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A Research on Formulation and Evaluation of Herbal Tooth Powder Using Guava Leaves

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Abstract: *Herbal tooth powder is a natural formulation widely used for maintaining oral hygiene and preventing dental disorders such as dental caries, plaque, gingivitis, and bad breath. The present study focuses on the formulation and evaluation of an herbal tooth powder using guava leaf (Psidium guajava) as the active ingredient along with ritha (Sapindus mukorossi), liquorice (Glycyrrhiza glabra), activated charcoal, rock salt, and camphor. These ingredients were selected based on their antimicrobial, antiinflammatory, cleansing, whitening, and refreshing properties.The formulation was prepared by drying, powdering, sieving, and uniformly blending all ingredients in appropriate proportions. The prepared tooth powder was evaluated for various parameters such as organoleptic properties, particle size, pH, abrasiveness, foamability, moisture content, and stability. The results indicated that the formulation possesses satisfactory physicochemical characteristics with good cleansing, foaming, and refreshing ability. The presence of natural antimicrobial agents helps in reducing oral microbial load without causing harmful side effects.The study concludes that the formulated herbal tooth powder is safe, effective, economical, and can serve as a suitable alternative to synthetic dentifrices for maintaining oral hygiene.*

Keywords: Herbal tooth powder, Guava leaf, Ritha, Liquorice, Charcoal, Oral hygiene.

I. INTRODUCTION

Oral hygiene is a fundamental aspect of overall health and significantly contributes to an individual's physical well-being, social confidence, and quality of life. The oral cavity is a complex biological environment that continuously interacts with food, microorganisms, and external agents. It serves as a gateway to the digestive and respiratory systems, making it highly vulnerable to microbial colonization and infection.The oral cavity contains a diverse microbiota, including bacteria such as Streptococcus mutans, Lactobacillus, and Actinomyces, which are primarily responsible for dental plaque formation. Plaque is a soft, sticky film that adheres to the tooth surface and, if not removed regularly, can mineralize into calculus (tartar). This leads to the development of dental caries, gingivitis, and periodontal diseases.Saliva plays a vital protective role in maintaining oral health. It acts as a natural cleanser by washing away food particles and bacteria, while also providing essential ions like calcium and phosphate that help in the remineralization of enamel. Saliva also contains enzymes such as amylase and antimicrobial proteins like lysozyme, lactoferrin, and immunoglobulins, which help control microbial growth.

Poor oral hygiene can result in multiple oral health problems including:

- Dental caries (tooth decay).
- Gingivitis (gum inflammation).
- Periodontitis (advanced gum disease).
- Halitosis (bad breath).

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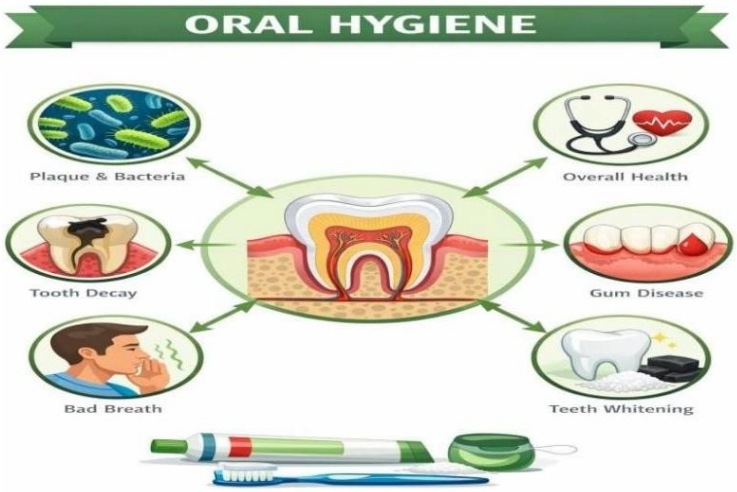

Fig No 1 : Oral Hygiene

Anatomy and Physiology of Teeth : Teeth are specialized calcified structures present in the oral cavity that play an essential role in mastication, speech, and facial aesthetics. Each tooth is anchored in the alveolar bone and supported by periodontal ligaments.

Structure of Tooth: Each tooth is divided into three main parts:

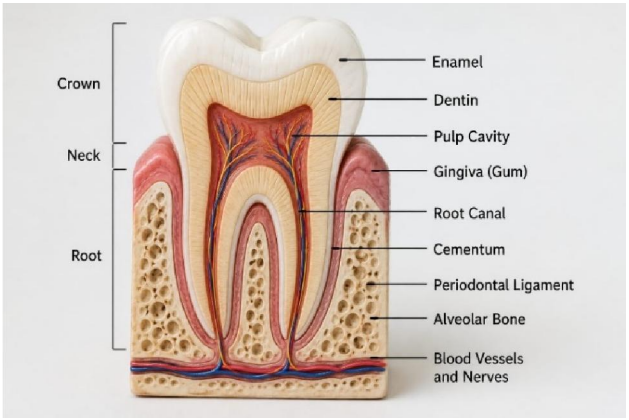

Fig No 2 : Structure of Tooth

a) **Crown :** The visible portion above the gum line,Covered by enamel,Responsible for chewing and grinding food.
b) **Neck (Cervix) :** The region between the crown and root,Surrounded by gingiva (gums).
c) **Root**: Embedded in the jawbone,Anchors the tooth firmly.

