



MOUTHWASH: AN ADVANCED PERSPECTIVE

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ABSTRACT

The objective of this study was to develop mouthwash formulations. Mouthwash, mouth rinse, oral rinse, or mouth bath is a liquid which is held in the mouth passively or swilled around the mouth by contraction of the Perioral muscles and/or movement of the head, and may be gargled, where the head is tilted back and the liquid bubbled at the back of the mouth. If you have cavities or are at a high risk of contracting gum diseases, your dentist may recommend an antibacterial mouthwash. Mouth rinses with fluoride can also help ward off tooth decay. Mouthwash freshens bad breath, can help reduce plaque and gingivitis, as well as fight tooth decay and prevent cavities. Mouthwash can really help improve your oral health. While it's not a replacement for brushing and flossing, mouthwash can play an important role in your oral hygiene routine. It can help to freshen your breath, remove plaque and reduce your risk of cavities and gum disease. For help deciding whether to use mouthwash before or after brushing, talk to your dentist.

KEYWORDS: Tooth decay, Oral hygiene, Mouthwash, herbal, Natural plants.

INTRODUCTION

Mouthwashes are typically liquid solutions that possess anti-inflammatory, antimicrobial, and analgesic properties. They are commonly utilized for their deodorizing, refreshing, and antiseptic qualities, as well as for plaque control. Ingredients commonly found in mouthwash formulations include alcohol, glycerin, artificial sweeteners, surfactants, flavorings, coloring agents, among others.^[1,2]

Mouthwash may be prescribed to address infections, inflammation, pain relief, and halitosis, or to administer fluoride for cavity prevention. Its preventive application primarily targets dental caries control, while therapeutic use aims to inhibit or diminish plaque-related bacteria. An international standards organization is currently finalizing guidelines that encompass mouth rinse safety, akin to those for toothpaste. Potential risks or side effects from mouth rinses stem from three sources: the physiochemical properties of the rinse, the active ingredients, and other components such as alcohol.^[3]

Using mouthwashes that claim to kill 99.9% of mouth bacteria can also eliminate beneficial bacteria, disrupting the mouth's microbiome and its ability to combat cavities, gingivitis, and bad breath. Chlorhexidine gluconate (CHG) is a potent antibacterial agent commonly found in mouthwashes. While it's acceptable to use mouthwash in the morning, it's also advisable to use it before bedtime to counteract harmful oral bacteria

activity while you sleep, resulting in a fresher feeling in the morning. However, excessive brushing, flossing, or teeth whitening can harm tooth enamel. Incorporating mouthwash into your daily oral hygiene routine can effectively freshen breath and eliminate any remaining harmful bacteria after brushing and flossing.^[5]



Fig. no. 1: Mouthwashes.

Advantages

1. Provide Fresh breath.
2. They reduce tooth decay by using sodium fluoride.
3. Reduce the inflammation of gum by killing bacteria.
4. Whiten teeth
5. Prevent gum disease using an antiseptic or anti-plaque agent
6. Mouthwash aids in the prevention of gingivitis and gum disease by eliminating the bacteria responsible for potential infections in the gums and dental sockets.^[6,7,8]
7. It has the potential to hinder plaque accumulation, fortify enamel, and promote demineralization of teeth, enabling individuals to fend off tooth decay.^[9]



Fig. no. 2: Advantage of Mouthwashes.

Overview of Advantages and Adverse effects of mouthwashes

Mouth rinses are formulated with a pH level typically below 10.4, often falling within the acidic range below 5.4-5.5. This acidity has the potential to erode enamel and, notably, dentin. Studies have demonstrated that acidified sodium chloride, while effective against plaque like Chlorhexidine, can induce enamel erosion comparable to that caused by orange juice.^[10]

Chlorhexidine mouthwash

Adverse effects: Chlorhexidine mouthwash has been associated with various potential side effects, including tooth staining, taste alterations, burning sensation on the tongue, oral mucosal shedding, and swelling of the parotid gland. Among these, localized reversible effects such as brown staining of the teeth and tongue are commonly reported with chlorhexidine use.

