



REVIEW ON EVALUATION AND COMPARISON OF MARKETED HERBAL TOOTHPASTE PRODUCTS BASED ON QUALITY PARAMETERS

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Abstract:

Herbal toothpaste products have emerged as popular alternatives to conventional toothpaste due to growing consumer preference for natural and safer oral care formulations. These products are formulated using medicinal plant ingredients such as neem, clove, babool, miswak, mint, and aloe vera, which are traditionally known for their antimicrobial, anti-inflammatory, and plaque-reducing properties. Despite their widespread availability and claimed benefits, variations in formulation quality and performance among marketed herbal toothpaste products raise concerns regarding their safety, efficacy, and consistency.

The present review aims to evaluate and compare marketed herbal toothpaste products based on standard quality parameters, including physical characteristics, physicochemical properties, performance efficiency, and safety aspects. Parameters such as color, texture, pH, spreadability, foaming ability, cleaning efficiency, stability, and microbial safety were critically analyzed from published literature. The review highlights that while many herbal toothpaste formulations demonstrate acceptable quality and oral health benefits, significant differences exist due to lack of standardization, variation in herbal ingredient concentration, and manufacturing practices.

Overall, herbal toothpaste products offer advantages such as natural composition, suitability for long-term use, and reduced risk of side effects compared to synthetic formulations. However, the review emphasizes the need for standardized evaluation protocols, clinical validation, and stricter regulatory oversight to ensure consistent quality and consumer safety. This review provides useful insights for researchers, manufacturers, and regulatory authorities in improving the quality and reliability of herbal toothpaste products.

Keywords: Herbal toothpaste, Oral hygiene, Quality evaluation, Marketed formulations, Physicochemical parameters, Safety assessment

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1. INTRODUCTION:

Oral health is an integral part of overall health and well-being, as it directly influences nutrition, speech, appearance, and quality of life. Poor oral hygiene can lead to common dental problems such as dental caries, gingivitis, periodontitis, bad breath, and tooth sensitivity. These conditions not only cause discomfort and pain but may also contribute to systemic health issues if left untreated. Therefore, maintaining proper oral hygiene through regular brushing, flossing, and the use of suitable oral care products is essential.[1]

Toothpaste plays a crucial role in daily oral hygiene practices by assisting in the mechanical removal of dental plaque, food debris, and stains from the tooth surface. Conventional toothpastes generally contain synthetic ingredients such as fluoride, detergents, artificial sweeteners, and preservatives, which are effective in controlling dental caries and plaque formation. However, prolonged use of some synthetic components has been associated with adverse effects such as tooth staining, altered taste sensation, mucosal irritation, and fluorosis, particularly in children. These concerns have led consumers to seek safer and more natural alternatives.[2]



Figure 1: Role of Herbal Toothpaste in Maintaining Oral Hygiene

In recent years, herbal toothpaste products have gained widespread popularity due to their use of plant-based ingredients and traditional medicinal knowledge. Herbal toothpastes commonly contain ingredients such as neem, clove, babool, miswak, and mint, which are known for their antimicrobial, anti-inflammatory, analgesic, and refreshing properties. These products are often perceived as safer for long-term use and suitable for individuals with sensitive teeth and gums.

Despite their growing market presence, the quality, efficacy, and safety of marketed herbal toothpaste products may vary significantly depending on formulation, ingredient concentration, and manufacturing practices. Therefore, systematic evaluation and comparison of these products based on standard quality parameters is essential to ensure their effectiveness and consumer safety.[3]

2. Herbal Toothpaste: Concept and Composition

2.1 Concept of Herbal Toothpaste

Herbal toothpaste is an oral hygiene formulation that primarily contains natural ingredients derived from medicinal plants and herbal extracts. Unlike conventional toothpaste, which relies heavily on synthetic chemicals for cleansing and therapeutic action, herbal toothpaste utilizes plant-based components that have been traditionally used for maintaining oral health. These formulations aim to clean teeth, prevent dental diseases, and promote gum health while minimizing the risk of adverse effects associated with synthetic ingredients.[4]

The concept of herbal toothpaste is closely linked to traditional systems of medicine such as Ayurveda and Unani, where plant materials like neem twigs, clove, and miswak have been used for centuries for cleaning teeth and strengthening gums. With increasing consumer awareness and preference for natural products, herbal toothpaste has emerged as a popular alternative for individuals seeking safer and long-term oral care solutions.[5]

2.2 Composition of Herbal Toothpaste

Herbal toothpaste formulations are composed of a combination of active herbal ingredients and suitable excipients that ensure cleansing, stability, and palatability. The active herbal components are responsible for therapeutic benefits such as antimicrobial action, plaque control, anti-inflammatory effects, and breath freshness.[6]

