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Effect of *Cinnamomum zeylanicum* Bark Extracts on Clinically Important Drug Resistant Pathogenic Bacteria

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ABSTRACT

Background: *Cinnamomum Zeylanicum*, is one of the oldest herbal medicines and a popular spice crop used in Asian countries. It has been valued for centuries for its distinct flavor and aroma, and it also possesses various medicinal properties. In *Cinnamomum Zeylanicum*, there are many constituents such as cinnamaldehyde, eugenol, linalool and cinnamic acid. Therapeutic compounds found in plants are gaining attention as a potential source for new drug development. **Objectives :** The study aims to identify potential novel treatments for bacterial infections by evaluating commercially available ethanolic extracts' in vitro antimicrobial activity and observing their effects on bacterial biological activity inhibition. **Material and methods:** The well diffusion method was used to examine the in vitro antimicrobial activity of an ethanol extract of *Cinnamomum zeylanicum* bark against both gram-positive (*S. aureus* and *S.epidermides*) and gram-negative (*E. coli* and *P. aeruginosa*) standard microbes. In this study, all pathogenic bacteria that affect humans tested were inhibited to varying degrees by the concentrations investigated. **Results:**The results indicate that the inhibition zone for gram positive bacteria is greater than that of gram negative bacteria at all concentrations, ranging from 19.22 (29%)mm to 18.44 (28%)mm against *S. aureus* and *S. epidermids*. The inhibition zones for *E. coli* and *P. aeruginosa* are 14.67 (22%) and 14.11 (21%) respectively. **Conclusion:** In this study, all pathogenic bacteria that affect humans were inhibited to varying degrees by the concentrations investigated.

Keywords : *Cinnamomum zeylanicum*; Resistant, Antibacteria ,Pathogenic bacteria

INTRODUCTION

The *Cinnamomum zeylanicum* tree is a tropical plant belonging to the family Lauraceae and is best known for its bark, which produces cinnamon, a well-known culinary spice. The digestive system isn't the only one that can benefit from cinnamon's healing effects [1]. Allergenfighting, inflammation-calming, fever-reducing, ulcer-preventing, antioxidant, and anesthetic are just a few of cinnamon's many uses [2]. Studies on antioxidants have shown that cinnamon bark, or *Cinnamomum zeylanicum*, is superior to alternatives at neutralizing free radicals [3]. Bark and leaves of the *Cinnamomum* genus are frequently used as spices in domestic cooking, and their distilled oils, which are essential or synthetic equivalents, are used as flavorings in commercial food processing [4]. Due to rising bacterial resistance to currently used antibiotics, the quest for new antimicrobial medications has become required, and natural products play an important role in this sector[5].

Staphylococcus aureus is one of the most common infectious agent-related causes of morbidity and mortality worldwide. This pathogen can cause a wide range of illnesses, from mild skin infections to deadly pneumonia and sepsis. Antibiotic resistance complicates the treatment of *S. aureus* infections, since there is no viable vaccination [6]. Moreover, *Staphylococcus Epidermidis*, a member of the coagulase-negative staphylococci (CoNS) family, is the most prevalent bacteria found on human skin and the leading cause of medical device-related diseases[7]. *Staphylococcus* spp. are skin commensals that have been isolated from a variety of clinical sources, including urinary tract infections (UTIs), respiratory tract infections (RTIs), wound infections (WIs), soft tissue infections, blood infections, and endocarditis . *Staphylococcus epidermidis* (*S. epidermidis*) is thought to be one of the most important species in this group[8]. Urinary tract pathogens include *Escherichia coli* and *Proteus mirabilis*. The continual rise in antibiotic resistance among clinical bacterial strains has become a major clinical issue[9]. Bark and leaves of the *Cinnamomum* genus are frequently used as spices in domestic cooking, and their distilled oils, which are essential or synthetic equivalents, are used as flavorings in commercial food processing.

