

ANTIMICROBIAL STUDY OF *JATIPATRADI* TOOTHPASTE IN DENTAL CARIES WSR TO KRIMIDANTA

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Article Received on 04 March 2026,
Article Revised on 25 March 2026,
Article Published on 01 April 2026,

<https://doi.org/10.5281/zenodo.19327321>

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How to cite this Article: Dr. Umera Banu*¹, Dr. Seema. M. B.², Dr. Surekha S. Medikeri³. (2026). Antimicrobial Study of Jatipatradi Toothpaste In Dental Caries Wsr To Krimidanta. World Journal of Pharmaceutical Research, 15(7), 476-482.

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ABSTRACT

Jatipatradi Churna, a classical Ayurvedic formulation, has been traditionally used in the management of *Danta* and *Mukha Rogas* (dental and oral disorders). However, its powder form may limit ease of application and patient compliance. To overcome these limitations, the present study aimed to develop and evaluate a modified dosage form *Jatipatradi* toothpaste, and it's In vitro antimicrobial study was carried out. The results indicated that the toothpaste exhibited desirable attributes suitable for oral application. Antimicrobial studies shows that *Jatipatradi* toothpaste possesses significant efficacy against oral pathogens such as *Staphylococcus aureus* and *Streptococcus mutans*.

KEYWORDS: Analytical study, *Jatipatradi churna*, *Jatipatradi* toothpaste, antimicrobial study.

INTRODUCTION

The mouth is a favourable habitat for a number of organisms due to the presence of nutrients and secretions. These organisms attach, colonize and accumulate on tooth surface giving rise to dental plaque. Dental plaque is a biofilm which is pale yellow in color that develops naturally on the teeth. This dental plaque gives rise to dental caries.^[1] Several organisms

causing dental caries like *Staphylococcus aureus*, *Streptococcus mutans*, *Bacillus* species, *Pseudomonas* species, *Aeromonas* species etc.

Teeth are very precious organs of the body, governing a lot of functions like chewing, speech control, giving shape to the mouth and the most important of all is to maintain the beauty of the face; once they are destroyed, they cannot regrow.^[4] To remove plaque and maintain dental hygiene agents like toothpaste and various mouth washes can be used. Toothpaste is a dentifrice which improves the aesthetic appearance and health of the teeth. It is commonly used for promotion of oral hygiene, removal of dental plaque and food debris from the mouth.^[2]

Krimidanta, however, has a significant impact on oral health. It is a pathological condition of teeth which is mainly caused by vitiated *Vata* along with *kapha dosha* and *krimi*, which is characterized by black discoloration, cavity formation, swelling, blood oozing and severe pain.^[5] It can be correlated to Dental caries/ Tooth decay which begins when bacteria in your mouth make acids that attack the tooth's surface (enamel). This can lead to a small hole in a tooth, called a cavity. If tooth decay is not treated, it can cause pain, infection, and even tooth loss.^[6]

Jatipatradi Churna^[3], a classical Ayurvedic formulation described in *Yogaratanakara* under *Dantaroga Chikitsadhyaya*, was modified into a toothpaste dosage form to enhance patient compliance and ease of application. The formulation was prepared using modern pharmaceutical techniques to ensure desirable characteristics such as homogeneity, spreadability, foaming index, and stability and evaluate its therapeutic potential, an in vitro antimicrobial study was conducted against oral pathogens associated with *Krimidanta* (dental caries), including *Streptococcus mutans* and *Staphylococcus aureus*.

MATERIALS AND METHODS

Antimicrobial activity of *Jatipatradi* Toothpaste was carried out at- CIRC, Centre for Incubation, Innovation, Research and Consultancy, Jyothy Institute of Technology, Tataguni, Kanakapura road, Bengaluru.

Preparation of *churna*

Jatipatradi churna was prepared by taking *Jatipatra*, *Punarnava*, *Gajapippali*, *Kushta*, *Vacha*, *Shunti*, *Ajamoda*, *Haritaki* and *Tila* in Pulveriser, powdered separately, filtered

through Sieve of 120 number mesh, mixed in a equal quantity until homogenous mixture and stored it in an airtight container.

Table No 1: Showing the Ingredients and their quantity used during preparation of *Jatipatradi* toothpaste final batch.

