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Review Article

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A comprehensive review on the formulation and evaluation of herbal tooth powder

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ABSTRACT

Oral hygiene is a fundamental component of general health, and herbal dentifrices have gained increasing popularity due to concerns about the side effects of synthetic dental products. Herbal tooth powders are formulated using natural plant-based ingredients that possess antimicrobial, anti-inflammatory, astringent, and cleansing properties. Herbs such as Neem, Triphala, Liquorice, Clove, and Turmeric have been traditionally used for maintaining oral hygiene. This review provides a comprehensive overview of herbal ingredients, preparation methods, mechanisms of action, evaluation parameters, advantages, limitations, and future prospects of herbal tooth powders. The findings suggest that herbal tooth powders represent a safe, effective, and economical alternative to chemical dentifrices, with significant potential for standardization and clinical application.

KEYWORDS

Herbal Tooth Powder, Oral Hygiene, Antimicrobial Activity, Herbal Dentistry, Phytochemicals.

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INTRODUCTION

Oral health plays a vital role in maintaining systemic well-being, as dental diseases can contribute to conditions such as cardiovascular infections and metabolic disorders [1]. Poor oral hygiene leads to plaque accumulation, gingival inflammation, and dental caries, which may progress to more serious oral and systemic complications. Tooth powders represent one of the oldest forms of dentifrices, historically used to clean teeth and improve oral hygiene [2]. Traditional cultures widely relied on natural powders made from herbs, bark, and minerals due to their simplicity, accessibility, and long shelf life.

However, many modern synthetic tooth powders contain harsh abrasives, detergents, and preservatives that may cause enamel wear, mucosal irritation, or taste disturbances upon long-term use [3]. These chemical components, although effective in cleaning, can disrupt oral tissues and natural microbial balance, increasing concerns about their prolonged use.As a result, herbal dental formulations have gained considerable attention. Medicinal plants rich in phytochemicals—such as alkaloids, flavonoids, tannins, terpenoids, and saponins—exhibit antimicrobial, astringent, and anti-inflammatory effects beneficial for dental care [4]. These bioactive constituents help inhibit oral pathogens, strengthen gingival tissues, and support overall oral hygiene. Ayurveda and other traditional medicinal systems have long incorporated herbal agents such as Neem, Triphala, Acacia catechu, Clove, and Ginger for maintaining oral hygiene [5], demonstrating their long-standing therapeutic relevance.

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MATERIALS AND METHODS

This review was prepared following a structured and systematic approach:

1. Literature Searchr

   Relevant articles were identified using major scientific databases (e.g., PubMed, Scopus, Web of Science, and Google Scholar). Keywords and Boolean combinations related to the review topic were used to ensure comprehensive coverage.

2. Inclusion and Exclusion Criteria

   Studies were selected based on predefined criteria such as publication date range, study type, relevance to the topic, and availability of full text. Non-English articles, duplicate records, and studies unrelated to the central theme were excluded.

3. Screening and Selection

   Titles and abstracts were screened first, followed by full-text assessment. Only studies that met the inclusion criteria were incorporated into the review.

4. Data Extraction

   Key information from selected studies—such as objectives, methods, major findings, and conclusions—was systematically extracted and summarized.

5. Analysis and Synthesis

   Extracted data were analyzed thematically. Trends, similarities, gaps, and contradictions across studies were identified to develop a cohesive narrative.

6. Quality Assessment

   The methodological quality of included studies was evaluated using appropriate assessment tools relevant to the study design.

7. Compilation and Writing

   Findings were organized logically, supported with evidence, and presented in a structured format to offer clear insights and highlight future research directions.

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RESULTS

History of herbal tooth powder

Ancient Era

The use of herbal dentifrices dates back to ancient civilizations, where mixtures of herbs, ash, charcoal, and bark were used for cleaning teeth [6]. Ayurvedic texts describe the use of chewing sticks made from Neem, Babool, and Liquorice for dental cleaning and disease prevention [7].

Medieval Period

During the medieval era, herbal powders prepared from sage, mint, and aromatic barks were commonly used in Europe to freshen breath and remove stains [8].

Modern Era

The introduction of synthetic dentifrices increased the use of chemical abrasives and detergents; however, consumer concerns about safety and long-term toxicity have led to renewed interest in herbal tooth powders [9].

Table 1. Historical evolution of herbal tooth powder

Period	Practice	Common Ingredients
Ancient	Herbal cleansing powders	Neem, Charcoal, Triphala
Medieval	Aromatic herbal powders	Sage, Rosemary, Mint
Industrial Era	Chemical tooth powders	Chalk, Fluoride
Present	Standardized herbal dentifrices	Polyherbal formulations

Need of the study

Synthetic dental formulations may cause adverse reactions such as enamel abrasion, gum irritation, and altered taste due to the presence of harsh chemicals and preservatives [3]. In contrast, herbal tooth powders provide several benefits, including better biocompatibility, minimal side effects, environmental friendliness, and cost-effectiveness [10].

The increasing global shift toward herbal and natural products highlights the need for scientifically validated herbal tooth powders.

Advantages of herbal tooth powders

1. Free from synthetic chemicals, preservatives, and detergents [11].
2. Provide natural antimicrobial and anti-inflammatory action [4].
3. Suitable for long-term use without mucosal irritation [12].
4. Eco-friendly and biodegradable [13].
5. Economical and stable due to dry formulation [14].

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Applications

- Daily use for maintaining oral hygiene [15].
- Management of plaque and gingivitis [16].
- Reduction of halitosis due to volatile oil content [17].
- Useful for individuals sensitive to synthetic dentifrices [18].

