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# ANTIBACTERIAL AND ANTIFUNGAL ACTIVITIES OF CHANDANADI HERBAL DECOCTION

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**ABSTRACT**

Ayurveda is a systematic medicinal system from India that comprehensively considers all aspects of health, including physical, mental, and social components. This study focuses on the antibacterial and antifungal attributes of Chandanadi herbal decoction. Employing the agar well diffusion method, the research gauges its effectiveness against gram-negative (*Escherichia coli*) and gram-positive bacteria (*Enterococcus faecalis, Staphylococcus aureus, Streptococcus mutans*) while utilizing Streptomycin and Clotrimazole as standard antibacterial and antifungal controls, respectively. The outcomes reveal diverse antibacterial responses, contingent on concentration, showcasing significant inhibition at elevated concentrations. In contrast, antifungal efficacy against *Aspergillus niger* and *Candida albicans* is comparatively restricted in comparison to Clotrimazole. The non-existence of inhibition zones across different concentrations implies diminished antifungal effectiveness. These discoveries improve our comprehension of Chandanadi herbal decoction's potential applications in addressing microbial challenges, highlighting the key role of concentration variations in future investigations.

**Keywords:** Antibacterial, Antifungal, Chandanadi Herbal Decoction

## INTRODUCTION

The Ayurvedic medicinal system has extensively documented herbal formulations to treat various diseases, playing a crucial role in contemporary healthcare while addressing a range of ailments[1]. The adoption of herbal medicines is increasing as dietary supplements to combat or prevent common illnesses[2]. There is a growing demand for these remedies, such as churnas (single or combination powders) in primary healthcare due to their perceived non-toxic nature, minimal side effects, and affordable cost[3], which have the potential to enhance the antimicrobial spectrum and overall potency.

Enteric or diarrheal infections represent significant public health challenges in developing countries, contributing to an annual death toll of 3.3 to 6.0 million children[4]. Major causative agents of both sporadic and epidemic diarrhoea in children and adults include enteric bacteria such as *Salmonella spp., Shigella spp., Proteus spp., Klebsiella spp., Escherichia coli, Pseudomonas spp., Vibrio cholerae,* and *Staphylococcus aureus*[4]. Recent observations indicate a growing resistance among human pathogenic bacteria to various synthetic drugs, prompting an exploration of alternative medicines due to the reported lower efficacy and increased side effects associated with synthetic drugs[5]. While numerous reports highlight the antimicrobial activity of crude extracts from plants that inhibit various bacteria, there is a limited number of published *in vitro* studies on the antimicrobial activity of herbal preparations. It remains uncertain whether these preparations are superior or equivalent to antibiotics[6]. Therefore, a scientific evaluation of these herbal preparations is crucial to assess their antibacterial and antifungal activity and establish their viability as an alternative medicine for treating various infections in response to this imperative need.

This study's primary objective was to conduct a comprehensive *in vitro* evaluation of Chandanadi herbal decoction for its antibacterial/antifungal properties and its inherent potency to impede the growth of a diverse range of bacteria and fungi. Furthermore, the investigation aims to compare its effectiveness with conventional antibiotics, thereby shedding light on its potential as an alternative therapeutic option. The findings will enrich the scientific understanding of the herbal decoction's antimicrobial properties, bolstering its prospective application in treating bacterial and fungal infections. The study was conducted at the Center for Research on Molecular Biology and Applied Science, DNRA 41, Valiyavila, Thirumala, TVPM-6, Kerala, India.

## MATERIALS AND METHODS

In this study, Chandanadi herbal decoction was prepared using the kwatha vidhi (herbal decoction) process. This decoction was used to assess the antimicrobial activity against bacterial and fungal strains employing the Agar well diffusion method.

The antibacterial evaluations utilized Muller Hinton Agar Medium, nutrient broth, and Streptomycin as the standard antibacterial agent. The antifungal properties were assessed using the Potato Dextrose Agar Medium and Clotrimazole as the standard antifungal agent. The McFarland Standards were followed to adjust the cultures.

This section provides a comprehensive overview of the methodology, materials, and procedures applied to assess the antibacterial and antifungal properties of Chandanadi herbal decoction.

