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Original article

Formulation and Evaluation of Gomay Nimbadi Dhoop Stick for Antimicrobial Property: AnExperimental Study

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Abstract

Various traditional methods, including Dhoopana and Havana, have been employed in fumigation procedures to reduce microbial levels in the environment to nonpathogenic thresholds. Although the use of formaldehyde in combination with potassium permanganate is widely acknowledged as the predominant fumigation method, it is also associated with various health risks. In the present study the herbal dhoop stick was manufactured. In the manufacturing process of Dhoop sticks, various ingredients such as neem, tulsi, Kapoor, cow dung, cow urine, cow ghee, and guggul were meticulously combined in different quantities. The evaluation of the anti-microbial properties of the prepared dhoop stick by dhoopan was done on the nutrient agar plates in the kitchen area of hospital for three days. An assessment of number of colonies before and after the administration of dhoopstick revealed reduction in the mean score from 2480.66±72.94 cfu/100cm^2 to 1938.66±144.57 cfu/100cm^2 which was statistically significant (*p*- p-0.020447). Additionally, it was found that There was no significant difference found between after scores of both dhoopstick and formaldehyde (*p*- 0.103734). Both the Dhoop Stick and formaldehyde exposures show a consistent reduction in microbial colony counts on agar plates in the hospital kitchen over the three-day period.

Keywords: Herbal dhoopan, dhoopstick, Gomay Nimbadi, Antimicrobial Property, Herbal fumigation

Introduction

Microbial pathogens contribute to a global annual loss of over 400 million years of life. (1,2) Non-host origins such as abiotic surfaces, water and organic matter are crucial components of the lifecycle of the pathogen. These settings create conditions where pathogens can thrive or endure, promoting their transmission. Even if environments solely act as surfaces for pathogencontamination, the transmission from the environment to the host can play a crucial role in determining the invasion and long-term persistence of the pathogen. (3) Nosocomial infections, commonly referred to as healthcare-associated infections (HAI), these infections

typically emerge after a patient has been hospitalized, becoming apparent 48 hours after admission. The consequences of hospital-acquired infections extend beyond the individual patient, impacting not only at the personal level but also at the community level due to their association with the spread of multidrug-resistant infections. (4)

ICUs in India present a common source of infections. Recent research from different provinces of the country has revealed that both primary and secondary gram-positive and gram-negative bacterial infections are prevalent. (5)

Before approaching the application of potentially perilous technology, such as fumigation of rooms using high concentrations of toxic chemicals, which has been proposed for reducing microbial agents on surfaces and controlling infections, it is crucial to thoroughly assess the advantages and drawbacks. While chemical fumigation has proven effective in various contexts, including building decontamination after bioterrorism events, agriculture, and residential structures, there have been instances where fumigants escaped, leading to illness and fatalities among exposed workers and the public. (6)

Herbal-based fumigation is described in Ayurveda and practiced around the globe by various cultures and civilizations as well. According to Ayurveda, Charak Samhita and Sushrutha SamhitaDhoopana is identified as fumigation and is utilized for the treatment of numerous ailments and disinfection of the environment and abiotic objects or surfaces. (7)

Although the use of formaldehyde in combination with potassium permanganate is widely acknowledged as the predominant fumigation method, it is also associated with various health risks. The present experimental study aimed to formulate and evaluate the herbal dhoopana (Nimb, Tulsi, Gomoy, Goghrit, Kapoor and Gomutra) for antibacterial potential.

Aims & Objectives

The aim of this study was to evaluate the antimicrobial properties of herbal dhoop sticks as an alternative fumigation method compared to formaldehyde, aiming to reduce microbial levels in hospital environments

Materials and Method

Plant Materials like Neem Leaves and Tulsi Leaves were Procured from the Herbal Garden of Govigyan Anusandhan kendra Deolapar, Nagpur and were identified by the Dravya Guna Department of GAC Nagpur. The plant materials were further shadow-dried for 5 days and then pulverised in a domestic grinder and sieved to obtain a fine powder. Guggul which acted like a binder and Kapoor, Neem oil, and Tulsi oil were acquired from the authentic drug provider and used after their quality assessment. Re-distilled cow Urine was procured from the National Environmental and Engineering Research Institute (NEERI), Nagpur. Dried Cow dung Powder which acted as a biofuel, being one of the bases and Cow ghee were procured from the Govigyan Anusandhan kendra Deolapar, Nagpur and were used in theformulation of Dhoop stick after their quality assessment.