Limitations

- Abrasiveness varies based on particle size and plant materials [19].
- Variation in phytochemical content due to environmental factors [20].
- Standardization and stability are challenging for commercial scale-up [21].

Formulation of herbal tooth powder

Herbal tooth powder formulations generally contain functional categories such as abrasives, antimicrobial agents, astringents, anti-inflammatory agents, and flavoring agents.

1. Abrasives

Help remove plaque and stains mechanically.
Examples: Calcium carbonate, Triphala, Charcoal, Acacia catechu [22].

2. Antimicrobial Agents

Prevent bacterial growth responsible for caries and gingivitis.
Examples: Neem, Clove, Turmeric, Tulsi [16].

3. Astringents

Tighten gums and reduce inflammation.
Examples: Triphala, Pomegranate rind, Acacia bark [23].

4. Anti-inflammatory Agents

Provide relief from gingival swelling and irritation.
Examples: Liquorice, Turmeric, Aloe vera [24].

5. Flavoring Agents

Improve the aroma and acceptability of the formulation.
Examples: Peppermint, Cinnamon, Spearmint [25].

Herbal ingredients used in tooth powder

Table 2. Common herbal ingredients used in herbal tooth powder

Sr. No.	Herb	Botanical Name	Key Phytochemicals	Uses
1	Neem	*Azadirachta indica*	Azadirachtin, Nimbidin	Antimicrobial, anti-plaque [26]
2	Triphala	—	Tannins, Gallic acid	Astringent, gum strengthening [23]

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3	Liquorice	*Glycyrrhiza glabra*	Glycyrrhizin	Anti-inflammatory, soothing [24]
4	Clove	*Syzygium aromaticum*	Eugenol	Analgesic, antimicrobial [15]
5	Turmeric	*Curcuma longa*	Curcumin	Anti-inflammatory [24]
6	Peppermint	*Mentha piperita*	Menthol	Cooling, flavoring [25]
7	Acacia Bark	*Acacia catechu*	Catechin, Tannins	Astringent, gum tonic [22]
8	Charcoal	—	Activated carbon	Adsorbent, stain removal [27]

Mechanism of action of herbal tooth powder

1. Mechanical plaque removal: Abrasives physically dislodge plaque from the tooth surface [22].
2. Antimicrobial activity: Phytochemicals such as tannins, flavonoids, and phenols inhibit bacterial growth, especially *Streptococcus mutans* [26].
3. Astringent effects: Tannins contract gum tissues and improve gingival health [23].
4. Anti-inflammatory action: Compounds like curcumin and glycyrrhizin reduce gum swelling and irritation [24].
5. Odor control: Volatile oils neutralize malodor-causing compounds [17].
6. Whitening effect: Charcoal and herbal abrasives remove stains and adsorb impurities [27].

Preparation method

General Procedure

1. Dry all plant materials at 40–50°C and pulverize into a fine powder.
2. Sieve using mesh size #80 for uniform particle size.
3. Mix all powders using geometric dilution.
4. Store in airtight, moisture-free containers.

Example Formula

- Neem powder – 20%
- Triphala – 15%
- Liquorice – 10%
- Clove – 5%
- Turmeric – 5%
- Peppermint – 3%
- Calcium carbonate – 40%

Evaluation of Herbal Tooth Powder

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1. Organoleptic Properties

Color, odor, taste, and texture are determined through sensory evaluation [28].

2. pH Determination

A 1% slurry is analyzed using a pH meter; ideal pH ranges from 6.5 to 8.0 [29].

3. Abrasiveness Test

Evaluated using enamel blocks or gravimetric analysis to ensure non-damaging cleaning action [19].

4. Foaming Ability

Measured by the shaking method; herbal formulations typically exhibit minimal foaming [30].

5. Bulk Density and Flow Properties

Tapped density, Carr's index, and angle of repose are determined to assess flowability [31].

6. Microbial Load Test

Total aerobic microbial count (TAMC) and yeast/mould count are performed [32].

7. Antimicrobial Activity

Agar well diffusion method is used to test activity against *Streptococcus mutans*, *Lactobacillus*, and *S. aureus* [33].

8. Stability Studies

Conducted under different temperatures according to ICH guidelines to assess physical and chemical stability [34].

DISCUSSION

This review highlights that herbal tooth powders provide a safe and effective alternative to synthetic dentifrices due to their natural antimicrobial, anti-inflammatory, and astringent properties. Herbs such as Neem, Triphala, Clove, Liquorice, and Turmeric possess well-documented therapeutic actions that help control plaque, gingivitis, and oral microbial load. Compared to chemical formulations, herbal powders minimize risks such as enamel abrasion, mucosal irritation, and long-term toxicity.

However, challenges remain, particularly regarding standardization, variability in phytochemical content, and ensuring optimal abrasiveness and microbial stability. Despite these limitations, the increasing consumer preference for natural and eco-friendly products supports the growing relevance of herbal dentifrices. With advancements in formulation technologies and the need for more clinical validation, herbal tooth powders have strong potential for wider acceptance in preventive oral care

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CONCLUSION

Herbal tooth powders offer a natural, safe, and effective solution for maintaining oral hygiene. Owing to their antimicrobial, anti-inflammatory, and astringent properties, herbal ingredients can effectively manage plaque, gingivitis, and halitosis. Proper formulation and evaluation are essential for ensuring quality, efficacy, and safety. With increasing global interest in herbal personal care products, standardized herbal tooth powders have immense potential in preventive dentistry.

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ABBREVIATIONS

No Abbreviations

FUNDING

None

CONFLICT OF INTERESTS

None

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