

## Antibacterial Activity of Cinnamon Oil and Extract Against Common Bacterial Pathogens

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### ABSTRACT

The study expected to survey the in-vitro hostile to bacterial effect of cinnamon oil and extract tested against gram-positive (*Bacillus subtilis*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus pyogenes*, and *Enterococcus faecalis*) and gram-negative (*Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Salmonella typhi*) pathogens by using agar well diffusion method. According to the result cinnamon oil had best inhibitory activity showing widest zone of 44mm against *Klebsiella pneumoniae* and a zone of 37mm against *Escherichia coli*, *Streptococcus pyogenes*. In the case of cinnamon extract have low antibacterial activity as compare to oil, showing maximum 18mm zone against *Streptococcus pyogenes* and zone of 17mm against *Klebsiella pneumoniae*, *Escherichia coli*. This study was proved that cinnamon essential oil and extract were important as herbal drug to use in pharmaceutical industries to treatment infectious diseases.

**Keywords:** Antibacterial, Cinnamon, Pathogens, Agar well diffusion, essential oil.

### INTRODUCTION:

Amid the most recent two decades, developing confirmation demonstrates that plants are rich wellsprings of various classes of antimicrobial substances going about as barrier frameworks to secure them against biotic (living) and abiotic (non-living) stresses. Among these secondary metabolites polyphenols, terpenoids, alkaloids, lectins, polypeptides, and polyacetylenes are known not antimicrobial specialists; the greater part of these metabolites are additionally affirmed as a GRAS (Generally Recognized as Safe) material for sustenance items, demonstrating immaterial symptoms [S. Fazal nabvi *et al*, 2015].

(*Cinnamomum zeylanicum*) is called true cinnamon or Ceylon cinnamon having a place with the family Lauraceae. Its develop in east and south east of Asia to Australia. Cinnamon is an evergreen tree coming to around nine meters in high and it is secured with a smooth, pale bark. Cinnamon can be

utilized as zest as a result of its sweet enhancing and fiery qualities, and it additionally assumes a critical part in Pharmacological impacts, for example, antiinflammation, antimicrobial, cancer prevention agent, antidiabetes sort 2 antispasmodic, antiulcer, and cytotoxic properties [Ali sharif, 2011]

Cinnamon bark, leaves, blossoms and natural products are utilized to get ready fundamental oils, which are bound for use in beauty care products or nourishment items. Cinnamon mostly contains crucial oils and critical mixes like Cinnamaldehyde, eugenol, cinnamic corrosive and cinnamate. It has got great calming, hostile to microbial, against oxidant, hostile to ulcer, antidiabetic [Monika *et al*, 2014; M. Sayeed *et al*, 2014].

Cinnamon bark is rich in cinnamaldehyde (50.5%), which is exceedingly electro-negative. Such electro-negative mixes meddle in natural procedures including electron exchange and respond with nitrogen-containing

segments, e.g. proteins and nucleic acids, and consequently repress the development of the microorganisms [Charu *et al*, 2008].

It is vital to discover the specific miniaturized scale living beings for which the home grown concentrates are dynamic. There is increasing acquaintance acceptability of the utilization of home grown medications in today's medicinal practice. The utilization of therapeutic plants turned into the primary medications is a worldwide wonder. Plants have extraordinary conceivable against irresistible specialists and can be utilized for remedial purposes [Hassan *et al*, 2014].

### AIM OF STUDY

The objective of this study was to determine the antibacterial effect of extracts and from the *Cinnamomum zeylanicum*, essential oil against *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bacillus subtilis*, *Staphylococcus epidermidis*, *Klebsiella pneumoniae*, *Enterococcus faecalis*, and *Salmonella typhi*.

### MATERIAL AND METHOD

**Test organism:** Ten bacterial isolates (five Gram-positive and five Gram-negative), were selected for this study. The Gram-positive bacteria comprised *Bacillus subtilis*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus pyogenes*, and *Enterococcus faecalis*, while the Gram-negative bacteria comprised *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Salmonella typhi*.

