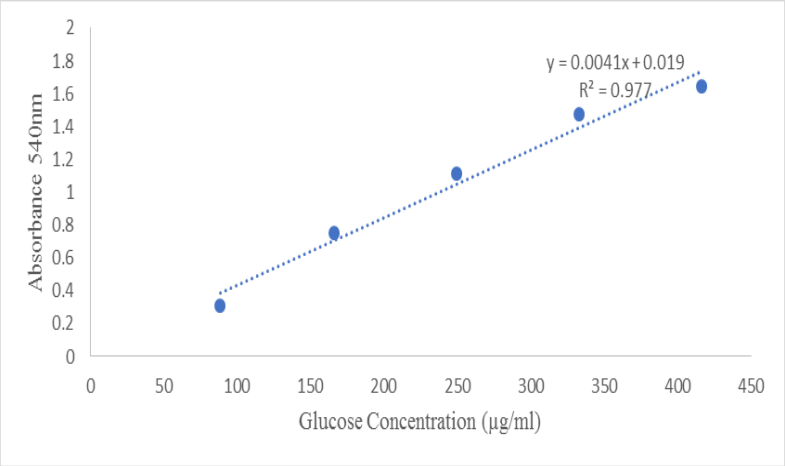


Fig 1: Carbohydrate standard curve.

Phenols

Tube	Concentration (mg/ml)	Optical Density at 765nm
1	1	0.039
2	10	0.197
3	20	0.345
4	30	0.598
5	40	0.671

Clove	Aqueous	Ethanol	Chloroform
Absorbance of Unknown Sample	1.48	1.50	1.49
Concentration of Unknown Sample (mg/ml)	84.28	85.37	84.68
Cinnamon	**Aqueous**	**Ethanol**	**Chloroform**
Absorbance of Unknown Sample	1.44	1.48	1.35
Concentration of Unknown Sample (mg/ml)	82.08	84.28	76.77

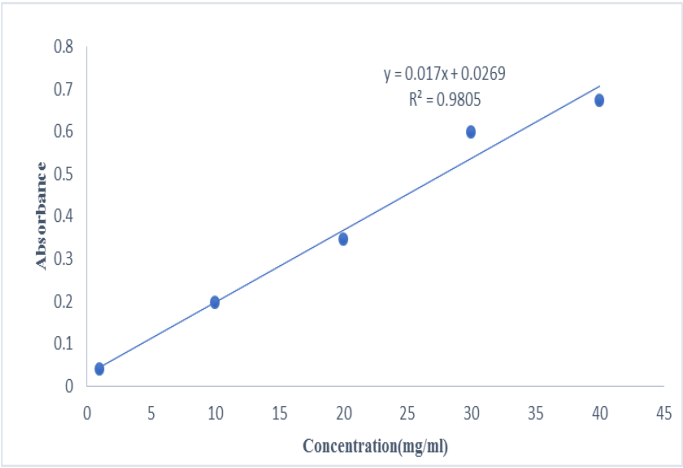


Fig. 2: Phenol standard curve.

Antibacterial test results

Sr. No	Micro-organism	Antibiotics	Zone of Inhibition (mm)
1	*Pseudomonas aeruginosa*	Amoxicillin	20
2	*Staphylococcus epidermidis*	Amoxicillin	21

1. Spices aqueous extract's antimicrobial efficacy against microorganisms.

Sr. No	Spice	Micro-organisms with zone of inhibition (mm)									
		Pseudomonas aeruginosa					*Staphylococcus epidermidis*				
		NC	PC	35µL	45µL	55µL	NC	PC	35µL	45µL	55µL
1	Clove	0	21	20	21	22	0	20	0	12	14
2	Cinnamon	0	20	0	0	0	0	21	0	0	0