Common herbal ingredients include neem (*Azadirachta indica*), known for its strong antibacterial and plaque-inhibiting properties; clove (*Syzygium aromaticum*), which provides analgesic

and antiseptic effects; babool (*Acacia arabica*), which strengthens gums and reduces bleeding; miswak (*Salvadora persica*), widely recognized for its natural cleansing and antimicrobial activity; and mint (*Mentha* species), which offers a refreshing flavor and cooling sensation.[7]

In addition to herbal actives, excipients such as mild abrasives, humectants, binders, foaming agents, sweeteners, and preservatives are incorporated to ensure effective cleaning, acceptable texture, and product stability. Natural abrasives help remove stains without damaging enamel, while humectants prevent drying of the paste. Binders maintain consistency, and natural flavoring agents improve consumer acceptability.[8]

2.3 Difference Between Herbal and Conventional Toothpaste

The major difference between herbal and conventional toothpaste lies in their ingredient profile. Herbal toothpaste emphasizes natural, plant-based constituents with minimal synthetic additives, making it suitable for prolonged use and sensitive individuals. In contrast, conventional toothpaste relies more on chemical agents that provide quick results but may cause side effects with long-term use.[9]

3. Marketed Herbal Toothpaste Products

The increasing demand for natural oral care products has led to the wide availability of various marketed herbal toothpaste formulations. These products are designed to promote oral hygiene using plant-based ingredients while minimizing the use of synthetic chemicals. Most marketed herbal toothpastes claim benefits such as prevention of dental caries, reduction of plaque, strengthening of gums, control of bad breath, and overall improvement of oral health.[10]

Commonly available herbal toothpaste products contain traditional medicinal ingredients such as neem, clove, babool, miswak, mint, and aloe vera, either individually or in combination. The selection of products for evaluation in this review is based on their market popularity, ingredient profile, consumer acceptance, and widespread availability. Although these products are marketed as safe and effective, their quality and performance may vary due to differences in formulation, concentration of herbal actives, and manufacturing standards.[11]

Therefore, systematic evaluation and comparison of marketed herbal toothpaste products using standard quality parameters is essential to assess their effectiveness, safety, and overall quality.



Figure 2: Common Herbal Ingredients Used in Marketed Herbal Toothpaste Products

4. Quality Parameters for Evaluation of Herbal Toothpaste

Evaluation of herbal toothpaste products is essential to ensure their quality, safety, efficacy, and consumer acceptability. Since these products are used daily and come in direct contact with oral tissues, they must meet standard quality requirements. The commonly used evaluation parameters for herbal toothpaste include physical, physicochemical, performance, and safety-related tests.[12]

4.1 Physical Evaluation Parameters

Physical parameters provide preliminary information about the appearance and uniformity of toothpaste formulations. These characteristics influence consumer acceptance and indicate formulation stability.

Color reflects the presence of herbal ingredients and should be uniform without discoloration.

Odor should be pleasant and characteristic of the herbal components without any rancid or unpleasant[13] smell.

Taste plays an important role in user compliance; herbal toothpaste should have an acceptable taste without bitterness.

Texture and consistency should be smooth, free from grittiness, and uniform to ensure comfortable application during brushing.

Homogeneity ensures that the ingredients are evenly distributed throughout the formulation without phase separation.[14]

Table 1: Physical Evaluation Parameters of Herbal Toothpaste

Parameter	Description / Acceptance Criteria
Color	Uniform, characteristic, stable
Odor	Pleasant, herbal, non-offensive
Taste	Acceptable, non-bitter
Texture	Smooth, non-gritty
Homogeneity	Uniform, no lumps or separation

4.2 Physicochemical Evaluation Parameters

Physicochemical parameters determine the chemical stability and compatibility of toothpaste with oral tissues.

pH is one of the most important parameters and should ideally be near neutral to avoid enamel erosion or mucosal irritation.

Moisture content affects shelf life and microbial stability; excessive moisture may lead to microbial growth.

Spreadability indicates ease of application on the toothbrush and uniform spreading on teeth. Abrasive property should be mild to effectively

remove plaque and stains without damaging tooth enamel.[15]

4.3 Performance Evaluation Parameters

Performance parameters assess the functional efficiency of herbal toothpaste during use.

Foaming ability reflects the cleansing action and is influenced by the type of surfactant used. Cleaning efficiency indicates the ability of toothpaste to remove plaque, debris, and stains from teeth.

Stability studies help determine the product's ability to retain its physical and chemical properties during storage under different conditions.[16]

4.4 Safety Evaluation Parameters

Safety evaluation is critical since toothpaste is used regularly and may be accidentally ingested.

Irritation potential is assessed to ensure the formulation does not cause oral mucosal irritation.

Microbial load testing ensures the product is free from harmful microorganisms.

