

A Review Article on Herbal Toothpowder

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ABSTRACT

Because of their inexpensive cost, potential medicinal benefits, and lack of chemical additives, herbal tooth powders have drawn more attention as natural alternatives to traditional dentifrices. The purpose of this study was to create and assess a polyherbal tooth powder utilizing widely accessible medicinal herbs with antibacterial, anti-inflammatory, and oral-cleaning qualities. In measured amounts, the formulation included finely ground powders of *Mentha arvensis* (mint), *Glycyrrhiza glabra* (licorice), *Trachyspermum ammi* (ajwain), *Azadirachta indica* (neem), *Syzygium aromaticum* (clove), and *Cinnamomum verum* (cinnamon). Particle size, flow characteristics, pH, and organoleptic qualities were among the physicochemical attributes that were evaluated. Using agar well diffusion assays, antimicrobial effectiveness was assessed against common oral infections as *Streptococcus mutans* and *Candida albicans*. A brief volunteer-based use test was also carried out to look at freshness, cleaning capacity, and any negative reactions. The teeth powder that was created showed appropriate physicochemical characteristics, including a neutral pH, a smooth texture, and a tolerable taste and scent. The possible function of the herbal components in lowering cariogenic and fungal organisms was supported by antimicrobial testing, which showed significant inhibitory zones against *S. mutans* and modest effectiveness against *C. albicans*. During application, participants noted no discomfort or sensitivity, a pleasant mouthfeel, and excellent cleansing. The product's potential as a safer and greener substitute for store-bought toothpaste is highlighted by the lack of artificial foaming ingredients and preservatives. According to the study's findings, a well blended herbal tooth powder can improve oral hygiene while lowering exposure to artificial chemicals. To compare efficacy with dentifrices on the market, optimize formulation stability, and validate therapeutic effects, more extensive long-term clinical trials are advised. The results add to the increasing body of data that herbal oral care products are affordable and long-lasting ways to enhance dental health.

Keywords: natural medicine, polyherbal formulation, oral hygiene, antimicrobial action, herbal tooth powder, and dentifrice.

INTRODUCTION

Dental caries, gingivitis, and periodontal disease—all of which continue to afflict sizable populations worldwide—are directly linked to poor oral hygiene, which is a basic aspect of overall health [1]. The mainstay of oral hygiene has historically been conventional dentifrices, which contain fluoride, detergents, abrasives, and synthetic antibacterial agents [2]. However, the usage of herbal substitutes has increased due to growing public concerns about the long-term effects of synthetic additives and growing interest in natural and holistic health practices [3]. Because of their traditional roots,

presumed safety, and minimum chemical processing, herbal tooth powders have attracted fresh attention among these natural goods [4].

Traditional medical systems like Ayurveda, Siddha, and Unani have traditionally used herbal tooth powders to promote overall dental health, strengthen gums, and stop plaque accumulation [5]. Typically, these compositions include herbs known for their medicinal qualities, like peppermint (*Mentha piperita*), licorice (*Glycyrrhiza glabra*), babool (*Acacia nilotica*), clove (*Syzygium aromaticum*), and neem (*Azadirachta indica*) [6]. Clove is recognized for its analgesic and antibacterial properties, licorice

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for its anti-inflammatory properties, and neem and babool for their antimicrobial and astringent properties [7–9]. These herbal ingredients may work in concert to lower the oral microbial burden, support gingival health, and preserve fresh breath [10].

Concerns about the chemical ingredients in commercial toothpaste, such as sodium lauryl sulfate, triclosan, artificial sweeteners, and preservatives, are another factor contributing to the increased demand for herbal oral care products [11]. Many consumers are looking for safer and more natural alternatives because these compounds have been linked to mucosal irritation, hypersensitivity reactions, and environmental issues [12]. Herbal tooth powders also have a longer shelf life and less of an environmental impact because they don't contain foaming agents and require fewer preservatives [13].

The scientific community has become much more interested in herbal oral care formulations in recent years. Herbal tooth powders' ability to reduce plaque and improve gingival health has been the subject of numerous clinical investigations; several of these studies have found results that are on par with or better than those of traditional dentifrices [14, 15]. Furthermore, studies conducted in vitro have shown that herbal compounds have potent antibacterial action against important oral pathogens as *Porphyromonas gingivalis* and *Streptococcus mutans*, which are microorganisms linked to periodontal disease and cavities [16]. Notwithstanding these encouraging outcomes, further methodologically rigorous research is required because of the variety of formulation techniques, the absence of uniform concentrations, and the paucity of long-term clinical data [17].