Preparation of Dhoop Sticks:

Table 1. Ingredients for Preparation of Dhoop Sticks

Sr no.	Ingredients	Batch A	Batch B	Batch C
1.	Neem powder	5 gms	10 gms	7 gms
	Neem oil	3 ml	3 ml	3 ml
2.	Tulsi powder	2 gms	3 gms	5 gms
	Tulsi oil	3.5 ml	3.5 ml	3 ml
3.	Kapoor	4 gms	5 gms	6 gms
4.	Guggul	7 gms	5 gms	5 gms
5.	Cow ghee	3 ml	3.5 ml	3 ml
6.	Cow urine	31 ml	40 ml	38 ml
7.	Cow dung	15 gms	25 gms	25 gms

Table 2. Sites exposed to dhoop and formaldehyde

Sr no.	Day	Area	Set 1 exposed to Dhoop		Set 2 exposed to formaldehyde	
1	Day-1	Hospital Kitchen	No.of colonies before exposure to dhoop	No. of colonies after exposure to dhoop	No.of colonies Before exposure to formaldehyde	No. of colonies after exposure to formaldehyde
2	Day-2	Hospital Kitchen	No.of colonies before exposure to dhoop	No. of colonies after exposure to dhoop	No.of colonies Before exposure to formaldehyde	No. of colonies after exposure to formaldehyde
3	Day-3	Hospital Kitchen	No.of colonies before exposure to dhoop	No. of colonies after exposure to dhoop	No.of colonies Before exposure to formaldehyde	No. of colonies after exposure to formaldehyde

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The table allows to observe and compare the impact of sunlight (Dhoop) and formaldehyde on the bacterial colonies in the hospital kitchen over three consecutive days. By comparing the number of colonies before and after exposure, you can infer the effectiveness of Dhoop and formaldehyde in controlling bacterial growth.

Results and Discussion

Microbial evaluation of dhoop stick

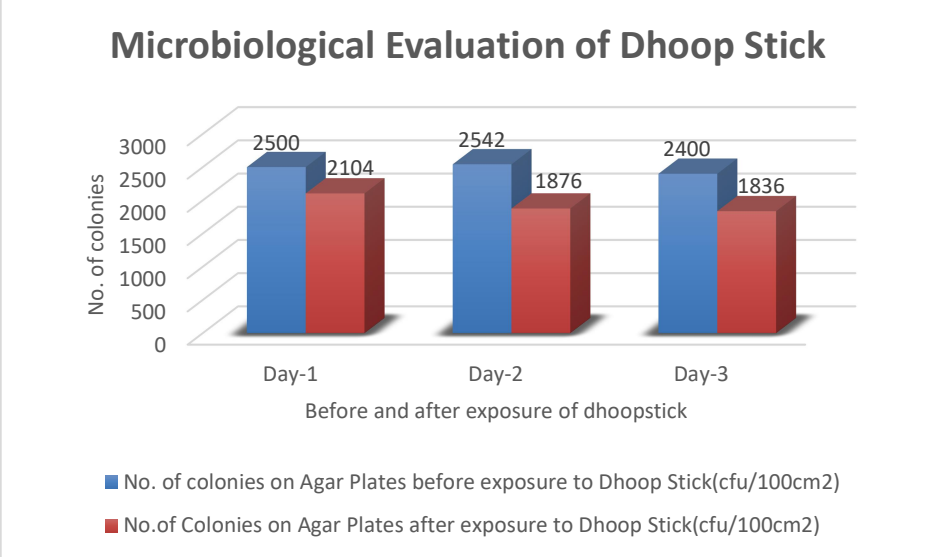

Fig 1. Colonies before and after use of dhoop stick on various days

The fig.1 presents data from a three-day experiment conducted in a hospital kitchen to assess the impact of exposing the environment to a Dhoop Stick (a type of incense stick) on microbial colony counts on agar plates. An assessment of number of colonies before and after the administration of dhoopstick revealed reduction in the mean score from 2480.66±72.94 cfu/100cm^2 to 1938.66±144.57 cfu/100cm^2. The difference in means was statistically significant (p-0.020447). Similarly, notable findings by Kumar A. *et al* indicated a substantial decrease in microbial load following exposure to dhoop in various settings. Specifically, a significant reduction of 66.12% was observed in environmental plates, 55.38% in the main laboratory, and 60% in the laminar airflow (LAF) room. [8] Additionally, The conducted study revealed that the combustion of dhoop sticks with diverse compositions emitted pleasant-smelling fumes, effectively reducing contamination levels and the associated infection risks. The observed effectiveness extended to combatting pathogens such as *Pseudomonas aeruginosa, Streptococcus aureus*, and *Escherichia coli.* [9] An alternative study has documented the antifungal properties of plant extracts and smoke against fungal pathogens like Bipolaris sorokiniana and Fusarium oxysporum. This approach was identified to offer numerous benefits compared to traditional methods of disease control associated with fungal pathogens. [10]

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Microbial evaluation of formaldehyde

The table presents data from a three-day experiment conducted in a hospital kitchen to evaluate the impact of exposing the environment to formaldehyde on microbial colony counts on agar plates.