Layers of Tooth -

a) **Enamel:** Outermost protective layer, Hardest tissue in the human body, Composed of approximately 96% inorganic material.
(hydroxyapatite), Provides resistance to mechanical and chemical damage

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b) **Dentin:** Located beneath enamel, Contains about 70% inorganic material and 20% organic matrix (collagen) Less hard than enamel but more resilient.

c) **Pulp:** Innermost soft tissue, Contains nerves, blood vessels, and connective tissue, Responsible for nourishment and sensation.

Types of Tooth Powder

a) **Herbal Tooth Powder:** Prepared using medicinal plant ingredients such as neem, guava, tulsi, and liquorice. It provides antimicrobial and antiinflammatory benefits.

b) **Whitening Tooth Powder:** Contains abrasives like activated charcoal or baking soda to remove stains and improve tooth brightness.

c) **Natural Tooth Powder:** Made from naturally occurring substances such as salt, chalk, and essential oils.

d) **Medicated Tooth Powder:** Contains active pharmaceutical agents to treat specific dental conditions like sensitivity or infection.

e) **Homemade Tooth Powder:** Prepared at home using simple natural ingredients; economical and customizable.

Ideal Properties of Herbal Tooth Powder -

- Non-toxic and safe for oral use.
- Non-irritant to oral mucosa and gums.
- Possess mild abrasive action without damaging enamel.
- Exhibit good cleansing and polishing properties .
- Have pleasant taste and aroma.
- Provide antimicrobial and anti-inflammatory effects.
- Should not stain teeth.
- Maintain oral freshness for a long duration.
- Chemically and physically stable.

Advantages of Herbal Tooth Powder -

- Natural and safe for oral use.
- Free from harmful chemicals and synthetic agents.
- Exhibits antimicrobial activity.
- Reduces gum inflammation and bleeding.
- Helps in removal of plaque and stains.
- Provides teeth whitening effect.

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Disadvantages of Herbal Tooth Powder -

- Lack of fluoride may reduce cavity protection .
- Excessive abrasiveness may damage enamel .
- Variation in composition due to natural sources.
- Possible allergic reactions to some herbs.
- Strong or unpleasant taste in some formulations.
- Lack of standardization and quality control.
- Less convenient compared to toothpaste.

Uses of Herbal Tooth Powder -

- Cleaning teeth and removing food debris.
- Preventing dental caries.
- Reducing plaque formation.
- Treating gum diseases (gingivitis, periodontitis).
- Whitening teeth and removing stains.
- Freshening breath.

Importance of Herbal Formulations:

Herbal formulations contain bioactive compounds such as flavonoids, tannins, alkaloids, and essential oils. These compounds provide therapeutic benefits like antimicrobial, antioxidant, and anti-inflammatory effects.The use of herbal tooth powder is supported by traditional systems like Ayurveda, which emphasize natural remedies for maintaining oral health. Due to increasing awareness of the side effects of synthetic products, herbal dentifrices are becoming more popular as safer and more effective alternatives.

Objectives of Herbal Tooth Powder

- To formulate herbal tooth powder using natural ingredients.
- To evaluate physicochemical properties of the formulation.
- To assess antimicrobial and cleansing activity.
- To study organoleptic characteristics (color, odor, taste).
- To determine pH, particle size, and abrasiveness.
- To evaluate foamability and stability of the formulation.
- To ensure safety and effectiveness for oral use.
- To develop a cost-effective and eco-friendly dentifrice.
- To provide an alternative to synthetic tooth powders and toothpastes.

Material and methods

Materials: Guava leaf powder (Psidium guajava), Ritha (Sapindus mukorossi), Liquorice (Glycyrrhiza glabra), Activated charcoal, Rock salt, Camphor.

Equipment : Mortar and pestle, Sieve No. 80, Weighing balance, Beaker, Measuring cylinder, pH Paper, Glass rod, Airtight container.