With the growing popularity of natural dental care products around the world and the growing accessibility of herbal dentifrices, it is necessary to evaluate the scientific data pertaining to their safety and effectiveness. Thus, the purpose of this review is to assess the herbal tooth powders' composition, mode of action, clinical efficacy, antibacterial potential, safety profile, and user acceptance while pointing out areas that require further study [18].

Phytochemical Composition of Herbal Tooth Powders

Botanicals rich in bioactive phytochemicals such as alkaloids, flavonoids, tannins, glycosides, saponins, and essential oils are commonly found in herbal tooth powders, all of which have positive effects on oral health. Herbs like *Camellia sinensis* and *Azadirachta indica* (neem) contain flavonoids that have antibacterial and antioxidant qualities that help stop the growth of oral pathogens linked to gingivitis and cavities [19]. The astringent and plaque-inhibitory properties of tannins, which are found in large quantities in *Terminalia chebula* and *Acacia catechu*, encourage gingival tightness and lessen bacterial adherence to enamel surfaces [20].

Gingival discomfort may be lessened by alkaloids found in plants such as *Piper nigrum* and *Glycyrrhiza glabra*, which have anti-inflammatory and mild analgesic properties [21]. Commonly obtained from *Sapindus mukorossi* and *Trigonella foenum-graecum*, saponins have detergent-like qualities that help remove plaque mechanically and improve foaming in some formulations [22]. Strong antibacterial, antifungal, and deodorizing properties of essential oils, such as eugenol from cloves, menthol from mints, and cinnamonaldehyde from cinnamon, promote good oral hygiene and lessen halitosis [23].

Mechanisms of Action of Common Herbal Ingredients

Antimicrobial Activity

Furthermore, phenolic acids like gallic acid and ferulic acid, which are antioxidants and free-radical scavengers, may be present in herbal tooth powders. These acids shield oral tissues from oxidative stress brought on by bacterial metabolism [24]. Terpenes and terpenoids, particularly found in plants like *Boswellia serrata* and *Eucalyptus globulus*, also enhance periodontal health by having antibacterial and anti-inflammatory properties [25]. When taken as a whole, this varied phytochemical profile improves the medicinal potential of herbal tooth powders and offers a healthy substitute for artificial dentifrices.



Streptococcus mutans, *Porphyromonas gingivalis*, and *Candida albicans* are among the prevalent oral infections that are targeted by the broad-spectrum antibacterial qualities of many herbal tooth powder constituents. Herbs high in essential oils, such as peppermint, clove, and cinnamon, have active ingredients like menthol, eugenol, and cinnamonaldehyde that interfere with microbial enzyme systems and break down bacterial cell walls [26]. By preventing bacterial adhesion to enamel and decreasing glucosyltransferase activity, neem extracts have strong antibacterial activity and reduce the formation of plaque [27]. Likewise, tannin-rich extracts from *Terminalia chebula* and *Embolica officinalis* can inhibit acidogenic bacteria and slow the development of dental caries [28].

Anti-inflammatory Properties

Strong anti-inflammatory bioactive components found in herbs like aloe vera, turmeric, and licorice (*Glycyrrhiza glabra*) alter inflammatory pathways in gingival tissues. Turmeric's main ingredient, curcumin, reduces inflammation by inhibiting the production of COX-2 and NF- κ B, which promotes better periodontal health [29]. Licorice's glycyrrhizin helps lessen gingival edema and irritation by lowering oxidative stress and inflammatory mediators [30]. Aloe vera is a helpful adjunct in the treatment of gingivitis because of its polysaccharides, which also promote tissue repair and suppress inflammatory cytokines [31].

Antiplaque and Anticalculus Effects

Natural chelating agents, surfactants, and astringents found in a number of botanicals utilized in herbal tooth powders aid in preventing calculus development and reducing plaque accumulation. *Terminalia bellirica* and *Acacia catechu* tannins tighten gingival tissues and prevent germs from colonizing tooth surfaces [32]. By improving debris clearance and decreasing biofilm buildup, saponin-rich herbs like *Sapindus mukorossi* facilitate mechanical plaque removal through their natural cleansing activity [33]. Furthermore, green tea (*Camellia sinensis*) contains plant-derived polyphenols that reduce plaque development by inhibiting bacterial quorum sensing and salivary amylase [34].