**Ingredients of Chandanadi Herbal Decoction**

Chandanadi kwatha is an herbal decoction detailed in the Annaraksha adhyaya of Ashtanga Samgraha Sutrasthana. In this study, Chandanadi herbal decoction was prepared using the kwatha vidhi (herbal decoction) process. This decoction was explicitly designed for the purification of water and contains 10 ingredients: (i) Raktachandana (*Pterocarpus santalinus* L.f.), (ii) Aswatha (*Ficus religiosa* L.), (iii) Udumbara (*Ficus racemosa* L.), (iv) Plaksha (*Ficus microcarpa* L.f.), (v) Nyagrodha (*Ficus benghalensis* L.), (vi) Palasa (*Butea monosperma* (Lam.) Taub.), (vii) Murva (*Marsdenia tenacissima*), (viii) Elavaluka (*Prunus avium*), (ix) Tulasi (*Ocimum sanctum* L.) and (x) Tanduliya (*Amaranthus spinosus* L.).

**Preparation of Chandanadi Herbal Decoction**

***Kwatha Vidhi:*** 15 g each of the 7 dry ingredients (total 105 g) and 30 g each of the 3 wet drugs [Elavaluka (*Prunus avium*), Tulsi (*Ocimum sanctum* L.) and Tanduliya (*Amaranthus spinosus* L.)] were crushed separately, boiled with 08 times water (1560 ml) and reduced to 390 ml (25%). Then, the decoction was further reduced to 195 ml (50% of 390 ml), allowed to cool, and filtered for use.

**Agar well diffusion method (Antibacterial activity)**

The agar well diffusion method is a widely utilized approach for evaluating the antimicrobial activity of plant or microbial extracts[7]. Much like the disk-diffusion method, this procedure spreads a microbial inoculum evenly across the agar plate surface. Subsequently, an aseptic punch with a diameter of 6 to 8 mm was created using a sterile cork borer or tip. A volume (20–100 µL) of the antimicrobial agent or extract solution at the desired concentration was introduced into the well. Following this, the agar plates underwent incubation under conditions suitable for the specific characteristics of the test microorganism. The antimicrobial agent diffused within the agar medium, resulting in the inhibition of microbial strain growth.

**Muller Hinton agar medium preparation**

The Muller Hinton Agar Medium (MHI Agar Media) utilized in this study was obtained commercially, and 33.8 g was dissolved in 1000 ml of distilled water. The resulting solution underwent autoclaving at 121°C for 15 minutes under 15 lbs pressure. Subsequently, the autoclaved medium was thoroughly mixed and poured into 100 mm petri plates, with approximately 25-30 ml dispensed per plate while the medium remained molten.

**Nutrient broth preparation**

A nutrient broth was prepared by dissolving 13 g of commercially available nutrient medium (HiMedia) in 1000 ml of distilled water. The mixture was then boiled until complete dissolution of the medium occurred. The prepared medium was dispensed as needed and subsequently sterilized via autoclaving at 121°C under 15 lbs pressure for 15 minutes.

**Antibacterial agent**

The antibacterial agent - Streptomycin was used as a standard in this study, prepared at 10 mg/ml.

**Test organisms**

The bacterial strains used in the experiments were *Escherichia coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 25923), *Streptococcus mutans* (ATCC 25175) and *Enterococcus faecalis* (ATCC 29212). These strains were cultured, and their growth was adjusted in accordance with the McFarland Standard to achieve a concentration of 0.5%.

**Procedure for Antibacterial Activity Evaluation**

Petri plates containing 20 ml of Muller Hinton Agar Medium were filled with bacterial cultures of *Escherichia coli, Staphylococcus aureus, Streptococcus mutans,* and *Enterococcus faecalis*, adjusted to a McFarland Standard of 0.5%. Wells approximately 10 mm in diameter were generated using a well cutter. Varying sample concentrations (25 µL, 50 µL, and 100 µL) were then introduced into the wells. Subsequently, the plates underwent incubation at 37 °C for 24 hours. The antibacterial activity was evaluated by measuring the diameter of the inhibition zone formed around the well[8]. Streptomycin was employed as the positive control in this experimental setup.