2. Spices ethanol extract's antimicrobial efficacy against microorganisms.

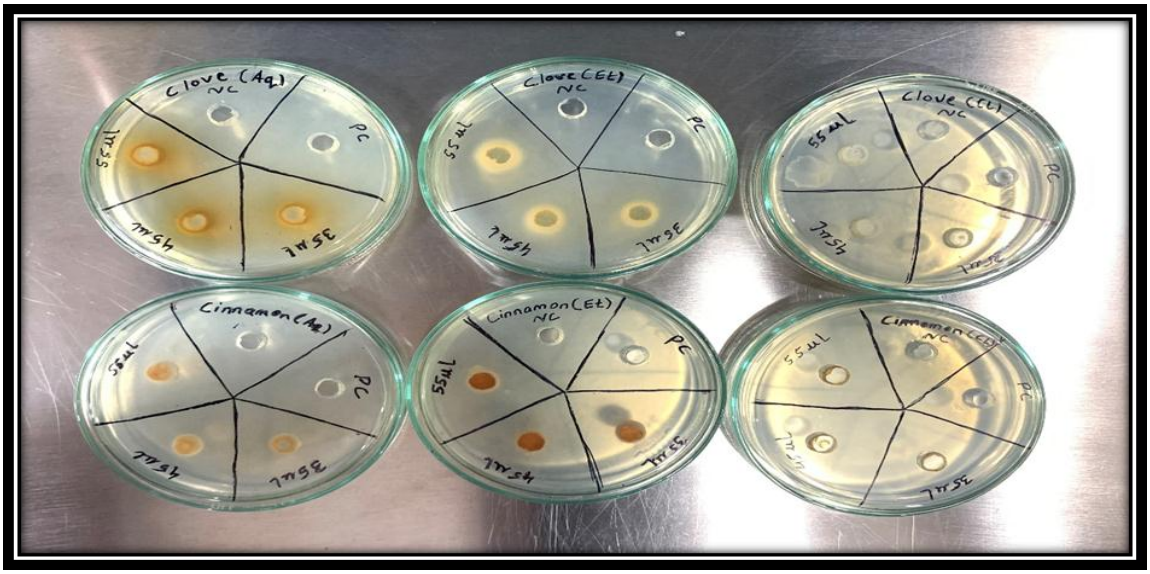
Sr. No	Spice	Microorganisms with zone of inhibition (mm)									
		Pseudomonas aeruginosa					*Staphylococcus epidermidis*				
		NC	PC	35µL	45µL	55µL	NC	PC	35µL	45µL	55µL
1	Clove	0	20	12	13	15	0	20	14	16	18
2	Cinnamon	0	20	10	14	16	0	20	10	14	16

3. Spices chloroform extract's antimicrobial efficacy against microorganisms.

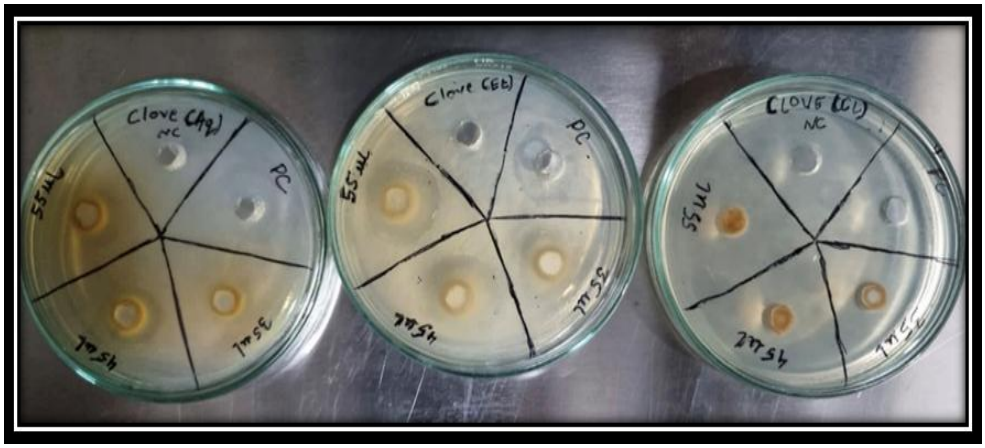
Sr. No	Spice	Microorganisms with zone of inhibition (mm)									
		Pseudomonas aeruginosa					*Staphylococcus epidermidis*				
		NC	PC	35µL	45µL	55µL	NC	PC	35µL	45µL	55µL
1	Clove	0	20	0	0	0	0	20	0	0	0
2	Cinnamon	0	20	0	0	0	0	20	0	8	12