Comparative Efficacy of Herbal vs. Conventional Dentifrices

Several clinical and laboratory studies have compared the performance of herbal tooth powders and herbal dentifrices with conventional fluoride- or triclosan-based formulations. Many herbal preparations demonstrate comparable or superior antimicrobial and antiplaque effects due to their rich phytochemical profiles. For example, randomized controlled trials have shown that neem-based and clove-based dentifrices produce significant reductions in plaque index and gingival inflammation, often comparable to standard fluoride toothpaste [35]. Similarly, formulations containing *Terminalia chebula*, green tea extract, or miswak have exhibited measurable decreases in salivary bacterial counts and plaque accumulation in both short-term and long-term usage studies [36].

The ability of herbal dentifrices to lessen calculus and halitosis is now being assessed more and more. According to studies, herbal powders high in polyphenols can suppress bacteria that produce volatile sulfur compounds (VSCs) just as well as traditional chemical mouthwashes, which helps to improve breath freshness [37]. Additionally, herbal powders that contain saponin improve mechanical plaque removal, producing outcomes that are on par with those of commercially available synthetic abrasives [38]. Although fluoride is still the most widely validated agent in terms of remineralization potential, some herbal formulations enhanced with antioxidant compounds or calcium-rich plant extracts have demonstrated encouraging initial results in preventing early demineralization lesions and remineralizing enamel [39].

Significantly, consumers looking for natural, chemical-free dental care products frequently choose herbal dentifrices, and research indicates that user satisfaction with herbal products is on par with that of conventional dentifrices [40]. Herbal powders are still not widely accepted as completely equal substitutes for conventional products, nevertheless, due to differences in formulation quality, a lack of regulated phytochemical doses, and a dearth of extensive clinical research.



Safety Profile and Toxicological Considerations

Due to their natural nature, herbal tooth powders are generally thought to be safe; however, the purity, dosage, and processing of the different plant constituents greatly influence their safety profile. When used in oral formulations at approved doses, some herbs that are frequently used in dentifrices, including neem, turmeric, and clove, have shown low toxicity and good biocompatibility [41]. Additionally, phytochemicals such as flavonoids and polyphenols frequently have protective and antioxidant effects on oral tissues, which adds to their positive safety attributes [42].

Nevertheless, when herbal ingredients are used in large quantities or in combination without established quality controls, there are worries about the possibility of cytotoxic consequences, allergic reactions, or mucosal irritation. For instance, sensitive people may experience localized irritation if concentrated essential oils like menthol or eugenol are used excessively [43]. Furthermore, if used vigorously or for extended periods of time, some crude herbal powders may contain naturally occurring abrasive particles that could cause enamel wear [44].

Contamination hazards, such as the presence of pesticide residues, heavy metals (lead, mercury, and arsenic), or microbiological pollutants introduced during cultivation, processing, or storage, are another significant safety worry. Concerns regarding the quality and safety of the product for long-term usage have been raised by several studies that have documented cases where the heavy metal concentration of some unregulated herbal powders surpassed allowable levels [45]. Moreover, variations in phytochemical composition brought on by different plant species, harvesting schedules, and extraction techniques may result in erratic therapeutic outcomes and possible toxicity if active ingredients concentrate over acceptable limits [46].

Although herbal tooth powders are generally thought to be safe, strict standardization, quality control, and regulatory monitoring are necessary to guarantee their efficacy and safety. Products that follow accepted production practices and are regularly tested for pollutants and toxicological characteristics should be trusted by clinicians and consumers.

Consumer Acceptability and Sensory Characteristics

Taste, scent, mouthfeel, and texture all have a significant impact on how well-liked herbal tooth powders are among consumers. Aromatic essential oils like clove, peppermint, and cinnamon are found in many formulations. These oils improve palatability and create a pleasing sensory experience, which raises customer satisfaction and compliance [47]. A wide variety of consumers may find the product more palatable if natural sweeteners, such as licorice extract, are used to enhance flavor and cover up the bitterness of some herbal compounds [48].