The study aims to identify potential novel treatments for bacterial infections by evaluating commercially available ethanolic extracts' in vitro antimicrobial activity and observing their effects on bacterial biological activity inhibition.

MATERIALS AND METHODS

Samples Collection

The bark of *Cinnamomum zeylanicum* was acquired from local market of Thi-Qar. The plants materials were washed and sun dried before grained and stored in a sterilized container until required .

Preparation of Antimicrobial extraction

At room temperature, In a soxhlet device with 200 ml of the ethanol solvent, a 20 g sample that was powdered was collected. Each sample was held at 40°C before being used. A 20 mg/ml stock solution was prepared. One day ahead of time, stock solutions were packed. Several aliquots of each sample were saved to perform the initial check and further testing according to the techniques [10, 11]. A 100 g/ml extract concentration was obtained through serial dilution of the stock solution. Concentrations of 10%, 5%, and 2.5% were obtained by diluting the crude extract.

Examine microorganisms and their origins

S.aureus, *S. epidermidis*, *E. coli*, and *P. aeruginosa* isolates were collected from the Thi-Qar University College of Science, Department of Biology. API Staph. and API Enterobacteracea [12]. were used to confirm bacterial species identification. The bacteria were isolated from clinical specimens. The pure communities subcultured on Nutrient agar slants.

Antimicrobial Test

In vitro testing of the Antimicrobial properties of a crude ethanol extraction was performed using the technique of good diffusion. This technique was discovered [13]. This method tested ethanol extracts of *Cinnamomum zeylanicum* bark for Antimicrobial properties. The impact of various bark extracts on the chosen bacterial strains was investigated using a Kirby-Bauer agar-well diffusion method. The 20 ml of sterilized Mueller Hinton agar medium was poured into the sterile Petri dishes and left to set. The bacterial cultures grown in broth were swabbed by hand onto individual Petri dishes using sterilized cotton swabs. Wells were drilled into the agar (with a diameter of 5 mm) using a sterile borer. Each well was sterilely injected with (30 µl) the ethanol extract of plant, and the plates were incubated at 37°C for 24 hours. The area of inhibition was determined. Antimicrobial effectiveness was measured by measuring the diameter of the zone of inhibition (DIZ) against the examined bacteria. DIZ was represented in millimeters. Cheesbrough techniques were used to conduct all experiments in triplicate [14].

Statistical Analysis

The antimicrobial activity was evaluated by measuring the diameter of the zone of inhibition, which was calculated as the median SD for triplicates. According to Box, Hunter (15). The data were analyzed in SPSS software using the ANOVA test.

Results and Discussions

The agar diffusing method (wells of medium agar are filled with specimen extract) was used to conduct an antimicrobial assay, and the results showed that the ethanol extracted from *Cinnamomum zeylanicum* plants exhibited strong antibacterial inhibitory zones against *E. coli*, *P. aeruginosa*, *S. aureus*, and *S. epidermidis*. The antimicrobial screening of *Cinnamomum zeylanicum* crude ethanolic extract against *S. epidermidis* is seen in figure 1. The higher mean zone of inhibition against *S. epidermidis* was observed at 10% con. of *Cinnamomum zeylanicum*, which was 24 mm. At 5% and 2.5% con, the other inhibition areas are 19 mm and 13 mm, respectively.