Si. No.	Name of the Ingredients	Final batch
1.	<i>Jatipatradi churna</i> (gm)	45.8 gm
2.	Calcium carbonate (gm)	80 gm
3.	Glycerine (ml)	59.6 ml
4.	Xanthan gum (gm)	7.0 gm
5.	Sesame oil (ml)	16.9ml
6.	Vitamin E (ml)	1.9 ml
7.	Saccharine (gm)	0.75 gm
8.	Peppermint oil (ml)	4 ml
9.	Cocamidopropyl betadine (ml)	14.5 ml
10.	Sodium lauryl sarcocinate (ml)	16.1 ml
11.	Geogard ect (ml)	1.50 ml
12.	Distilled water (ml)	51.9 ml

PROCEDURE

Xanthan gum was dispersed in glycerine and allowed to swell for 10–15 minutes, forming a smooth gel base. Sesame oil, vitamin E, sodium saccharine, and peppermint oil were mixed separately and incorporated into the gel base for stability. *Jatipatradi churna* and calcium carbonate were triturated to ensure even distribution, then combined with the other phases. Surfactants, preservative, and distilled water were added with continuous stirring to obtain a lump-free homogeneous paste, which was finally packed in collapsible tubes to prevent contamination and drying.

MINIMUM INHIBITORY CONCENTRATION (MIC) ASSAY^[7]

To evaluate the antimicrobial efficacy of the test sample against *Staphylococcus aureus* and *Streptococcus mutans*, a turbidity-based assay was performed using Mueller Hinton broth as the growth medium. For each bacterium, two sets of six test tubes were prepared: five containing the test sample at concentrations ranging from 20 to 100 µg/mL and one blank control, with all preparations carried out under sterile conditions. Each tube was inoculated with 50 µL of actively growing bacterial suspension and incubated at 37 °C for three hours.

Following incubation, turbidity was visually compared with the control to assess bacterial growth. Quantitative analysis was conducted by measuring optical density at 600 nm (OD600) using a UV-Visible spectrophotometer. Lower OD600 values indicated stronger

antimicrobial activity of the test sample.

Table no 2: Showing the percentage of inhibition and minimum inhibitory concentration of *Jatipatradi churna* on *Staphylococcus aureus* and *Streptococcus mutans*.

	Percentage of Inhibition		MIC	
	<i>S aureus</i>	<i>S mutans</i>	<i>S aureus</i>	<i>S mutans</i>
Standard (Amoxicillin)	87.02	82.41	0.7312	30.21
Sample	21.066	16.910	254.496	281.719

Table no 3: Showing the percentage of inhibitory activity of *Jatipatradi churna* on *Staphylococcus aureus* and *Streptococcus mutans* at different concentrations.

Conc	% of inhibition (<i>S.aureus</i>)		% of inhibition (<i>S.mutans</i>)	
	Sample	Standard (Amoxicillin)	Sample	Standard (Amoxicillin)
20	6.853	50	3.997	40.72
40	11.168	73.08	4.151	57.33
60	12.437	81.97	13.297	69.06
80	19.543	84.38	13.989	77.85
100	21.066	87.02	16.910	82.41
MIC	254.496	0.7312	281.719	30.21

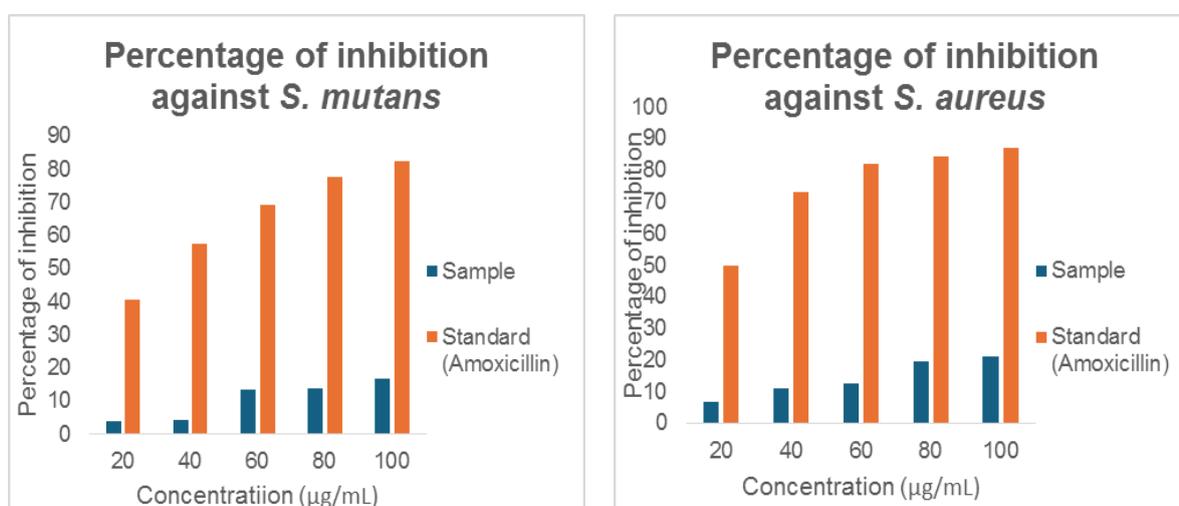


Figure no 1: Showing the percentage of inhibition against *Staphylococcus aureus* and *Streptococcus mutans* at different concentrations.