Another important element affecting user preference is texture. In general, it is better to use finely ground herbal powders with consistent particle sizes because coarse or gritty formulations might feel uncomfortable and irritating while brushing [49]. Gentle natural abrasives like wood charcoal or calcium carbonate are frequently used by manufacturers; when treated correctly, they help increase cleaning effectiveness without sacrificing enamel integrity [50]. Furthermore, some users, especially those who are accustomed to Ayurvedic or Unani oral hygiene procedures, value the traditional feel and "raw," earthy flavor profile of herbal powders [51].

According to consumer research, people usually choose herbal dentifrices because of their natural ingredients, perceived health benefits, and lack of artificial additives. Natural oral care solutions are becoming more and more popular, according to surveys, especially among people looking for holistic and eco-friendly options [52]. Nonetheless, some consumers express worries about brand differences in flavor and scent, as well as the lack of foaming found in traditional toothpaste—elements that could lower new users' perceptions of cleaning effectiveness [53]. Enhancing user adherence and long-term acceptability of herbal tooth powders can be achieved by addressing these sensory constraints through better formulation strategies.



Challenges in Standardization and Quality Control

In the manufacturing of herbal tooth powders, standardization and quality control continue to be significant obstacles. Due to variations in plant species, harvesting conditions, storage methods, and extraction techniques, herbal products frequently show significant variability in their phytochemical content, in contrast to conventional dentifrices, which adhere to established manufacturing guidelines and contain chemically defined ingredients [54]. It can be challenging to ensure consistent product performance or safety between batches due to this inherent variability, which might result in uneven therapeutic effects.

The absence of generally recognized legal frameworks controlling herbal dentifrices in many nations is another issue. There are disparities in the standards for testing, labeling, and safety evaluation since some areas define herbal oral care items as cosmetics and others as traditional medicines [55]. Without uniform standards, problems like heavy metal contamination, synthetic chemical adulteration, or microbiological development can go unnoticed, endangering customers' health [56].

To enhance the authentication and phytochemical profiling of herbal constituents, analytical methods such DNA barcoding, gas chromatography–mass spectrometry (GC-MS), and high-performance liquid chromatography (HPLC) have been proposed. The identification, potency, and purity of plant components utilized in tooth powder formulations must be guaranteed using these techniques [57]. Furthermore, pharmacopeial monographs for frequently used herbs and adherence to Good Manufacturing Practices (GMP) can reduce variability and improve product reliability [58].

Since many herbal tooth powders rely on conventional claims rather than solid scientific evidence, the lack of extensive clinical studies makes evaluating quality even more difficult. To make sure that herbal tooth powders are safe and effective for long-term oral care, it is imperative to strengthen clinical research, improve regulatory monitoring, and put strict quality control mechanisms in place [59].

Future Directions and Research Gaps

Even while herbal tooth powders are becoming more and more popular, there are still a lot of unanswered questions regarding their long-term safety, mechanisms, and effectiveness. The creation of carefully planned, extensive clinical trials that contrast standardized herbal formulations with traditional dentifrices using recognized clinical endpoints including plaque index, gingival bleeding scores, and enamel remineralization outcomes is one of the main research priorities [60]. The credibility of the majority of recent research is limited by their small size, short duration, and lack of rigorous methodological methods [61].

The standardization of phytochemical elements is a crucial topic for further study. Due to the inherent variability of herbal constituents, accurate identification of active compounds, their ideal concentrations, and their synergistic interactions within multi-herb formulations are necessary for consistent therapeutic effects [62]. In order to provide uniform quality profiles for herbal tooth powder formulations, sophisticated analytical techniques like metabolomics and molecular fingerprinting may be essential [63].

Long-term safety also requires more research, especially in relation to cumulative exposure to abrasives, essential oils, and bioactive plant components. To ensure product safety for everyday use across a range of populations, longitudinal toxicological examinations are crucial, including assessments of mucosal tolerance, enamel wear, and potential systemic absorption [64]. Furthermore, as preserving microbial balance is essential to preventing oral illnesses, research on the ecological effects on the oral microbiome is becoming more and more significant. Research on the effects of herbal formulations on biofilm dynamics and microbial diversity will help create safer and more efficient products [65].

