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Anti-Microbial and Stain Removing Effect of Herbal Dentifrfice: An In Vitro Study

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Abstract- Dental plaque accumulation and extrinsic tooth staining are major contributors to oral diseases such as dental caries and periodontal disorders. Conventional dentifrices often contain synthetic antimicrobial and abrasive agents, which may cause adverse effects with long-term use. Herbal dentifrices, formulated with plant-based ingredients, are gaining attention as safer alternatives due to their antimicrobial, anti-inflammatory, and cleansing properties.

Keywords: Herbal dentifrice; Antimicrobial activity; Stain removal; Dental plaque; In vitro study; Oral hygiene.

I. INTRODUCTION

Oral health plays a crucial role in overall well-being, with dental plaque being a primary etiological factor in the development of dental caries, gingivitis, and periodontal diseases. Plaque accumulation also contributes to extrinsic tooth staining, which affects dental esthetics and patient confidence. Dentifrices are widely used as mechanical and chemical aids for plaque control and stain removal, often containing synthetic antimicrobial agents and abrasives.

However, prolonged use of synthetic components such as triclosan, sodium lauryl sulfate, and chemical abrasives has been associated with undesirable effects including mucosal irritation, altered taste perception, and enamel abrasion. These concerns have increased interest in herbal dentifrices, which incorporate plant-derived ingredients known for their antimicrobial, anti-inflammatory, antioxidant, and cleansing properties. Herbal agents such as neem, clove, miswak, turmeric, and tea tree oil have been traditionally used in oral care and have demonstrated efficacy against oral microorganisms.

Herbal dentifrices are believed to offer effective plaque control and stain removal while minimizing adverse effects. Despite their growing popularity,

scientific evidence supporting their antimicrobial and stain-removing efficacy remains limited. Therefore, the present in vitro study was undertaken to evaluate the antimicrobial activity and stain-removing effect of a herbal dentifrice and to compare its performance with a conventional dentifrice.

Aim of the Study:
Formulation and Evaluation of Herbal Dentifrice and Comparative Studies with Conventional Dentifrices.

Objective of the Study:

- To formulate herbal dentifrice.
- To Evaluate Organoleptic, Preliminary, Phytochemical and Rheological Evaluation
- To evaluate anti- microbial activity of herbal dentifrice against common oral microbes (Streptococcus Mutans)
- To perform comparative evaluation of anti-microbial activity of herbal and conventional dentifrices.
- To perform stain removal activity by the formulated Herbal dentifrice.

Description Of Materials

Ingredients Used In The Formulation Of Herbal Tooth Powder:

- **Neem Powder :**
-

Fig.4

- **Synonyms:** Neem tree, limba, margosa,nimb.
- **Biological Source:** It consists of dried powder of the leaves of the plant Azadirachta Indica.
- **Family:** Meliaceae
- **Plant part used :** leaves
- **Chemical Constituents:** It contains nimbidin, nimbin, nimbinin and nimbidol. It contains glycerides of saturated and unsaturated fatty acids. The main fatty acids are oleic and stearic.
- **Uses:**
- Neem is used as anti-inflammatory, antiseptic , antibacterial agent.
- Neem leaves are used in number of tooth powder which helps in curing problems related to gingivitis and gum diseases.
- Nimbin, nimbidin compounds possess anti-viral activity.
- Its natural bitter compounds reduce bad breath and keep the mouth fresh.

Clove Powder:

Fig.5

Fig.6

- **Synonyms:** Clove buds, Lavang, Clove flower.
- **Biological Source:** Eugenia caryophyllus flower buds are dried and used to make clove
- **Family:** Myrtaceae.
- Chemical Constituents: Clove contains 14-21% of volatile oil. Clove oil has 60%-90% eugenol, which is the cause of its anaesthetic and antiseptic properties.
- **Uses:**
- Clove is used as an antiseptic, stimulant, aromatic, carminative and as a flavouring agent.
- Clove reduces swelling ,irritation in gums and useful in gingivitis and periodontitis
- Clove is used for tooth ache, pain during dental work, dental plaque, indigestion.
- It acts as a mild abrasive and natural cleanser.