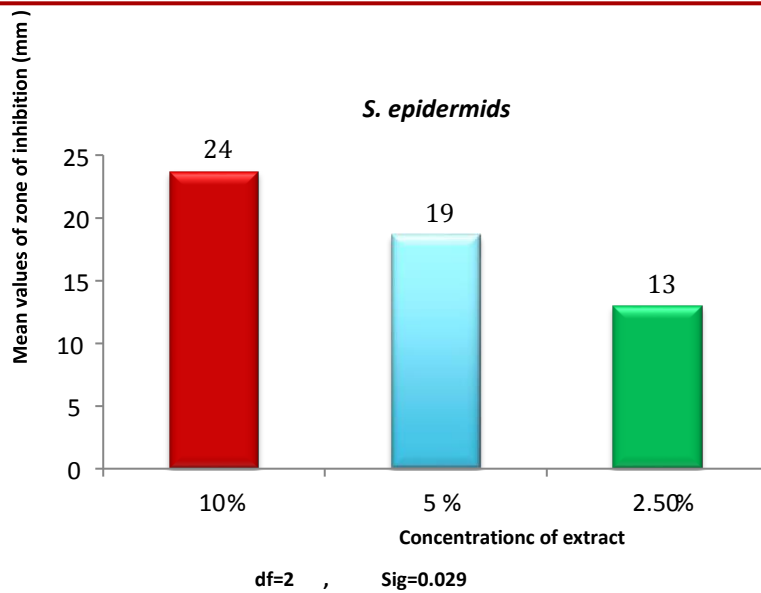


Figure 1. Effect of *Cinnamomum zeylanicum* extract against *S. epidermids*

Figure 2 shows the antibacterial activity of *Cinnamomum zeylanicum* extracts against *S. aureus*. The higher average zone of inhibition was measured at 25 mm when the concentration was set at 10%. Other inhibition zones measured 19 mm and 14 mm, with 5% and 2.5% concentrations, respectively.

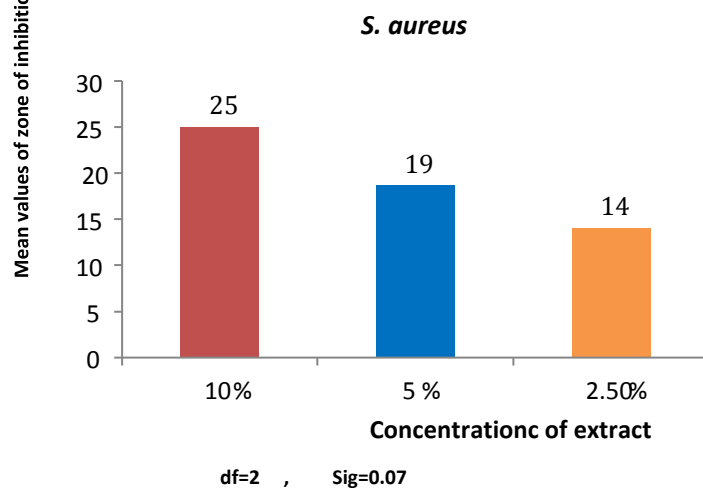


Figure 2. Effect of *Cinnamomum zeylanicum* extract against *S. aureus*

The effect of *Cinnamomum zeylanicum* extracts on *Escherichia coli* is seen in Figure 3. At 10% concentration, the more significant mean zone of inhibitions was determined to be 18mm. The other inhibition zones are 16mm and 10 mm at 5% and 2.5 % concentration. Respectively.