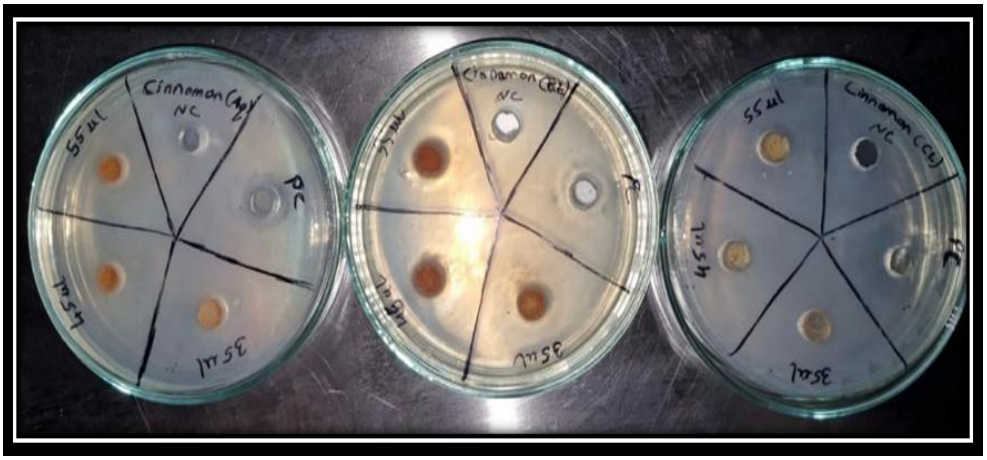
NC = Negative Control

PC = Positive Control (Drug - Amoxicillin)



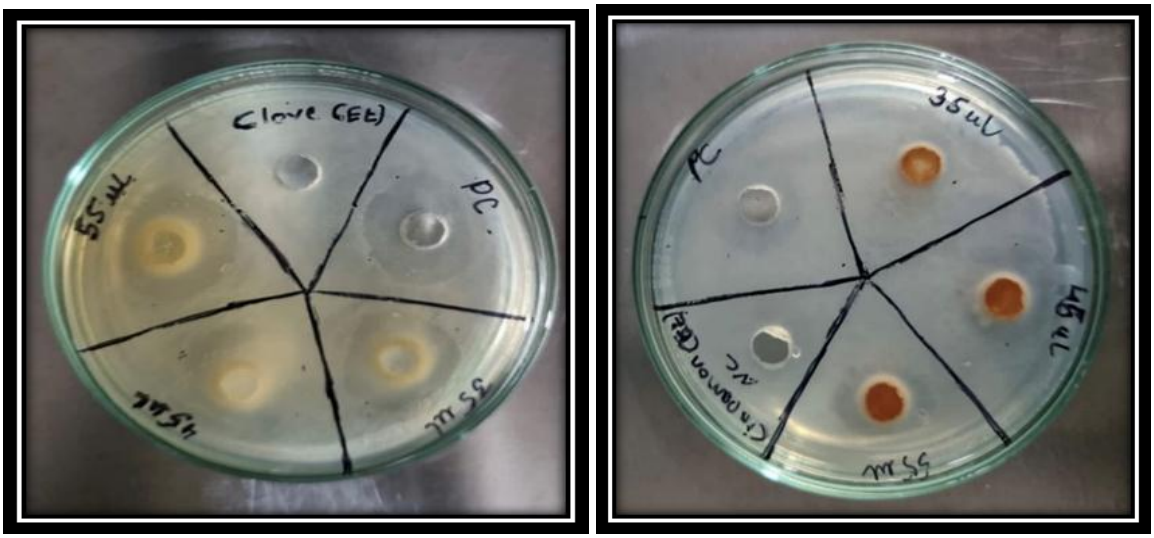
Photoplate 1: Agar well diffusion method.



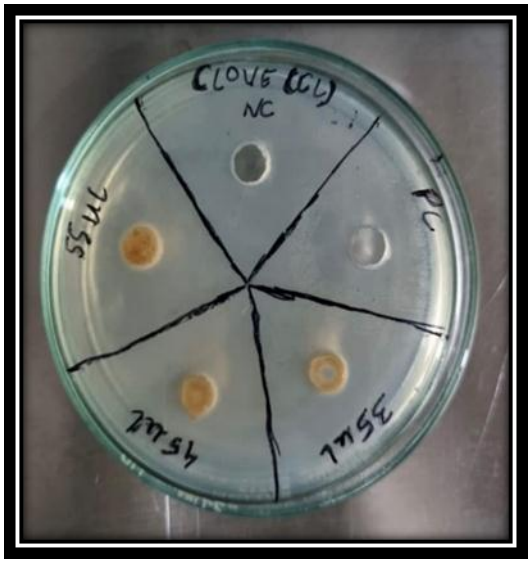


Photoplate 2: Zone of inhibition after 24 hours.

Photoplate 3: Cloves aqueous extract's antimicrobial efficacy against microorganisms.



Photoplate 4: Clove and Cinnamon ethanol extract's antimicrobial efficacy against microorganisms.



Photoplate 5: Clove chloroform extract's antimicrobial efficacy against microorganisms.

Antibacterial activity of the extracts against microorganisms was found to be very high. The data clearly shows the existence of substances used to treat a variety of bacterial infections, demonstrating that they have been utilized in traditional medicine since ancient times. Furthermore, the broad-spectrum activity of aqueous, ethanol and chloroform suggest that novel antimicrobial formulations will be developed in the near future.