Advantages of chlorhexidine mouthwash

Chlorhexidine rinses have demonstrated efficacy in enhancing plaque control among individuals experiencing recurrent problems, ineffective plaque management, certain rare oral mucous membrane conditions, as well as post-periodontal or oral surgical procedures.

Phenols and Essential oils

Advantages of Phenols and Essential oils: Mouthwashes with essential oils offer a range of benefits for oral health.

Phenols and essential oils rinses possess broad-spectrum antimicrobial properties that hinder bacterial aggregation, impede bacterial growth, and slow down plaque development, leading to a decrease in plaque volume and virulence. Moreover, they demonstrate bactericidal properties, penetrate plaque effectively, and also exhibit anti-inflammatory effects along with inhibition of prostaglandin synthetase activity.

Adverse effects: The elevated alcohol content, sometimes reaching up to 26%, in mouthwashes can cause irritation or dryness in certain individuals. Additionally, there is a possibility of allergic reactions to essential oils present in some formulations.

Fluoride rinses**Advantages of fluoride mouth rinse**

Fluoride plays a crucial role in preventing dental caries by facilitating remineralization with fluorapatite and fluoro hydroxyapatite, thereby enhancing enamel resilience against acid attacks. This leads to a reduction in dental caries and is recommended for high-risk patients.

Cetylpyridinium chloride**Advantages of cetylpyridinium chloride**

Cetylpyridinium chloride possesses antiseptic and antimicrobial properties. Mouthwashes containing cetylpyridinium chloride effectively inhibit and diminish plaque accumulation.

Hexitidine

Advantages: Hexitidine mouthwashes, although chlorhexidine demonstrates superior plaque reduction, still provide advantages. They may be preferred by individuals seeking to avoid the staining effects associated with chlorhexidine or those experiencing discomfort with other mouthwashes.

Adverse effects: The use of Hexitidine mouthwashes resulted in tooth discoloration in all participants and

frequent instances of soreness, as well as tongue and oral mucosal irritation.

Sanguinarine, a plant extract often combined with zinc salts in mouth rinses, has recently been linked to a significantly increased risk of oral precancerous lesions, even after discontinuation of mouthwash use.

Povidone-iodine

Advantages: Povidone iodine, when used as a 1% mouthwash, seems to lack significant plaque inhibitory activity. However, povidone-iodine, containing iodine linked to povidone, effectively targets bacterial cell surfaces due to its affinity for cell membranes. It exhibits broad-spectrum activity against bacteria, fungi, protozoa, and viruses.

Adverse effects: While povidone iodine mouthwash typically has minimal side effects, excessive consumption can potentially disrupt thyroid function. Prolonged use, particularly through gargling, may contribute to thyroid gland dysfunction, manifesting as hypo- or hyperthyroidism, hyperplasia, adenoma, or goiter.^[11]

Systemic adverse effects of mouthwash

Fisher (1974) identified several potential allergens in antiseptics, such as benzalkonium chloride, essential oils, alcohol, iodine, and other compounds.

Allergic reactions in the oral mucosa can present as either type I hypersensitivity, characterized by urticaria, edema, and erythema mediated by IgE antibodies, or type IV hypersensitivity reactions, which manifest as contact dermatitis with symptoms like erythema, ulceration, and epithelial peeling, typically appearing 24 to 48 hours after exposure to the allergen. Mouthwashes have been linked to triggering allergic reactions. When mouthwash was applied openly on the antecubital fossae of both patients and control subjects, immediate erythematous or urticarial responses were observed in all individuals tested.