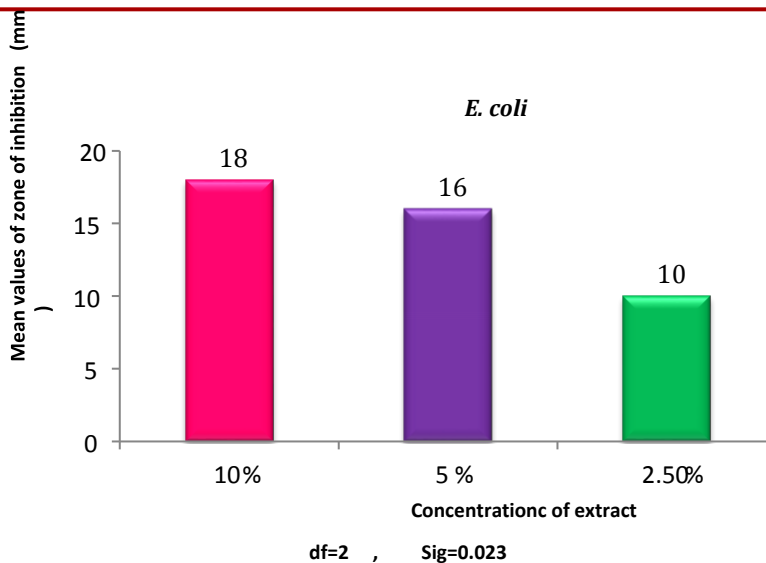


Figure 3. Effect of *Cinnamomum zeylanicum* extract against *E. coli*

The effect of *Cinnamomum zeylanicum* extracts on *P. aeruginosa* is seen in Figure 4. At 10%, 5% and 2.5% concentration, the average zone of inhibition was 17 mm, 16 mm, and 9 mm, respectively.

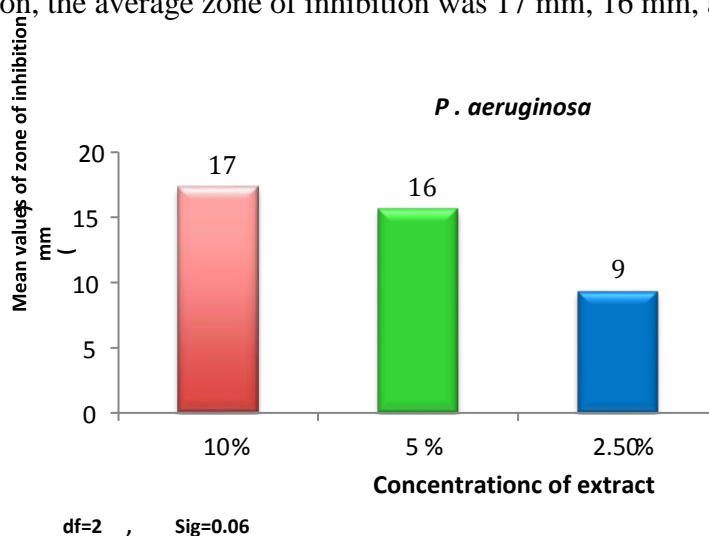


Figure 4. Effect of *Cinnamomum zeylanicum* extract against *P. aeruginosa*

Fig.5 shows that *Cinnamomum zeylanicum* ethanol extracts are effective against human pathogenic microbes of both the Gram-positive and - Gram-negative strains. These positive bacteria were 57 percent more inhibited than the harmful bacteria, which were only impaired by 43 percent. The extract under investigation had differing degrees of inhibitory activity against all human pathogenic bacteria studied. *S. aureus* was found to be 19.22(29 %) more inhibitory than the other bacteria, with inhibition concentrations of 18.44(28%), 14.67(22%), and 14.11(21%) for *S. epidermids*, *E.coli*, and *P.aeruginosa* respectively, as seen in fig 6.

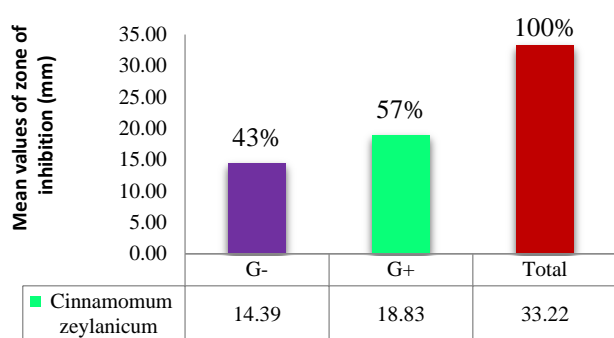


Figure 5. Effect of *Cinnamomum zeylanicum* the G+ and G- bacteria.