**Maintenance of bacterial culture and inoculum preparation:** Pure cultures were refreshed and maintained on nutrient agar slants and plates on regular basis. The cultures were streaked on sterile nutrient agar plates and kept in incubator for 24 hours at 37°C and stored at 4 °C.

**Essential oil:** Essential oil of cinnamon was purchased from a local market of Karachi, Pakistan.

**Preparation of cinnamon extract:** The spice cinnamon (*Cinnamomum zeylanicum*) was purchased from local market. The spice was washed with distilled water thoroughly. Dry spice was crushed and sieved through mesh cloth to get the fine powder. Powdered spices were soaked in 50ml of distilled water and were kept at room temperature for 24 hours, then were filtered using Whatman no. 1 filter paper. The filtrate was heated at 40-50°C using waterbath for 30 min.

**Determination of antibacterial activity of cinnamon extract and oil:** The antibacterial activity of cinnamon extract and oil were determined by the agar well diffusion method.

**Agar well diffusion method:** One hundred microlitres (100µl) of standardized inoculum (106 CFU/ml; 0.5 MacFarland) of each test bacterium was spread with the help of sterile spreader onto sterile Muller-Hinton Agar (MHA) so as to achieve confluent growth. The plates were allowed to dry and a sterile cork borer (6 mm diameter) was used to bore wells in the agar. Subsequently, a 50 µl volume of the extract and the oil was introduced in wells of the agar plates.

The plates were allowed to stand for at least 1 h for diffusion to take place and then incubated at 37°C for 24 h. The zone of inhibition was recorded to the nearest size in mm

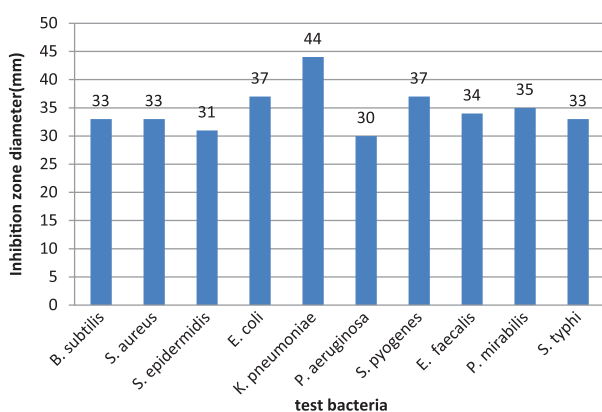
### RESULT

Antibacterial activity of cinnamon oil and extract against test bacterial species is summarized in

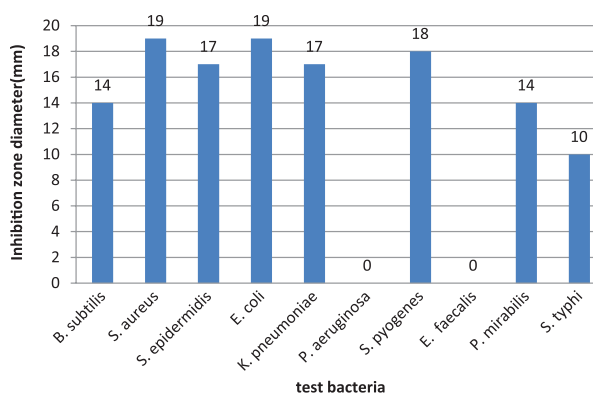
Table 1. Antibacterial activity of cinnamon oil is found to be effective against almost all test bacteria. *Klebsiella pneumoniae* is found to be the most sensitive with a widest inhibition zone diameter of 44mm, followed by *E. coli* (37mm), *S. pyogenes* (37mm). It also inhibited the growth

**Table I:** Zone of inhibition (mm) of cinnamon extract and cinnamon oil against test bacteria on Mueller-Hinton agar medium