**Agar well diffusion method (Antifungal activity)**

The agar well diffusion method for assessing antifungal activity was performed by introducing wells into agar plates with fungal cultures. Introducing samples into the wells resulted in diffusion through the agar, impeding fungal growth and causing the development of observable zones of inhibition, facilitating the evaluation of the antifungal effectiveness.

**Potato dextrose agar medium**

Prepared by dissolving 39 g of commercially available Potato Dextrose Agar Medium (HiMedia) in 1000 ml of distilled water. Autoclaved at 15 lbs pressure and 121°C for 15 minutes, the molten medium was mixed and poured onto 100 mm petri plates (25-30 ml/plate).

**Antifungal Agent**

The antifungal agent Clotrimazole was used as a standard in this study and was prepared at a concentration of 10 mg/ml.

**Test organisms**

The fungal strains used in this study were *Aspergillus niger* (ATCC 16404) and *Candida albicans* (ATCC 10231). These strains were cultured, and their growth was adjusted in accordance with the McFarland standard to achieve a concentration of 0.5%.

**Procedure for antifungal activity evaluation**

The process included the creation of Potato Dextrose agar plates, onto which mature fungal species *Aspergillus niger* and *Candida albicans* were swabbed post-overnight cultivation. Wells with an approximate diameter of 10 mm were generated using a well cutter, and different sample volumes (25 µL, 50 µL, and 100 µL) were introduced. After overnight incubation at room temperature, the ensuing inhibition zones were measured and juxtaposed with those induced by the standard antimycotic Clotrimazole[8].

**Table 1: Determining the antibacterial activity using the Zones of inhibition at varying concentrations**

| Organism | Concentration | Zone of inhibition (mm) |
|---|---|---|
| Gram-Negative Organism: *Escherichia coli* | Streptomycin (100 µg) | 32 |
| | 25 µL | Nil |
| | 50 µL | Nil |
| | 100 µL | 12 |
| Gram-Positive Organism: *Enterococcus faecalis* | Streptomycin (100 µg) | 22 |
| | 25 µL | Nil |
| | 50 µL | Nil |
| | 100 µL | 12 |
| Gram-Positive Organism: *Staphylococcus aureus* | Streptomycin (100 µg) | 28 |
| | 25 µL | Nil |
| | 50 µL | 11 |
| | 100 µL | 15 |
| Gram-Positive Organism: *Streptococcus mutans* | Streptomycin (100 µg) | 29 |
| | 25 µL | Nil |
| | 50 µL | 11 |
| | 100 µL | 16 |

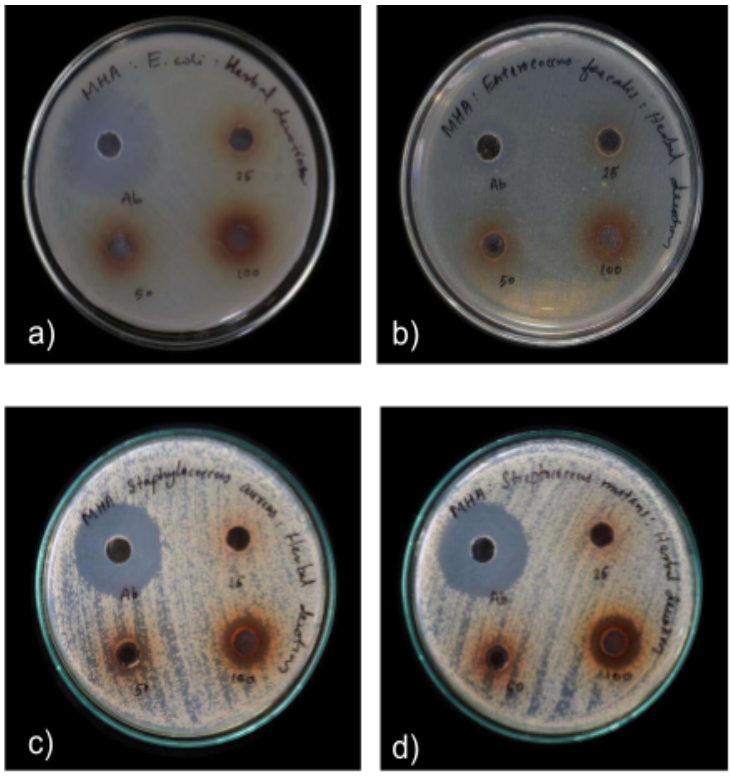


Fig 1: The antibacterial activity was assayed by measuring the diameter of the inhibition zone formed around the well:
a) *E coli,* b)*Enterococcus faecalis,* c)*Staphylococcus aureus,* and d) *Streptococcus mutans*.