Lastly, research into the environmental effects of herbal dental care products, eco-friendly packaging, and sustainable sourcing is required. Herbal tooth powders can better meet customer demands for natural and sustainable healthcare goods by ensuring



that plant components are procured ethically and processed using eco-friendly techniques [66].

Types of Herbal tooth powder

1. Herbal tooth powder: Herbal tooth powders softly clean teeth by using natural abrasives like clay or charcoal.[67]

- The components of neem and cloves promote dental hygiene and lessen plaque.[68]
- Powders made from miswak provide conventional antibacterial properties for teeth that are cleaner.[70]
- Blends of herbs and turmeric may help to improve hygiene and soothe gums.[71]
- Powdered mint or sage improves breath and aids in getting rid of minor surface stains.[72]

2. Homemade tooth powder: This type of tooth powder uses natural abrasives, such as salt or baking soda, to clean teeth.

- Adding neem or clove helps lower plaque and bacteria. Turmeric promotes good dental hygiene and soothes gums.[73]
- Chemical-free surface stains can be removed with safe DIY powders.[74]

3. Whitening herbal teeth powder: Herbal powders mostly use mild natural abrasives to gently scrape away surface stains.

- For a whiter appearance, softly polish with charcoal or baking soda mixtures.
- The interior color of teeth is unaffected by herbal whitening; just external stains are.[75]
- Neem and clove are examples of ingredients that promote whiter teeth.[76]
- Powders made from miswak help remove stains by acting as a natural cleanser.[77]

Benefits of herbal tooth powder

Because herbal tooth powders frequently contain botanicals like neem, clove, licorice, and mint that promote general oral cleanliness and fresh breath, they have become more and more popular as natural substitutes for traditional toothpastes. Because their plant-based constituents contain natural antimicrobial properties that inhibit the growth of dangerous oral bacteria without the use of synthetic chemicals, several herbal formulations can reduce plaque (77). For those who prefer gentle, non-foaming solutions, clove and mint in particular may help relax gum tissues, making brushing more comfortable (78). When used regularly, several herbal tooth powders also contain naturally occurring minerals that are moderately abrasive and aid in the non-abrasive removal of surface stains, giving teeth a cleaner, brighter appearance (79). Herbal powders are also generally free of artificial flavors, foaming agents, and preservatives, which makes them appealing to those looking for simpler, plant-based ingredients for their daily oral care regimen, in contrast to many commercial pastes (80).

Neem



Synonyms There are numerous aliases for neem powder, such as Azadirachta, Indian Lilac, Nimba, Margosa, and Nimba Churna.[81]



Origin in Biology (biological source)

The dried leaves of *Azadirachta indica* A. Juss are used to make neem powder.

Family

The Meliaceae

Utilized Plant Part

Although the bark and seeds are also utilized in other neem products, the leaves are most frequently ground into a powder for therapeutic purposes.[82]

Chemical Components (chemical constituents)

Numerous bioactive substances, primarily Azadirachtin, Nimbin, and Gedunin, are found in neem leaves.

Quercetin is a flavonoid that Nimbin is a derivative of sodium

These substances support the antibacterial, anti-inflammatory, and antioxidant qualities of neem.[83]

Applications (uses)
promotes dental health by lowering dangerous microorganisms

aids in lowering inflammation in a number of conventional treatments [84].

can treat mild skin infections and acne [85].

Due to its antibacterial properties, it has been used historically to promote wound healing.

In Ayurveda, it serves as a natural detoxifier [86].

Black Pepper:**Synonyms**

Alternative Names for *Piper nigrum*

Peppercorns in black

Maricha Kali Mirch Spice with pepper [87]

Origin in Biology (biological source)

derived from *Piper nigrum* L.'s dried, unripe fruits.

Family

The Piperaceae

Utilized Plant Part

Peppercorns and other dried fruits [88]

Chemical Components (chemical constituents)

The piperine

Sabinene, pinene, and limonene are essential oils.

Chavicine

Both piperidine and piperettine

Oils that are volatile

Starch and resin [89]

Applications (uses)

enhances digestion

improves nutrition uptake

has minor anti-inflammatory properties.

utilized as a seasoning and spice [90]

serves as a naturally occurring antibacterial

has antioxidant properties [91].

helps reduce bloating and gas.

promotes comfort in the respiratory system [92]

Dry Ginger**Synonyms**

Rhizoma Siccum and Zingiberis
Saunth/Sunthi
Dried root of ginger
Shunthi Nagara

Origin in Biology (Biological source)

The dried rhizomes of *Zingiber officinale* Roscoe are used to make dried ginger [93].