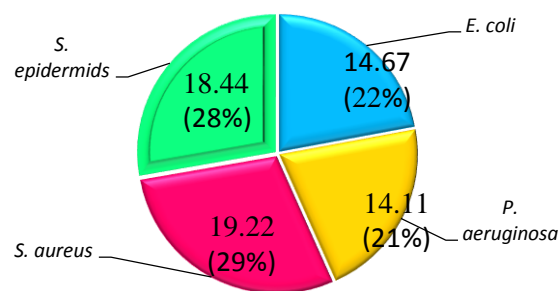
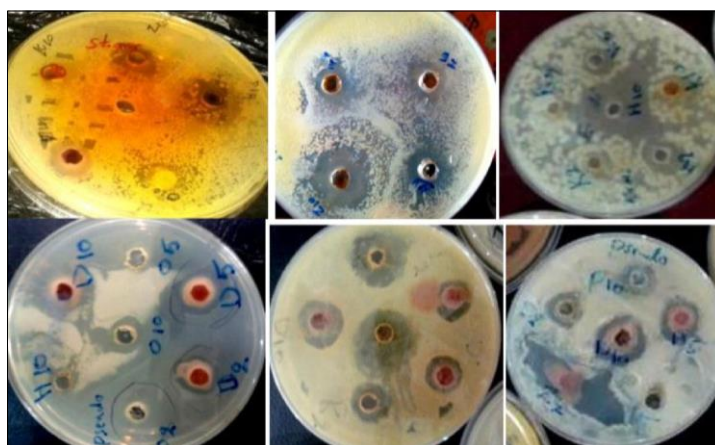


Figure 6. Percent of inhibition of four extract against types of bacteria



PICs. : shows Inhibition zone produced by present plant extracts on tested bacteria

[16]established that cinnamaldehyde, a component of cinnamon bark, acts against a wide variety of pathogenic G+ve and G-ve bacteria. Two primary phytochemicals in cinnamon are responsible for its antimicrobial effects: Bark cinnamic aldehyde (65-75 percent) and eugenol from the leaf (80 percent) [17]. Cinnamaldehyde inhibits the biosynthesis enzymes in bacteria[18]. It may also affect a particular *H. pylori* enzyme called urease.

It has been suggested in [19].that a decrease in pH inside the cell is responsible for *C. zeylanicum's* inhibitory action[19]. That a decrease in pH inside the cell is responsible for *C. zeylanicum's* inhibitory action [20]. Cinnamaldehyde and cinnamyl are two oil molecules shown to have antibacterial effects by binding to membrane proteins and blocking the production of peptidoglycan, an essential part of the microbe's cell wall. *E. coli* and other G- ve bacteria *P. aeruginosa* has an elevated level of intrinsic resistance to practically all recognized antibacterial agents and antibiotics that are exceedingly immune to synthetic drugs because of its extraordinarily porous outer membrane. Steroids, terpenoids, and flavonoids are just a few examples of plant-derived natural compounds that have gained popularity in recent decades because of the enormous variety of pharmacological actions they exhibit, including

anticancer, antioxidant, and antimicrobial activity [21]. Consistent with earlier publications [22, 23], that the greater resistance of G- ve bacteria to herbal extract is linked to the presence of exterior membrane lipopolysaccharides, the present results reveal that the activity of the present extracts was more efficient against G+ ve bacteria. Owing to the existence of a complex cell wall structure that prevents herbal antimicrobial agents from penetrating bacterial cells, several experiments have shown that herbal antimicrobial agents are unable to inhibit the growth of Gram-negative bacteria. However, extracts inhibited the growth of many bacteria in the current sample, demonstrating the extracts' capacity to penetrate bacterial cells [18; 20].

CONCLUSION

The findings indicate that the cinnamon has a wide range of antimicrobial activity, which is enhanced by increasing the quantity of this concentration, suggesting that it may be used as an antibiotic substitute. To isolate and characterize their active compounds, pharmacological tests are needed. Furthermore, in vivo studies of these plant extracts are needed to further understand their protection, effectiveness, and properties. We came to the conclusion that plant extracts could be used to develop better treatments for a variety of infectious diseases.

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