**Table 2: Determining the antifungal activity using the Zones of inhibition at varying concentrations**

| Organism | Concentration | Zone of inhibition (mm) |
|---|---|---|
| *Aspergillus niger* | Clotrimazole (100 µg) | 28 |
| | 25 µL | Nil |
| | 50 µL | Nil |
| | 100 µL | Nil |
| *Candida albicans* | Clotrimazole (100 µg) | 29 |
| | 25 µL | Nil |
| | 50 µL | Nil |
| | 100 µL | Nil |

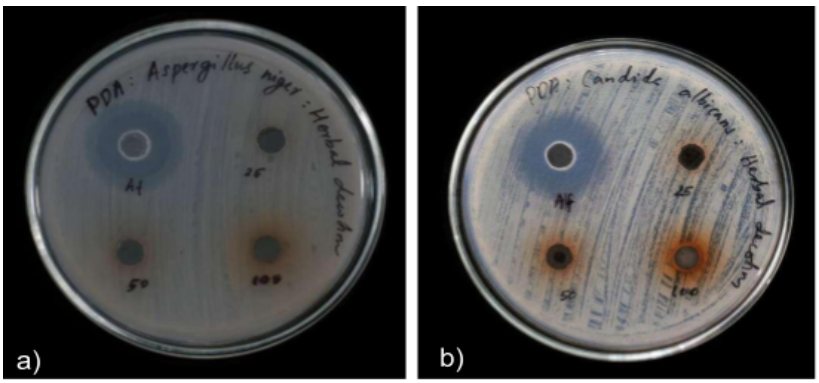


Fig 2: The antifungal activity was determined by Agar well diffusion method by measuring the zone of inhibition: a) *Aspergillus niger*, and b) *Candida albicans*

## RESULTS

Results obtained from the agar well diffusion method for determining the antibacterial and antifungal activity have been provided below.

### Antimicrobial Activities of Chandanadi Herbal Decoction

The antibacterial effectiveness of Chandanadi herbal decoction against both gram-negative *(Escherichia coli)* and gram-positive bacteria (*Enterococcus faecalis, Staphylococcus aureus, Streptococcus mutans)* after an overnight incubation employing the agar well diffusion method was evaluated.

For the gram-negative organism *Escherichia coli*: Streptomycin (100 µg), serving as the positive control, displayed an impressive zone of inhibition measuring 32 mm. In contrast, Chandanadi herbal decoction exhibited no inhibitory effects at 25 µL and 50 µL concentrations. However, at a concentration of 100 µL, a zone of inhibition measuring 12 mm was observed.

For the gram-positive organism *Enterococcus faecalis,* mirroring the gram-negative organism, the positive control Streptomycin (100 µg) manifested an inhibition zone of 22 mm. Chandanadi herbal decoction did not demonstrate inhibition at concentrations of 25 µL and 50 µL. At the concentration of 100 µL, a zone of inhibition measuring 12 mm was observed.

For the gram-positive organism *Staphylococcus aureus,* Streptomycin (100 µg) as the positive control presented a zone of inhibition measuring 28 mm. Chandanadi herbal decoction did not exhibit inhibition at a concentration of 25 µL. However, at 50 µL, a zone of inhibition measuring 11 mm was observed, and at a concentration of 100 µL, a zone of inhibition measuring 15 mm was observed.

For the gram-positive organism *Streptococcus mutans*, Streptomycin (100 µg) demonstrated an inhibition zone of 29 mm. Chandanadi herbal decoction did not exhibit inhibition at a concentration of 25 µL. At 50 µL, a zone of inhibition measuring 11 mm was observed, and at 100 µL, a zone of inhibition measuring 16 mm was observed.