DISCUSSION

Plant-based medicines have made a significant contribution to the improvement of human health and serve as a source of inspiration for new drug formulations. Based on the findings,

it is clear that this Clove and Cinnamon has enormous potential for application in pharmacology and as a possible source of important pharmaceuticals. It may also be used to enhance society's health state due to the presence of numerous chemicals that are needed for good health.

Each spice has a unique set of bio-functions as well as additive and synergistic properties that safeguard the human body. Spices have always been a component of the diet, with a holistic approach. Spices add minimal calories to meals because they have strong aromas and are used in tiny amounts, despite the fact that many spices, especially those made from seeds, contain high fat, protein, and carbohydrate content in terms of weight. Spices, on the other hand, may contribute a substantial quantity of minerals and other micronutrients to the diet when used in larger quantities, such as calcium, magnesium, iron, and many more.

Antimicrobials derived from plants have far more curative qualities than manufactured antimicrobial medications since they have less adverse effects. The current study adds to our understanding of the presence of numerous phytochemical active components in Clove and Cinnamon that have high antibacterial potency through a broad spectrum. Further fractionation and purification will reveal the potential constituent, which is a vital requirement due to the present antibiotics' impending resistance.

Medicinal plants remain an essential medicinal assistance in the treatment of human illnesses. There is a resurgent interest in traditional medicine nowadays, as well as a growing desire for additional medications derived from plants. The present prevalent notion that "green medicine" is safer and more trustworthy than expensive synthetic medications, many of which have negative side effects, has sparked renewed interest in plant-derived pharmaceutical drugs.

Spices have been used in meals as flavouring agents, food preservatives, and traditional remedies since ancient times. In general, the usefulness of spices used for medical purposes is determined by the phytochemicals they contain. Anti-inflammatory, antidiarrheal, antimicrobial, antioxidant, and insecticidal properties have been described for spices, herbs, plant extracts, and their phytochemical constituents. Alkaloids are employed in allopathic systems and have key biological properties such as cytotoxicity. Steroids and sterols are essential in pharmacy because they include molecules similar to sex hormones and may be utilized to make drugs. Saponins have antimicrobial properties as well as anti-

hypercholesterolemic properties. Tannins inhibited bacteria, yeasts, fungi, and viruses from growing. Antioxidants are phenols and tannins. Plants' potential as a source of pharmaceuticals has yet to be fully explored. Multiple drug resistance has emerged as a major issue in pharmacotherapy, with a rising variety of disorders, particularly bacterial infections, demonstrating diverse levels of drug resistance. Herbal medicines and phytochemical screening of numerous plant species for therapeutic leads are getting a lot of interest these days.

Clove and Cinnamon have been studied for its antimicrobial properties. Clove extracts were made with water, ethanol, and chloroform. The antibacterial characteristics of the extracts are shown as above. The extracts were phytochemically examined to determine the secondary metabolites derived from both the spices that influence its antibacterial activities. Phytochemicals, or secondary metabolites of plants, are an important part of our nutrition. The zone of inhibition of extracts against *Pseudomonas aeruginosa* and *Staphylococcus epidermidis* is shown above. Saponins include anti-cancerous and cholesterol-lowering qualities due to antioxidant capabilities conferred by flavonoids and tannins. Alkaloids are employed as anti-malarial and analgesic chemicals.

The isolates were identified using a variety of biochemical assays, and they were found to be responsive to clove and cinnamon extracts. Bactericidal activity was determined by using Clove and Cinnamon aqueous extracts, ethanol extracts and chloroform extracts with a minimum inhibitory concentration of 35 µl. By examining the zone of inhibition and calculating the anti-microbial activity of the Clove and Cinnamon extract, the microbial activity of the spices i.e. Clove and Cinnamon was determined.

CONCLUSION

Alkaloids, tannins, saponins, flavonoids, steroids, and terpenoids were found in abundance in clove and cinnamon extracts tested. Because of the existence of many components that are essential for good health, clove and cinnamon was tested for phytochemical ingredients and appeared to have the potential to operate as a source of helpful pharmaceuticals as well as to enhance the health status of customers. The current study's findings are encouraging, since both *Pseudomonas aeruginosa* and *Staphylococcus epidermidis* infections were successfully treated with clove and cinnamon extracts and showed anti-bacterial properties. However, the antibacterial action of spices varies significantly depending on the kind of spice,

microorganism, and test medium used. This study paves the way for the creation of new antimicrobials to replace antibiotics.

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