Further investigation identified cinnamic aldehyde as the causative ingredient. The frequency of positive reactions was found to vary based on the application site, vehicle, concentration, and timing of assessment. Among several related cinnamates tested, only cinnamic acid elicited readily detectable responses at comparable concentrations.^[13] Lim et al. documented cases of perioral and mucosal edema resulting from contact allergy to proflavine in an acriflavine mouthwash.^[14]



Fig. no: 3: Side effects of mouthwashes.

Natural preparation

Triphala

The term “triphala” refers to a blend of amalaki, haritaki, and Bahera, with a history of use in Ayurveda dating back centuries. Triphala is renowned for its ability to boost the body’s antibody production, thereby enhancing immunity.

Prepared as follows

To prepare the solution, begin by dissolving 60 grams of triphala churna in 1000 mL of double-deionized water. Boil the mixture and then filter it to remove any impurities. Next, add 2 mL of glycerin to act as a sweetening agent, followed by 1 mL of pudina extract for flavoring. Allow the solution to cool before transferring 50 mL into each amber-colored bottle for storage.

Mouth Rinse Containing Tea Tree Oil (TTO), Clove, and Basil

The mouth rinse contains tea tree oil (TTO) at a concentration of 0.2–0.3%, clove extract at 0.2–0.3%, and basil extract at 0.2–0.3%. It was formulated by Anchor Health and Beauty Care Pvt. Ltd. In Mumbai, India. The minimum inhibitory concentration (MIC) of the mouth rinse was determined using a broth macrodilution assay, revealing a MIC value of 25%.

Garlic extract mouthwash up

To prepare the solution, start by adding twenty-five grams of garlic extract powder to 1000 ml of deionized water. Boil the mixture and then filter it to remove any particulates. Next, incorporate 10 ml of pudina extract

into the filtered solution. Allow the mixture to cool, then dispense it into amber-colored bottles for storage.

Pomegranate extract

Pomegranate extract for mouthwash can be obtained from three sources: pomegranate peel extract (PPE), pomegranate aril extract, or pomegranate juice. To prepare PPE, pomegranate peels are dried, ground into a powder, and then extracted using a Soxhlet extractor, resulting in PPE after 5 days. Likewise, pomegranate aril extract undergoes a similar process but requires 15 days of drying. Fresh pomegranate juice is obtained using a sterilized grinder, and heating it for an hour yields a concentrated form.

Salvadora persica L. and Green Tea

In the manufacturing process, *Camellia sinensis* var. *assamica* (0.25 mg) is combined with extracts of *S. persica* L. roots (7.82 mg) in 1 ml of distilled water. This mixture is prescribed to be used as 15 ml twice daily. Patients are instructed to rinse with the solution for 30 seconds and to avoid eating or drinking for 30 minutes afterward.

Green tea mouthwash

To prepare the green tea mouthwash, green tea fragments were first broken down into smaller pieces and soaked in 500 ml of ethanol for 48 hours. The filtered leaves were then placed in a hot air oven at 50°C for 3–4 days to dry, resulting in the extract. Subsequently, 0.5 g of the extract is added to 100 ml of distilled water to constitute a 5% green tea mouthwash.



Fig. no. 5: Green tea mouthwash.

Curry leaves

To prepare the solution, fresh curry leaves were dried under the sun for 3–4 days and then crushed to obtain a fine powder. One hundred thirty-five grams of this powder was mixed with 4500 ml of distilled water to achieve a concentration of 3%. The solution was dispensed into conical flasks and placed in a rotary shaker set at 120 revolutions per minute (rpm) for 18 hours. Afterward, the solution was filtered. To enhance taste, 10 milliliters of glycerin were added as a sweetening agent, and 5 ml of Pudina were added as a flavoring agent.

Neem mouthwash

To prepare the neem solution, start by cutting 100 grams of neem sticks into small pieces and blending them into a coarse powder. Store the powder at room temperature. Then, soak the neem powder properly for 2–4 hours. Next, transfer the soaked neem powder into a distillation apparatus along with 10 parts of water. Constantly heat the mixture until 60% of the concentrate is collected. Afterward, thoroughly cool the concentrate and dissolve

it in 1000 ml of distilled water to constitute a 2% neem solution.