Family
Zingiberaceae

Utilized	Plant	Part
Dry rhizome		

Chemical Components (chemical constituents)

Gingerols
The Shogaols
Zingerone
Essential oils, such as bisabolene and zingiberene
Gingerdione Resin Starch [94]

Applications(uses)

reduces motion sickness and nausea
demonstrates anti-inflammatory properties
serves as an organic antioxidant [95].
lessens bloating and aids with digestion
beneficial for treating colds and coughs [96]
uses traditional medicine to provide minor pain relief.
increases appetite [97]

Clove:**Alternatives (Synonyms)**

Aromatic Syzygium
Laung
Caryophyllus
Clavus[98]

Origin in Biology (Biological source)

The dried flower buds of *Syzygium aromaticum* (L.)
Merr. & Perry are used to make cloves.

Family

The Myrtaceae

Utilized	Plant	Part
Buds of dried flowers [99]		

Chemical Components (chemical constituents)

Eugenol (the main ingredient)
Acetate eugenyl
Beta-caryophyllene
Tannins
Flavonoids
Clove oil is a volatile oil [100].

Applications (uses)

promotes good dental hygiene and lessens tooth pain.
As a natural antioxidant
utilized as a seasoning and spice [101]
demonstrates potent antibacterial action
mildly reducing inflammation [102]
aids in digestion and lowers gas [103].

Licorice (Glycyrrhiza glabra)

Synonyms

The liquorice

Mulethi

Yashtimadhu

Origin in Biology (Biological source)

Glycyrrhiza glabra roots [111]

Family

The Fabaceae

Utilized

The root

Plant**Part****Chemical Components (chemical constituents)**

Glycyrrhetic acid

Glycyrrhizin

Liquiritin

Glabridin

Saponins

Flavonoids [112]

Applications(uses)

relieves sore throats
has anti-inflammatory properties
relieves colds and coughs
lowers acidity and aids with digestion.
exhibits anti-ulcer properties [113].

The leaves of guava (Psidium guajava)**Synonyms**

Amrood departs

Jama departs

Guava leaves

Origin in Biology (biological source)

Psidium guajava leaves [114]

Family

The Myrtaceae

Used Plant Parts

Leaves

Chemical Components (chemical constituents)

Quercetin

Flavonoids

Tannins

Terpenoids

Vitamin

Essential oils [115]

C

Applications (uses)

Reduces upset stomach and diarrhea
demonstrates potent antimicrobial activity
aids in blood sugar regulation lessens inflammation
aids in the healing of wounds
has antioxidant properties [116].

Mint (Mentha species)**Synonyms**

Pudina

Mint pepper

The spearmint

Mentha departs

Origin in Biology (Biological source)
leaves from other species of *Mentha*, such as *Mentha arvensis* or *Mentha piperita*. [117]

Family

The Lamiaceae

Used Plant Parts

Leaves

Chemical Components (chemical constituents)

Menthol

Menthone

Acid rosmarinic

Tannins

Flavonoids

Essential oils [118]

Applications (uses)

reduces gas and pain in the stomach
has a calming and cooling effect.
lessens nausea

demonstrates antimicrobial activity
promotes dental health and breath freshness
somewhat reduces inflammation [119]

Conclusion

The rich phytochemical makeup of herbal tooth powders makes them a promising natural substitute for traditional dentifrices, providing a number of oral health advantages. When included into daily practices, many of the herbs utilized in these formulations have antibacterial, anti-inflammatory, antioxidant, and antiplaque qualities that can help improve dental hygiene. Research indicates that a number of herbal powders reduce gingival irritation and plaque just as well as conventional solutions.

But even with their extensive historical use and rising international renown, there are still many obstacles to overcome. Their acceptability in mainstream dentistry is hampered by factors such as variability in phytochemical content, a lack of standardized manufacturing procedures, possible contamination issues, and a dearth of high-quality clinical trials. To ensure the safety, effectiveness, and dependability of herbal tooth powder formulations, these gaps must be

filled by thorough scientific study, increased regulatory monitoring, and improved quality control.

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