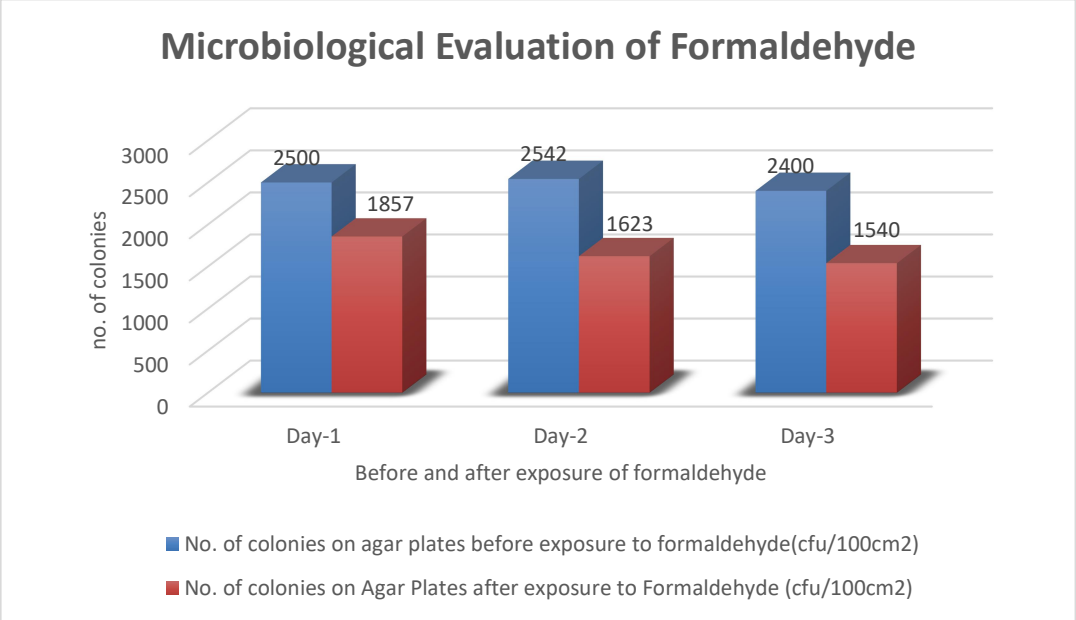

Fig no. 2 Number of colonies before and after use of formaldehyde on various days

On the first day, after 30 minutes of exposure to formaldehyde in the hospital kitchen The evaluation of colony counts before and after the application of formaldehyde revealed a decrease in the average count from 2480.66±72.94 cfu/100cm^2 to 1673.33±164.38 cfu/100cm^2 This observed reduction was statistically significant, (p-0.010631) indicating a statistically meaningful improvement.

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Comparison of number of colonies after exposure of dhoopstick and formaldehyde

Fig. 1 Comparison of number of colonies after exposure of dhoop stick and formaldehyde

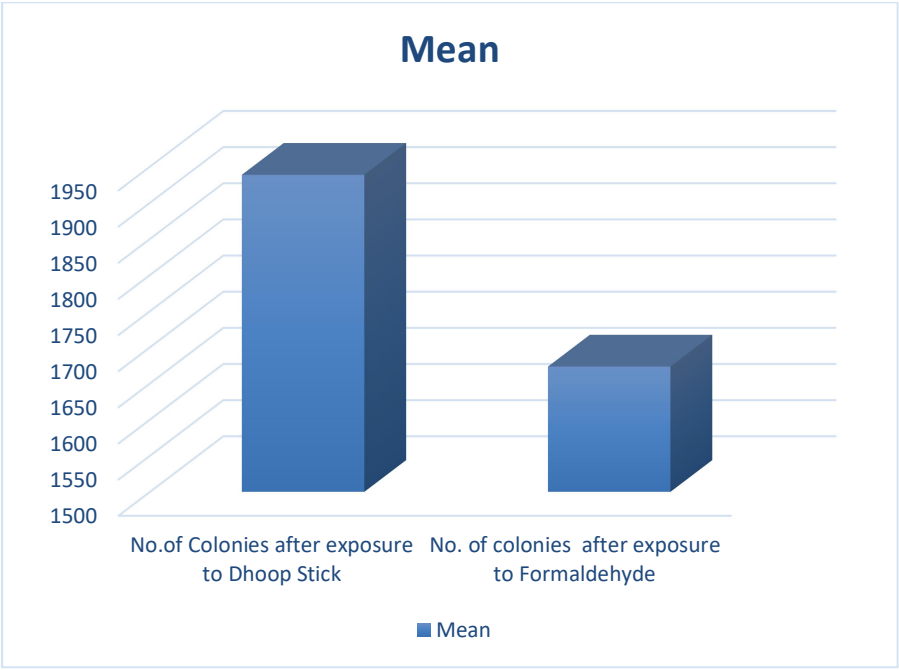

Fig. 2 Mean difference of number of colonies after exposure of dhoop stick and formaldehyde

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There was no significant difference found between after scores of both dhoopstick and formaldehyde (*p*-0.103734).

Conclusion

The Dhoop Stick exposures showed a consistent reduction in microbial colony counts on agar plates in the hospital kitchen over the three-day period. The mean values indicate an overall decrease in microbial contamination, suggesting that the Dhoop Stick may have antimicrobial properties or are effective in reducing microbial load in the tested environment. Further analysis and comparison with control groups may provide additional insights into the effectiveness of each substance in controlling microbial contamination.

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