These results indicate that Chandanadi herbal decoction exhibits variable antibacterial activity against the tested strains. While no inhibitory effects were observed at lower concentrations for certain bacterial strains, significant inhibition zones were noted at higher concentrations, suggesting a concentration-dependent impact. The effectiveness of the herbal decoction, particularly against *Staphylococcus aureus* and *Streptococcus mutans*, implies its potential as a reservoir of antibacterial agents. The outcomes for each bacterial strain and concentration are tabulated in Table 1 and evidenced in Figure 1.

### Antifungal Activity of Chandanadi Herbal Decoction

The antifungal effectiveness of Chandanadi Herbal Decoction against *Aspergillus niger* and *Candida albicans* employing the potato dextrose agar medium after overnight incubation at room temperature was evaluated.

In the case of *Aspergillus niger*: Clotrimazole (100 µg) demonstrated a 28 mm zone of inhibition. Chandanadi herbal decoction, across concentrations of 25 µL, 50 µL, and 100 µL, did not indicate any observable inhibition zones. Regarding *Candida albicans*: Clotrimazole (100 µg) exhibited a 29 mm zone of inhibition. Consistent with the outcomes observed with *Aspergillus niger*, Chandanadi herbal decoction at concentrations of 25 µL, 50 µL, and 100 µL did not present any evident inhibition zones (Table 2, Figure 2).

These findings suggest that, under the specific conditions of the experiment, Chandanadi herbal decoction did not exhibit significant antifungal activity against either *Aspergillus niger* or *Candida albicans*. The absence of inhibition zones at various concentrations indicates an efficacy level that does not match the positive control, Clotrimazole. It is crucial to interpret these results in light of the specific concentrations employed and the choice of the positive control.

## DISCUSSION

As one of the ancient healing sciences, Ayurveda provides a wealth of remedies for addressing various ailments and enhancing overall well-being. Despite its recognition for potent activities like Jwaraghna (antipyretic) and Rasayana (rejuvenating), the antimicrobial aspects have been historically understudied.

This research explores the antimicrobial potential of commonly used Ayurvedic medicines, drawing inspiration from ancient references that metaphorically labelled microbes as "Yathudana," "Rakshasa," "Pishacha," "Asura," "Gandharva," and "Krimi" in Samhita[9].

Ayurveda employs diverse strategies to combat infectious diseases, with the essential antimicrobial properties of Ayurvedic herbs and formulations playing a critical role in modern Ayurvedic medicine[10]. Many traditional Ayurvedic remedies incorporate chemical compounds responsible for their antimicrobial activity. Modern medicine has methodically

demonstrated that antimicrobial activity is crucial for addressing infectious diseases caused by pathogenic bacteria, viruses, and fungi. The mechanism of action for antimicrobial activity encompasses inhibiting bacterial growth, preventing microbial colony formation, and potentially destroying microorganisms.

Several research efforts have been dedicated to investigating utilizing multiple methods to assess the antimicrobial activity of diverse herbal preparations[11]. A study conducted by Bhargava *et al*.[12] delved into the antimicrobial potential of Sudarshana churna, examining its effectiveness against both gram-positive bacteria like *Staphylococcus aureus* and gram-negative bacteria such as *Klebsiella pneumoniae* and *Escherichia coli.* The methodology employed for this investigation was the agar disc diffusion method, allowing the assessment of Sudarshana churna's antimicrobial activity. The study's findings revealed that the aqueous extract of Sudarshana churna displayed significant antimicrobial properties. Specifically, it exhibited pronounced activity against the gram-positive bacterial strain *Staphylococcus aureus* and the gram-negative bacteria *Klebsiella pneumoniae* and *Escherichia coli*. Nevertheless, its efficacy was relatively diminished when tested against other gram-positive bacteria, specifically *Staphylococcus epidermidis* and *Bacillus subtilis.*

An independent study conducted by Reddy and Seetharam[13] investigated and demonstrated substantial antimicrobial efficacy of the ethanolic extract of Trikatu churna, along with its components, against various clinical and fungal isolates utilizing the agar well diffusion method. Additionally, a study conducted by Chittawadagi and Honawad[14] demonstrated the antimicrobial attributes of Samasharkara churna, employing both the disc diffusion method and the serial dilution method. The study included gram-positive bacteria such as *Staphylococcus aureus* and *Staphylococcus epidermidis*, gram-negative bacteria including *Klebsiella* and *Escherichia coli*, as well as fungi such as *Candida albicans* and *Aspergillus niger*.