Tea mouthwash

To formulate the tea extract, begin by mixing 7 tablespoons of green tea with four cups of mineral water. Allow the tea to steep at room temperature for at least 1 hour. After steeping, strain the tea using a sieve to remove the loose tea leaves. Discard the strained tea leaves. Then, mix 500 ml of the strained tea with 1000 ml of distilled water to obtain a 0.5% solution of tea mouthwash.

Curcumin mouthwash

The primary ingredient utilized in this formulation is Curcumin (Diferuloylmethane), a polyphenol derived from the *Curcuma longa* plant, commonly known as turmeric. Turmeric comprises raw turmeric in quantities ranging from 0.3% to 5.4%. It contains several active compounds, including the flavonoid curcumin and volatile oils such as turmerone, atlantone, and zingiberone. Additionally, turmeric contains sugars, proteins, and resins among other constituents.



Fig. no. 6: Curcumin mouthwash.

Green coffee bean extract mouthwash

To prepare a 2% green coffee bean extract, dissolve 2 grams of the powder in 100 ml of distilled water.

Aloe vera mouthwash

The composition of aloe vera juice consists of 99% aloe juice, 0.2% preservative, 0.001% spearmint flavor, and it is sweetened with sorbitol.



Fig. no. 7: Aloe vera mouthwash.

Mixed herbal mouthwash

The mixed herbal mouthwash is composed of several key ingredients, each contributing to its therapeutic properties. These ingredients and their respective concentrations include Babool chaal/acacia arabica at 20% w/v, Darim leaves/punica granatum at 10% w/v, Chameli leaves/Jasmine grandiflorum at 10% w/v, Mulethi/glycyrrhiza glabra at 5% w/v, and Neem/azadirachta indica at 2% w/v. Together, these components create a potent herbal formulation aimed at promoting oral health and hygiene.

Cinnamon extract mouthwash

Fresh cinnamon bark was ground into a fine powder using a mechanical grinder. Subsequently, 10 grams of the finely powdered cinnamon were added to 100 ml of deionized water and placed in a water bath within a round-bottomed flask for 5 hours at a temperature ranging from 55 to 60°C. The mixture was then filtered through a sterile filter paper (Whatman, UK). The resulting aqueous extract was decanted and further clarified by filtration through a muslin cloth. The clarified extract was then evaporated in a porcelain dish at 40°C to obtain a dried extract. Finally, this dried extract was dissolved in a mixture of PEG 400 (20% v/v) and sterile distilled water to achieve a final concentration of 20% w/v.^[15]

Synthetic preparation

Polyvinylpyrrolidone-iodine

PVP-1 mouthwash exhibits both virucidal and bactericidal activity against respiratory pathogens. Solutions containing 0.7% and 0.23% PVP-1 have been shown to significantly reduce bacterial counts of *Klebsiella pneumoniae* and *Streptococcus pneumoniae*. Furthermore, the 0.23% PVP-1 solution demonstrates virucidal effects against various viruses, including Influenza virus A subtype H1N1, SARS-CoV, MERS-CoV, and human rotavirus. In vitro experiments have indicated that the 0.23% PVP-1 gargle solution and throat spray effectively reduce strains of avian influenza within 10 seconds.

Chlorhexidine

Chlorhexidine mouthwash (0.12%) has been found to exhibit virucidal activity against enveloped viruses, including Herpes simplex, Cytomegalovirus, hepatitis B, Influenza A, and Parainfluenza viruses, although the inactivation time may vary among different viruses. Additionally, chlorhexidine mouth spray (0.12%) and benzydamine (0.15%) have been shown to effectively alleviate symptoms of streptococcal tonsillopharyngitis when used four times daily alongside antibiotics, with mild side effects reported.