ANTIMICROBIAL STUDY

Antibacterial activity of *Jatipatradi* toothpaste was tested using the agar well diffusion method. Mueller Hinton agar plates were prepared and sterilized. Each plate was inoculated with 100 µL of bacterial suspension of *Staphylococcus aureus* or *Streptococcus mutans*. Wells were punched using a sterile borer. 100 µL of the test sample (1 mg/mL in sterile

water) was added to each well. Amoxicillin (100 µg/mL) was used as a positive control in separate wells. Plates were incubated at 37°C for 24 hours. Zones of inhibition were measured in millimetres. Larger zones indicated stronger antibacterial activity.

Table no 4: Showing antimicrobial activity of the toothpaste Antibacterial activity – Well diffusion agar assay.

	<i>S. mutans</i>	<i>S. aureus</i>
	Zone of inhibition (in mm)	
Standard (Amoxicillin)	29 mm	29 mm
Sample	14 mm	17 mm



Staphylococcus Aureus



Streptococcus Mutans

Figure No 2: Showing the images of antimicrobial study of Jatipatradi toothpaste.

DISCUSSION

Jatipatradi churna, a formulation mentioned for danta and mukha roga are modified into toothpaste form and its antimicrobial activity on *krimidanta* (dental caries) was carried out. The contents of *Jatipatradi churna* provide antibacterial activity and provides multipurpose care of the teeth, gums and oral hygiene.

The pH of the *Jatipatradi* Toothpaste was 7.1 which is considered neutral and ideal for oral health. A neutral to slightly alkaline pH is vital for promoting optimal conditions for tooth mineralization and remineralization, particularly for enamel and dentin.^[8]

The moisture content of *Jatipatradi* Toothpaste was 10% which falls within the generally acceptable range (8–15%) used in toothpaste formulations. This level is considered good for oral mucosa, as it prevents dryness and irritation, while also helping inhibit bacterial growth.

Jatipatradi Toothpaste contains lipophilic, hydrophilic, and amphiphilic compounds that act synergistically, with their combined antimicrobial, anti-inflammatory, and cleansing actions proving more effective in preventing dental caries than any single ingredient alone. Lipophilic ingredients penetrate the mucosa to reduce inflammation, while hydrophilic constituents act on the tooth surface to inhibit cariogenic bacteria such as *Streptococcus mutans*. Amphiphilic agents maintain cleansing, hydration, and ensuring prolonged contact of actives with teeth. Together, these actions reduce bacterial colonization and protect enamel, creating an oral environment unfavourable for caries development.

The MIC assay revealed IC₅₀ values of 254.496 µg/mL for *Staphylococcus aureus* and 281.719 µg/mL for *Streptococcus mutans*. Based on these values, *Staphylococcus aureus* exhibited stronger inhibition. The IC₅₀ value for *Staphylococcus aureus* was 254.496 µg/mL, indicating that approximately 25.4 mg of *Jatipatradi Churna* is sufficient to exhibit antimicrobial activity in 100 g of toothpaste against this strain. For *Streptococcus mutans*, the IC₅₀ was 281.719 µg/mL, requiring approximately 28 mg of the powder per 100 g of toothpaste for effective inhibition. To ensure broad-spectrum antimicrobial efficacy and for better texture 45.8 g of *Jatipatradi Churna* was added into 300 g of the toothpaste base.

Jatipatradi toothpaste showed maximum zone of inhibition against *Staphylococcus aureus* of 17mm and low zone of inhibition against *Streptococcus mutans* of 14mm at the concentration of 500µg/ml, indicating moderate to strong antibacterial activity. The antimicrobial activity observed in this study was confined to the ethanolic extract of *Jatipatradi* toothpaste, suggesting that alcohol-soluble constituents were responsible for the inhibition zones. However, *Jatipatradi churna* is known to contain water-soluble, lipid-soluble, and alcohol-soluble phytochemicals with documented antimicrobial and anti-inflammatory properties. Thus, the use of ethanol alone may have restricted the detection of bioactivity to a limited fraction of compounds, Moreover, it is well established that lipid-soluble drugs and phytoconstituents are readily absorbed through the oral mucosa due to their ability to permeate cell membranes^[9], indicating that the therapeutic potential of lipophilic components in *Jatipatradi* toothpaste may be masked when excluded from in vitro assays.

CONCLUSION

The pH of the *Jatipatradi* toothpaste was found to be in the range of 7.1 which is considered neutral and ideal for oral health, study shows the 10% microbial content which prevents the

dryness of mouth and irritation, while also helping inhibit bacterial growth. MIC and zone of inhibition studies revealed effective antibacterial action, particularly against *Staphylococcus aureus* than *Streptococcus mutans*.

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