In the investigation conducted by Tiwari[15], a modified disc diffusion assay method was applied to assess the antimicrobial activity of Amrtarishta and showcased noteworthy antimicrobial effects. Amrtarishta displayed substantial antimicrobial activity against prevalent human pathogens, including *Staphylococcus aureus, Salmonella typhi, Escherichia coli,* and *Bacillus subtilis*. Mittal *et al*.[16], in their study, employed the bactericidal *in vitro* disc diffusion method to examine the antimicrobial effects of Dashmularishta. The results revealed that the components of Dashmularishta exhibited considerable antimicrobial activity against *Shigella flexneri, Pseudomonas aeruginosa,* and *Aspergillus niger,* with the highest inhibition zone.

In Tiwari's study[17], the antimicrobial effect of Draksharishta was assessed using the disc diffusion assay method. Measurement of the growth inhibition zone indicated significant efficacy of Draksharishta against common human pathogens, including *Salmonella typhi* and *Bacillus. subtilis, Escherichia coli,* and *Staphylococcus aureus.* The investigation by Khan and colleagues[18] was dedicated to examining the antimicrobial effects of a chloroform extract ($CHCl_3$) of Chyawanprash avaleha and hydrolyzed Chyawanprash avaleha against *Escherichia coli* and *Staphylococcus aureu*s on a nutrient agar medium. The cup-plate method was employed to evaluate the antimicrobial properties of Chyawanprash avaleha. Following the incubation period, measurement of the zone of inhibition demonstrated that both the chloroform extract of Chyawanprash avaleha and hydrolyzed $CHCl_3$ extracts of Chyawanprash avaleha exhibited excellent antimicrobial activity against *Escherichia coli,* with efficacy dependent on the concentration.

The study on Chandraprabha vati's antibacterial activity employed the tube dilution method, adding different drug concentrations to Luria Bertani broth. Subsequently, the tubes underwent a 24-hour incubation at 37 °C, and the results were scrutinized using a growth curve analysis. In a study led by Christa and fellow researchers[19], it was observed that Chandraprabha vati demonstrated antimicrobial action against *Escherichia coli.*

Arogyavardhini vati is a revered Ayurvedic remedy widely utilized for addressing various health issues related to the liver, skin, stomach, heart, and gallbladder. A study conducted by Wijenayake *et al*.[20] aimed to assess the antimicrobial properties of *Arogyavardhini vati* using the agar well diffusion method with Mullar Hinton Agar. The microbial strains chosen for this evaluation included *Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus* and *Candida albicans*. The study revealed that Arogyavardhini vati exhibited remarkable antimicrobial activity against *Pseudomonas aeruginosa* and *Staphylococcus aureus*. However, the remedy did not demonstrate significant antimicrobial activity against *Candida albicans* under the specified conditions. These results offer valuable insights into the distinct antimicrobial efficacy of Arogyavardhini vati against the specific microbial strains tested, highlighting its potential to address bacterial challenges associated with certain health conditions.

In a study by Kumari and Hiramath[21], the antimicrobial activity of Manikya rasa was examined against eleven human pathogenic microbes. The findings suggested that Manikya rasa demonstrated significant antimicrobial effectiveness, particularly against *Staphylococcus aureus*. Similarly, Kumar *et al*.[22] utilized the agar disc diffusion method to assess the *in vitro* antimicrobial activity of Shwasakuthara rasa, with *Staphylococcus aureus* chosen as the major microbe. The results indicated that Shwasakuthara rasa exhibited antimicrobial activity against *Staphylococcus aureus.*