Method of Preparation -

- All herbal raw materials were collected, authenticated, and cleaned to remove impurities.
- The materials were shade-dried at room temperature (25–30°C) until complete removal of moisture.
- Dried materials were subjected to size reduction using a mechanical grinder to obtain fine powder.
- The powdered materials were passed through sieve No. 80 to ensure uniform particle size distribution

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- All ingredients were accurately weighed according to the required formulation ratio using a digital weighing balance.
- The weighed powders were mixed geometrically in a mortar and pestle to obtain a uniform and homogeneous blend.
- Finely powdered camphor was incorporated at the final stage to prevent loss of volatile components.
- The final (blend) was again mixed thoroughly to ensure uniform distribution of all ingredients.
- The prepared herbal tooth powder was evaluated for physical appearance and uniformity.
- The formulation was then packed in a clean, dry, airtight container to protect it from moisture and contamination.
- The product was stored at room temperature in a cool and dry place for further evaluation studies.

Evaluation Parameters

1) Organoleptic Evaluation

- Color
- Odor
- Taste
- Texture

Method: The prepared tooth powder was visually inspected and evaluated by sensory observation. Purpose: To ensure patient acceptability and uniform appearance.

2) pH Determination Procedure :

- 1 g of tooth powder was dispersed in 10 ml distilled water.
- The solution was stirred and allowed to stand for 5 minutes .
- pH was measured using a calibrated pH Paper.
- Purpose: To ensure compatibility with oral cavity (ideal pH: 6–7).

Fig. No. 3 : pH test

3) Foamability Test :

- 1 g of powder was mixed with 10 ml distilled water in a measuring cylinder
- The mixture was shaken vigorously for 1–2 minuteFoam height was measured.

Purpose: To evaluate cleansing ability (due to ritha).

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Fig. No. 4 : Foamability test

4) Moisture Content :

Method: Loss on drying

- A known weight of sample was taken.
- Dried in a hot air oven at 105°C until constant weight.
- Loss in weight was calculated.

Purpose: To ensure stability and prevent microbial growth .

Fig. No. 5 : Moisture Content test

4) Bulk Density: Bulk density is the ratio of the mass of powder to its bulk volume (volume occupied by the powder including void spaces between particles).

Formula: Bulk Density = Mass of powder / Bulk volume Procedure:

- A clean, dry measuring cylinder (usually 50 ml or 100 ml) was taken.
- A known weight of powder (e.g., 10 g) was gently poured into the cylinder without compacting.
- The volume occupied by the powder was noted (bulk volume).
- Bulk density was calculated using the formula.

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Fig. No. 6 : Bulk Density

5) Tapped Density : Tapped density is the ratio of mass of powder to the volume occupied after tapping (mechanical vibration), which reduces void spaces.

Formula: Tapped Density = Mass of powder / Tapped volume Procedure:
The same powder sample used for bulk density was taken.
The measuring cylinder was tapped mechanically or manually (100–500 taps).
The volume after tapping was recorded (tapped volume).

- Tapped density was calculated.

Fig. No. 7 : Tapped Density

6) Angle of Repose :
Angle of repose is the maximum angle formed between the surface of a pile of powder and the horizontal plane when the powder is allowed to flow freely.
Formula: Tan θ = h / r
Where:
Θ = Angle of repose
H = Height of powder cone
R = Radius of base
Procedure:

- A funnel was fixed at a certain height above a flat surface.
- Powder was allowed to flow through the funnel freely.

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- It formed a conical heap.
- Height (h) and radius (r) of the heap were measured.
- Angle of repose was calculated using the formula Flow Property.
- Interpretation:

Angle of Repose	Flow Property
< 25°	Excellent
25–30°	Good
30–40°	Passable
> 40°	Poor

7) Stability Study Procedure:

- Formulation stored at room temperature (25–30°C).
- Observed for changes in color, odor, texture, and performance over time.

Purpose: To ensure product stability and shelf life.

Evaluation results:

1) Organoleptic Properties

Parameter	Observation
Color	brown
Odor	Aromatic
Taste	Slightly salty and sweet
Texture	Fine and smooth

Tab no 1 : Determination of organoleptic Properties

2) Physicochemical Parameters

Parameter	Result
pH	6.8
Moisture Content	2.5%
Foamability	Moderate foam

Tab no 2 : Determination of physicochemical Parameters

3) Flow Properties

Parameter	Result
Bulk Density (g/ml)	0.45
Tapped Density (g/ml)	0.60
Angle of Repose (°)	28°
Flow Property	Good

Tab no 3 : Determination of flow Property

4) Stability Study

Parameter	Observation
Color Change	No change
Odor Change	No change
Texture Change	No chang
Stability	Stable at room temperature

Tab no 4 : Determination of stability

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II. CONCLUSION

The herbal tooth powder was successfully formulated using natural ingredients and showed satisfactory physicochemical properties, good cleansing ability, and stability. It is safe, effective, and economical, making it a suitable alternative to synthetic dentifrices for maintaining oral hygiene.

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