Absence of toxic substances such as excessive fluoride or harsh chemicals is essential, especially in herbal formulations.[17]

Table 2: Summary of Quality Evaluation Parameters for Herbal Toothpaste

Category	Parameters Evaluated
Physical	Color, odor, taste, texture, homogeneity
Physicochemical	pH, moisture content, spreadability, abrasiveness
Performance	Foaming ability, cleaning efficiency, stability
Safety	Irritation test, microbial load, toxicity

4.5 Importance of Quality Evaluation

Systematic evaluation of marketed herbal toothpaste products ensures product consistency, consumer safety, and therapeutic effectiveness. Quality assessment also helps compare different formulations and identify the need for standardization. Therefore, evaluation based on well-defined parameters is essential for maintaining the credibility and acceptance of herbal toothpaste products in the market.[18]

5.1 Comparison Based on Physical Characteristics

Physical characteristics such as color, odor, taste, texture, and homogeneity play an important role in consumer acceptance and product usability. Most marketed herbal toothpaste products exhibit a characteristic color derived from herbal ingredients, ranging from light brown to greenish shades. However, noticeable variations are observed among brands, indicating differences in herbal composition and processing methods.[19]

Odor and taste also vary significantly between products. Toothpastes containing clove, mint, or

eucalyptus show a strong and pleasant aroma, whereas products with a higher concentration of neem or babool may have a slightly bitter taste, which could reduce user compliance. Texture and consistency are generally smooth in most products; however, some formulations show mild grittiness due to the nature and size of abrasive particles used. Homogeneity is satisfactory in well-formulated products, while inferior formulations may show uneven distribution of ingredients.[20]

5.2 Comparison of Physicochemical Properties

Physicochemical parameters provide insight into the chemical stability and safety of herbal toothpaste formulations. Among the evaluated products, pH values generally fall within the acceptable range for oral use, indicating suitability for maintaining enamel integrity and oral comfort. However, slight variations in pH may influence long-term effects on teeth and gums.

Moisture content differs across products depending on the type and concentration of humectants used. Toothpastes with balanced moisture levels show better shelf life and resistance to drying, while excessive moisture may increase the risk of microbial growth. Spreadability varies among formulations and directly affects ease of application during brushing. Products with optimal binder and humectant content exhibit better spreadability compared to overly thick or runny formulations. Abrasive properties also differ, with some products providing effective cleaning without damaging enamel, while others may be too harsh if abrasives are not properly controlled.[21]

5.3 Comparison Based on Performance Parameters

Performance parameters are critical in determining the practical effectiveness of herbal toothpaste during routine use. Foaming ability varies depending on the surfactants used, with some herbal toothpastes producing moderate foam, which is generally preferred by consumers. Excessive foaming is not essential for cleaning, but insufficient foam may reduce the perceived effectiveness of the product.[22]

Cleaning efficiency is influenced by a combination of abrasives, herbal actives, and surfactants. Products containing multiple antimicrobial herbs such as neem, clove, and miswak tend to demonstrate better plaque removal and breath freshness. Stability studies reported in literature indicate that well-formulated herbal toothpaste maintains its physical appearance, pH, and performance over time, while poorly stabilized products may undergo phase separation or loss of consistency during storage.[23]

5.4 Comparison of Safety Parameters

Safety evaluation is particularly important for herbal toothpaste, as these products are used daily and may

be accidentally swallowed. Most marketed herbal toothpaste products are reported to be non-irritant and safe for long-term use when formulated correctly. However, variations in microbial load and preservative systems can affect product safety. Products manufactured under strict quality control standards show minimal microbial contamination, while poorly regulated formulations may pose safety concerns.

The absence of harsh chemicals and reduced fluoride content in herbal toothpaste is often considered an advantage, especially for children and individuals with sensitive oral tissues. Nevertheless, lack of standardization in herbal content may result in inconsistent therapeutic effects.[24]

5.5 Overall Comparative Assessment

Overall comparison of marketed herbal toothpaste products reveals significant variation in quality, performance, and safety. While some formulations meet acceptable quality standards and provide effective oral care benefits, others show limitations due to poor formulation design or inadequate quality control. This highlights the need for standardized evaluation methods, improved formulation practices, and regulatory oversight to ensure consistent product quality.[25]

6. Advantages and Limitations of Herbal Toothpaste

Herbal toothpaste products offer several benefits due to their natural composition; however, they also have certain limitations that must be considered for their effective and safe use.[26]

6.1 Advantages of Herbal Toothpaste

Natural Composition

Herbal toothpaste formulations primarily contain plant-based ingredients such as neem, clove, babool, miswak, and mint, which have been traditionally used for maintaining oral hygiene.[27]

Antimicrobial and Anti-inflammatory Properties

Many herbal ingredients possess antimicrobial activity against oral pathogens and help reduce gum inflammation, plaque formation, and bad breath.

