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ANTIBACTERIAL EFFICACY OF MENTHOL IN A COMMERCIALLY AVAILABLE MOUTH FRESHENER

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ABSTRACT

Aim: In this study we aim to assess the antibacterial effect of menthol in a commercially available mouth freshener.

Materials and Methodology: Instantly dissolving breath strips were placed on the dorsum of the tongue and saliva samples were collected from twelve patients. Colony forming units (CFU) per mL saliva was counted both before and after the use of mouth freshener.

Results: The mean value of CFU / mL in saliva after the use of mouth freshener was lesser than the value before the use of mouth freshener

Conclusion: Menthol shows moderate antibacterial efficacy in the tested mouth freshener. Hence Synthetic antibacterial agents like Triclosan and Triclocarban which have harmful effects can be replaced with menthol in oral care products like mouthwashes, dentifrices, mouth fresheners.

Keywords: Menthol, Antibacterial, Antimicrobial, Mouth freshener, *Mentha piperita*

INTRODUCTION

Essential oils generally obtained from spices, aromatic herbs, fruits, and flowers majorly constitute terpenoids present as hemiterpenes, monoterpenes or sesquiterpens, menthol being one such monoterpene **[1, 2]**. It is a known fact that

many of the terpenes can act against a variety of microbes including gram positive and negative bacteria and fungi and hence their antibacterial properties have been utilized in a wide array of commercial products like antiseptics, food preservatives, dental root canal sealers and mouth fresheners **[3, 4]**. The antibacterial effect of essential oils and their monoterpenoid components such as menthol is generally explained by their toxic effects on the bacterial cell membrane structure and function **[5, 6]**. Monoterpenes rapidly separate from an aqueous phase into membranes due to their lipophilicity. This results in expansion of membranes, increased membrane permeability, inhibition of respiration and altered ion transportation processes **[7]**. Antibacterial effect of menthol may result, at least partially, from changes in membrane permeability and intracellular material leakage due to a variation in the lipid fraction of the microorganism plasma membrane. This effect seems to be dependent on the net surface charge and lipid composition of the microbial cell membrane besides the characteristics of menthol **[8]**. Essential oils and their constituents alone cannot replace antibiotics but they can intensify or strengthen the antibiotic action **[9]**.

Menthol is a primary constituent of a medicinally important plant *Mentha piperita* L. belonging to the family Lamiaceae. It was cultivated by the ancient Egyptians as documented in the thirteenth century pharmacopoeia of Iceland and now cultivated throughout all regions of the world. Menthol is the substance responsible for imparting the characteristic flavor and aroma to the mints and mint containing products **[10]**. Widespread usage of antibiotics has led to the serious issue of microbial resistance and a possible solution to this would be to switch to herbal(XI) and plant derived ingredients like menthol for antimicrobial effects. Mouth fresheners are used in various forms to mask halitosis or malodor. In addition to this several mouth fresheners claim to have antibacterial effect in the oral cavity. In this study we aim to assess the antibacterial efficacy of menthol in a commercially available mouth freshener.

MATERIALS AND METHODS

Patients between eighteen and thirty five years of age who reported to the outpatient department of a dental hospital were randomly chosen. Approval was obtained from the research & ethics committee of the institution. Inclusion criteria were patients with generalized chronic gingivitis. Gingival status of the patients were assessed using the

Gingival Index (American Academy of Periodontology) and those with a score of 1 or >1 were included in the study. A total of twelve patients were thus selected for the study. Informed consent was obtained from all the participants. Other inclusion criteria were individuals with no recent use of antibiotic or antibacterial mouthwash in the past one month and no associated comorbidities. Individuals with prostho-dontics appliances and with a history of recent treatment (3 months) with antibiotics or antimicrobials were excluded from the study.

Patients were explained about the procedure and consent obtained. All patients were given distilled water to rinse their mouth after which saliva samples were collected. The mouth freshener under study available as instantly dissolving breath strips were placed on the dorsum of the tongue. After 3 minutes again saliva samples were collected from the patients. Saliva was diluted using distilled water upto a dilution factor of 1:80. All the samples were smeared to brain-heart infusion agar and incubated at 37°C for 24 hours. The colony forming units (CFU) were counted in both before and after salivary samples for all patients.

RESULTS

A Clustered bar chart was plotted for each patient with the corresponding values of CFU/mLin saliva samples obtained before and after use of mouth freshener **(Figure 1)**. Also Means of CFU/ml in saliva samples collected before use of mouth freshener µ (BEFORE) plotted against the mean of CFU/mL in saliva samples collected after the use of mouth freshener µ (AFTER) **(Figure 2)**.