Fig. no. 8: chlorhexidine mouthwash

Cetylpyridinium chloride

Cetylpyridinium chloride, when used twice daily at a concentration of 0.05% for a period of 6 weeks, has been

shown not to disrupt normal oral flora or promote non-oral pathogenic bacteria. Additionally, a spray containing cetylpyridinium chloride, glycerin, and xanthan gum has

been found to effectively reduce the severity and frequency of upper respiratory infections in healthy adults. However, side effects such as tooth and tongue staining, ulcerations, and a burning sensation have been reported.

Benzydamine

Benzydamine hydrochloride gargles have been found to be more effective than aspirin gargles for providing 24-hour relief from postoperative sore throat in patients undergoing elective modified radical mastectomy. Benzydamine mouthwash is known to have positive effects on oral health, although it may also have potential for recreational use. Common side effects include a

tingling sensation, especially when used in combination with cetylpyridinium.

Ketamine

Ketamine gargle has been found to be effective in reducing postoperative sore throat, as demonstrated in both double-blind and single-blind studies. In a double-blind study, ketamine was shown to reduce the incidence and severity of postoperative sore throat. In the single-blind study, ketamine gargling was performed 5 minutes before elective surgery for septorhinoplasty under general anesthesia. The control group gargled with 30 ml saline, while the ketamine group gargled with 30 ml saline containing 40 mg ketamine.



Fig. no. 9: Ketoprofen mouthwash.

Ketoprofen

In a single-blinded study, ketoprofen lysine salt mouthwash was found to be more effective in treating sore throat compared to benzydamine hydrochloride. The focus of the study was primarily on pain management rather than on infection control. However, patients sensitive to ketoprofen may experience intraoral itching and edema of the lips as potential side effects.

Nystatin

Nystatin 1% mouth solution has demonstrated effectiveness in the prophylaxis of invasive pulmonary fungal infections in patients with malignancies. The solution is gargled for 15 minutes after meals and before bedtime. In contrast, normal saline and sodium bicarbonate have not shown prophylactic effectiveness in managing invasive pulmonary fungal infections when compared to 1% nystatin. Additionally, some commercial nystatin suspensions contain sugar, increasing the risk of caries.

Furaginum

Gargling with furaginum has been found to be effective in treating acute tonsillopharyngitis, especially when used in combination with systemic administration of antibiotics.^[16]

Evaluation

Color and Odour

Physical parameters like odour and color were examined by visual examination.

pH:

The pH of the prepared herbal mouthwash was measured using a digital pH meter. Prior to measurement, the pH meter was calibrated using standard buffer solutions. Approximately 1 ml of the mouthwash was weighed and dissolved in 50 ml of distilled water, and then the pH of the solution was measured.

Test for microbial growth in formulated mouthwash

The formulated mouthwash was inoculated onto agar media plates using the streak plate method, and a control was also prepared. The plates were then placed in an incubator and allowed to incubate at 37°C for 24 hours. After the incubation period, the plates were removed from the incubator and inspected for microbial growth by comparing them with the control plate.

Quality control tests for selected formulations

Quality control tests, including measuring mouthwash pH, tannin content percentage, and essential oil yield, were conducted on days 0 and 45 following the preparation of the formulations.

Stability studies

The formulation and preparation of any pharmaceutical product are incomplete without conducting proper stability studies of the prepared product. These studies are crucial for assessing the physical and chemical stability of the product over time, thereby ensuring its safety and efficacy.^[17]

CONCLUSION

Mouthwashes can be used for various conditions, depending on the lesions present in the oral cavity. Mouthwash is designed to help improve your oral hygiene and protect your gums from disease. The advantage along with side effects are included above for each ingredients. An attempt has been made to stipulate variety of the commonly available herbs and plants, and certain fruits, which are readily available, and could be used as effective mouthwashes by all. Some synthetic preparation are also included along with their evaluation techniques. If people can use and promote such cost-effective measures of maintaining the oral health which are innocent of any untoward side effects, it should help in overcoming some common dental problems.

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