Safety for Long-Term Use

Reduced use of synthetic chemicals, artificial colors, and harsh detergents makes herbal toothpaste suitable for long-term daily use, particularly for individuals with sensitive teeth and gums.[28]

Lower Risk of Side Effects

Herbal toothpaste minimizes risks such as enamel erosion, fluorosis, and mucosal irritation that may be associated with prolonged use of conventional toothpaste.

Better Consumer Acceptance

The mild flavor, soothing effect on gums, and perception of natural safety improve user compliance and acceptance among consumers.[29]

6.2 Limitations of Herbal Toothpaste

Lack of Standardization

Variability in herbal raw materials and processing methods may lead to inconsistent quality and therapeutic effectiveness among different products.

Limited Clinical Evidence

Some herbal toothpaste products lack extensive clinical studies to support their long-term efficacy and comparative performance.

Variation in Taste and Texture

Certain herbal ingredients may impart a bitter taste or coarse texture, which can reduce user acceptability.[30]

Preservation Challenges

Herbal formulations are more prone to microbial contamination if appropriate preservatives and quality control measures are not implemented.

Regulatory Gaps

Inadequate regulatory guidelines and quality monitoring may result in variations in safety and labeling compliance among marketed products.[31]

7. Regulatory Aspects and Quality Standards

Regulatory control and quality standards play a vital role in ensuring the safety, efficacy, and consistency of herbal toothpaste products. Toothpaste formulations are generally regulated as cosmetic or oral hygiene products, depending on national regulatory frameworks. Herbal toothpaste manufacturers are required to comply with good manufacturing practices to ensure product quality and consumer safety.

Quality standards emphasize the use of approved ingredients, permissible limits for abrasives, acceptable pH range, and control of microbial contamination. Proper labeling, including ingredient disclosure, usage instructions, and safety warnings, is also mandatory to ensure transparency and informed consumer choice. Herbal products must additionally meet guidelines related to raw material quality, processing, and storage to maintain consistency in herbal content.[32]

Despite these regulations, lack of uniform global standards for herbal toothpaste remains a challenge. Strengthening regulatory oversight, standardization of herbal ingredients, and implementation of validated quality evaluation methods are essential to improve product reliability and consumer confidence in marketed herbal toothpaste formulations.

8. FUTURE PERSPECTIVES

The growing demand for natural and safer oral care products highlights significant future potential for herbal toothpaste formulations. Further research is needed to establish standardized methods for evaluating the quality, safety, and efficacy of herbal toothpaste products. Development of validated analytical techniques for assessing herbal active components will help improve product consistency and therapeutic reliability.

Future studies should focus on conducting well-designed clinical trials to scientifically validate the long-term effectiveness of herbal toothpaste in preventing dental caries, plaque formation, and periodontal diseases. Incorporation of advanced formulation strategies, such as optimized abrasive systems and improved natural preservatives, may enhance product performance and shelf life.[33]

There is also scope for developing polyherbal toothpaste formulations that combine multiple herbal ingredients with complementary actions to achieve enhanced oral health benefits. Additionally, increased regulatory harmonization and stricter quality control measures will improve consumer confidence and global acceptance of herbal toothpaste products.

With rising awareness of eco-friendly and sustainable healthcare practices, herbal toothpaste formulations are expected to gain wider market acceptance. Continuous innovation, scientific validation, and regulatory support will play a crucial role in shaping the future of herbal toothpaste as an effective and reliable oral hygiene product.[34]

9.SUMMARY AND CONCLUSION:

Herbal toothpaste products have gained significant attention in recent years due to increased consumer awareness regarding natural, safe, and sustainable oral care alternatives. This review focused on the evaluation and comparison of marketed herbal toothpaste formulations based on various quality parameters, including physical, physicochemical, performance, and safety aspects. Herbal toothpastes commonly contain plant-based ingredients such as neem, clove, babool, miswak, mint, and aloe vera, which are traditionally known for their antimicrobial, anti-inflammatory, and plaque-reducing properties.

The review highlights that although most marketed herbal toothpaste products claim similar therapeutic benefits, noticeable variations exist in their quality attributes. Differences were observed in parameters such as pH, texture, spreadability, foaming ability, cleaning efficiency, and microbial safety, which can be attributed to variations in formulation composition, concentration of herbal actives, and manufacturing practices. Products developed under proper quality control standards demonstrated better stability, safety, and consumer acceptability.

Overall, herbal toothpaste offers several advantages, including natural composition, suitability for long-term use, and reduced risk of side effects when compared to conventional toothpaste. However, lack of standardization, limited clinical validation, and regulatory inconsistencies remain major challenges. Therefore, systematic quality evaluation and

regulatory compliance are essential to ensure product reliability.

In conclusion, marketed herbal toothpaste products show promising potential for maintaining oral hygiene, but there is a strong need for standardized evaluation methods, scientific validation, and stricter quality control to ensure consistent safety and efficacy for consumers.

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