In a study conducted by Shubha and Hiremath[23], an exploration into the antimicrobial activity of Rasaka (Zinc) (synonymous with Kharpara, Thamraranjaka, and Nethrarogari), classified under Maharasa, was undertaken using the agar disc diffusion method against gram-positive and gram-negative bacteria. The study incorporated gram-positive bacterial strains such as *Streptococcus pneumonia, Staphylococcus aureus,* Streptococcus pyogenes, and the gram-negative bacterial strain *Klebsiella pneumonia.* The evaluation of Rasaka bhasma's antimicrobial activity demonstrated that $ZnCO_3$ and ZnO displayed substantial effectiveness against Streptococcus compared to other organisms. Remarkably, $ZnCO_3$ exhibited superior activity against the selected organisms in contrast to ZnO.

The objective of the research was to extensively examine the antibacterial and antifungal efficacy against specific strains, drawing comparisons with established positive controls. Streptomycin and Clotrimazole are well-established antibiotics with known mechanisms of action and reliable antimicrobial activity against a wide range of microorganisms. They are commonly used as reference standards in agar well diffusion studies, allowing researchers to compare new antimicrobial agents' effectiveness against these established drugs and provide a standardized benchmark. Additionally, both Streptomycin and Clotrimazole have been extensively studied, and their concentrations required for inhibition of various microorganisms are well-documented, making them suitable for use as reference standards in experimental studies.

The study results revealed that Chandanadi herbal decoction lacked inhibitory effects at lower concentrations (25 µL and 50 µL) against *Escherichia coli.* However, a concentration of 100 µL resulted in a 12 mm zone of inhibition. In contrast, the positive control, Streptomycin (100 µg), displayed a substantial 32 mm inhibition zone. This indicates a concentration-dependent influence, signifying that higher concentrations exhibit antimicrobial effects against *Escherichia coli*. Conversely, the results demonstrated variable activity against gram-positive bacteria. Chandanadi herbal decoction did not impede the growth of *Enterococcus faecalis, Staphylococcus aureus,* and *Streptococcus mutans* at lower concentrations (25 and 50 µL). Nevertheless, significant inhibition zones were observed at higher concentrations (100 µL). The positive control, Streptomycin (100 µg), also showcased noteworthy inhibition zones against these strains. These findings underscore the concentration-dependent antibacterial effects of Chandanadi herbal decoction, suggesting its potential as an antimicrobial agent, particularly against gram-positive bacteria.

This study also investigated the antifungal activity against *Aspergillus niger* and *Candida albicans*. Chandanadi herbal decoction did not show any observable inhibition zones at various concentrations (25 µL, 50 µL, and 100 µL) against either fungus. In contrast, the positive control, Clotrimazole (100 µg), displayed significant inhibition zones. These results suggest that, under the specified conditions of the experiment, Chandanadi herbal decoction did not exhibit notable antifungal activity against the tested strains. The absence of inhibition zones indicates a lower efficacy than Clotrimazole's positive control.

The historical context provided in the discussion, in combination with the results of this study, underscores the rich tradition of Ayurveda in addressing infectious diseases. Moreover, the data generated in this study adds valuable evidence to the growing body of research supporting the antimicrobial potential of Ayurvedic remedies. Compared with other studies on herbal decoctions, such as Sudarshana churna[12], Trikatu churna[13], and Samasharkara churna[14] this study offers a comprehensive perspective on the need for further Ayurvedic antimicrobial research. Together, these collective studies enhance our understanding of the diverse antimicrobial properties inherent in Ayurvedic formulations.

## CONCLUSION

In summary, the investigation into Chandanadi herbal decoction unveils concentration-dependent antibacterial activity, particularly against gram-positive bacteria. However, its effectiveness as an antifungal agent against *Aspergillus niger* and *Candida albicans* appears relatively constrained when compared with the positive control. These findings contribute to exploring the inherent antimicrobial potential in Ayurvedic remedies. Subsequent research, incorporating variations in formulations and concentrations, is essential for a detailed understanding of Chandanadi herbal decoction's versatile applications in addressing microbial challenges. Ayurveda's holistic approach continues to serve as a wellspring of inspiration for contemporary antimicrobial research, offering potential solutions in the persistent battle against infectious diseases.

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