Test bacterial isolates	Zone of inhibition(mm)	
	Cinnamon oil	Cinnamon extract
<i>Bacillus subtilis</i>	33	14
<i>Staphylococcus aureus</i>	33	19
<i>Staphylococcus epidermidis</i>	31	17
<i>Escherichia coli</i>	37	19
<i>Klebsiella pneumoniae</i>	44	17
<i>Pseudomonas aeruginosa</i>	30	NZ
<i>Streptococcus pyogenes</i>	37	18
<i>Enterococcus faecalis</i>	34	NZ
<i>Proteus mirabilis</i>	35	14
<i>Salmonella typhi</i>	33	10



**Fig1.** Antibacterial effect of cinnamon oil against test bacteria



**Fig2.** Antibacterial effect of cinnamon extract against test bacteria

of *P. aeruginosa* and produced an inhibition zone diameter of 30mm. While cinnamon extract have less antibacterial activity against test bacteria. Extract is active against *S. aureus* and *E. coli* with an inhibition zone diameter of 19mm, followed by *S. pyogenes* (18mm), *S. epidermidis* and *Klebsiella pneumoniae* (17mm) respectively. *Salmonella sp.* is partially sensitive, while *P. aeruginosa* and *Enterococcus faecalis* is resistant to extract.

Keyword: - NZ = no zone of inhibition

### DISCUSSION

Plant essential oils and concentrates have

been utilized for some a great many years in nourishment protection, pharmaceutical, elective prescription and characteristic treatments. Essential oils are potential wellspring of novel antimicrobial compounds particularly against microbes pathogen. The outcome of the antibacterial activity uncovered that the vital oil of cinnamon demonstrated high antibacterial action against both Gram positive and Gram negative bacteria tried in the present study [Ouwehand *et al*, 2010].

The action of cinnamon is because of the presence of cinnamaldehyde, a fragrant aldehyde that restrains amino corrosive

decarboxylase action, and has been ended up being dynamic against numerous pathogenic microorganisms. Cinnamon bark is rich in cinnamaldehyde (50.5%), which is exceedingly electro-negative. Such electro-negative compounds meddle in natural procedures including electron exchange and respond with nitrogen-containing parts, e.g. proteins and nucleic acids, and along these lines repress the development of the microorganisms. [Charu *et al*, 2008].

Cinnamaldehyde is suitable for restraining cell division. Bacterial cell division is controlled by FtsZ, a prokaryotic homolog of tubulin. FtsZ gathers into a Z-ring at the site of cell division; cinnamaldehyde can diminish the *in vitro* get together response and packaging of FtsZ. It likewise can annoy the Z-ring morphology *in vivo*. [Filomena *et al*, 2013].

The antimicrobial action of EOs, like all common concentrates, is reliant on their substance arrangement and the measure of the single segments. A large number of the antimicrobial compounds are constitutively communicated by the plants, and others can be integrated as component of self-preservation because of pathogens [Ouwehand, *et al* 2010].

The action of an EO can influence both the outer envelope of the cell and the cytoplasm. The hydrophobicity that is regular of EOs is in charge of the disturbance of bacterial structures that prompts expanded penetrability because of a inability to separate the EOs from the bacterial cell film, the impacts of EOs for the most part prompt the destabilization of the phospholipid bilayer, the decimation of the plasma layer capacity and sythesis, the loss of essential intracellular segments and the inactivation of enzymatic systems [Zamirah, 2013].

#### CONCLUSION:

From the research study it is concluded that cinnamon oil and concentrate have potential

antibacterial properties against basic pathogen. Oil and concentrate influence specifically the cell membrane of the pathogenic microorganism by bringing on an expansion in porousness and spillage of key intracellular constituents, lastly upset the cell respiration and microbial compound framework. This study gives a secondary solutions for the treatment of numerous irresistible infections with less reactions. In this way, it has been recommended that further research on the essential oils and concentrates from the medicinal plants may be utilized as alternative antimicrobial characteristic substances furthermore assume an awesome part in the disclosure of new medications

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