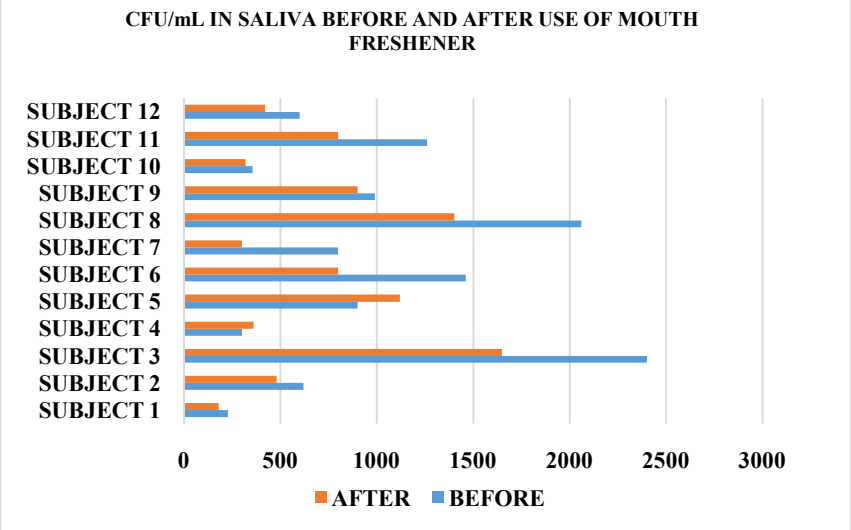

Figure 1: CFU/mLin saliva samples obtained before and after use of mouth freshener

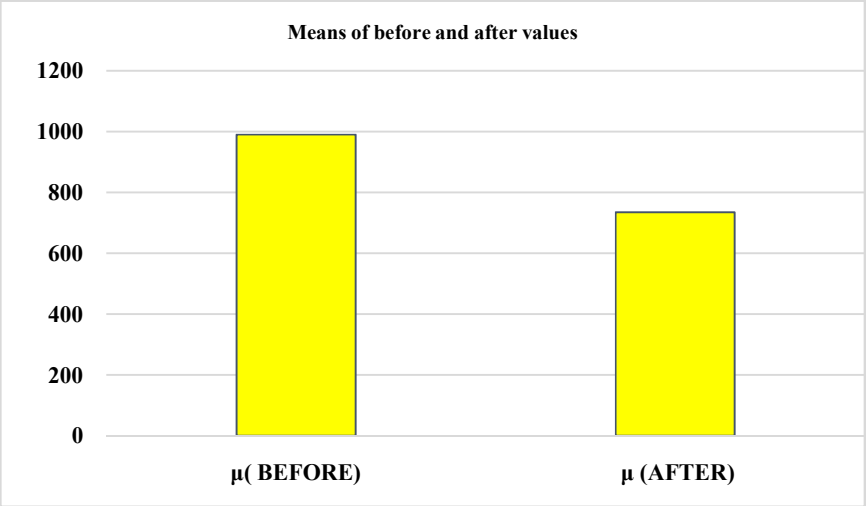

Figure 2: CFU/mL in saliva samples collected after the use of mouth freshener μ

DISCUSSION

The results reveal that menthol present in the mouth freshener reduces the bacterial count in the oral cavity (mean difference of 255) and hence show a moderate antibacterial efficacy. In a previous study done to assess the antimicrobial activity of monoterpenes including menthol *in vitro*, it was found that menthol inhibits growth of both gram-positive and gram-negative microbial strains and states specifically that menthol is toxic against *S. aureus* and *E. coli* **[12]**. In this study overall bacterial count reduction is studied and not the efficacy of menthol against specific bacterial strains or species. Another study that compared the antibacterial property of essesntial oil components in vitro revealed that menthol is less active against bacteria compared to peppermint oil and that *Citrobacter sp*. and *Bacillus sp*. were resistant to menthol **[13]**. In a study done on Mentha piperita oil using disc diffusion method, it was reported to have moderate antibacterial property against *Staphylococcus aureus*, *Micrococcus flavus* , *Bacillus subtilis*, *Staphylococcus epidermidis*, and *Salmonella enteritides* **[14]**. Another study which evaluated the action of common mouth washes on multidrug resistant biofilms reveals that menthol containing mouthwash had some activity against all bacterial strains except *S. epidermidis* and *S. pyogenes* **[15]**. Bacterial biofilms formation is a result of neglected dental hygiene that favours an environment for biofilm formation, thereby making the oral bacteria less susceptible to mouthwash or antiseptic formulations **[16-18]**. Hence maintenance of good oral hygiene, which is expected to avoid the biofilm formation, is advised to ensure

susceptibility of oral bacteria to mouthwashes and other oral care products **[19]**.

CONCLUSION

Synthetic antibacterial agents like Triclosan **[20]** and Triclocarban which have harmful effects can be replaced by menthol in oral care products like mouthwashes, dentifrices, mouth fresheners to achieve antibacterial action without side effects .

Conflict of interest

The authors declare that they have no conflict of interests.

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