Rock Salt :

Fig.7

- **Synonyms:** Halite, Sendha Namak, Saindhadhava lavana.
- Biological Source: Rock salt is a type of salt , that is formed when salt water from a sea or lake evaporates and leaves behind crystals of sodium chloride. Sodium chloride rock is a chemical sedimentary rock that forms from a

evaporation of ocean and saline lake water. It is also known as "Halite"

- Chemical Constituents: Apart from being mainly composed of sodium chloride, rocksalt also contains essential minerals like calcium, potassium,magnesium,zinc,iron,copper,hydrogen,sulphur,cobalt and oxygen.
- **Uses:**
- Rocksalt treats yellowing of teeth and bleeding of gums.
- Among its external benefit, rock salt has major cosmetic value has a teeth whitener.
- Rocksalt act has a mild abrasive that helps to remove surface stains and food debris from teeth.
- The minerals in the rock salt help to strengthen the gums and reduce inflammation.

Alum :

Fig.8

Fig.9

Synonyms: Potassium Aluminium Sulphate, Potash Alum

- **Biological Source:** Alum is a mineral origin drug of Unani medicine. Alum occurs naturally in various minerals. For example Potassium Alum is found in the minerals alunite, leucite, kalinite which can be treated with sulfuric acid to obtain crystals of alum.
- **Chemical Constituents:** The general chemical formula for alum is XAl(SO4)2.12H20. Alum is basically hydrated double sulphate salt of Aluminium.
- **Uses:**
- Alum is an effective remedies for teeth and gum related problems.
- Alum has Antiseptic , Astringent , Analgesic properties.
- Alum is used in management of mucositis and oral ulcers and in cases of gingivitis.
- Alum prevents cavities and strengthen the gums.
- Its Antiseptic property helps to fight against tooth decay.

Tamarind Seed Powder :

Fig.10

Biological source: Tamarind, commonly known as Imli, is a rich source of Tamarind gum or tamarind kernel powder . Tamarind seed is regarded as a by-product of the use of the fruit pulp Tamarindus indica.

- Family: Fabaceae.
- Genus: Tamarindus.
- Species: T. Indica.
- Chemical constituents : Camp sterol, β-amyrin, β-sitosterol, palmitic acid, oleic acid, linoleic acid and eicosanoic acid. The Mucilage, arabinose, xylose, Galactose pectin, glucose and uranic acid was found.
- **Uses:**
  - Tamarind seed powder has Mild Abrasive Action that helps in removing food debris,

plaque, and surface stains without causing excessive enamel wear.

- Tamarind seeds are rich in Polysaccharides, which acts as natural
- binders and maintain the powder's consistency.
- Tamarind seed powder acts as a natural polishing agent, making teeth smoother and shinier.
- Tamarind seed powder contribute to strengthening teeth and supporting oral health.
- Dental preparation of tamarind seed powder plays important role in health benefits. For smokers who smoke a lot, applying tamarind seed powder to their gums and teeth is thought to provide health benefits.

- **Charcoal :**

Fig.11

Fig.12

- Synonymns: Ash, Carbon, Char, Residues.
- Biological source: Form of charcoal made from animal wastes and plant residues, Biochar.
- **Family Name:** aluminium sulfate,Hydrous potassium.
- **Chemicals constituents:** Charcoal contains varying amount of oxygen and hydrogen as well as Ash and other impurities.

- **Uses:**
- Charcoal makes the teeth appear whiter.
- Charcoal is a safe and excellent alternative to the teeth whitening products.
- Charcoal helps in removal of superficial stains from teeth.
- Charcoal is the pure form of food grade charcoal which helps in pulling the stains off your teeth.
- Charcoal has a adsorbing and detoxifying Properties that can absorbed impurities, toxins and bacteria from the mouth.

Liquorice :

Fig.13

- **Synonymns:** Yashtimadhu and Madhuka , Mulethi.
- **Biological source:** Liquorice, also called as "sweet herb" .The genus glycyrrhiza contains about 30 Species but dried unpeeled roots of Glycyrrhiza glabra Linn. And Glycyrrhiza uralensis Fisch. are the common Sources of liquorice.
- Family : Leguminosae.
- Chemical constituent: Glycyrrhizol – A, 1 methoxyficifolinol, Licorisoflavin A, 6,8 Diprenglygenistein, Glyrrhizine.

- **Uses:**
- In Ayurveda it is Recommended that chewing liquorice herbal sticks, reduces dental Caries and plaque.
- Liquorice reduces the growth of bacteria in the oral cavity that leads to bad breath and odour.
- Liquorice powder has antibacterial and antimicrobial properties.
- Brushing Teeth with liquorice powder prevents cavities and plaque.

Description Of Materials And Equipments:
Materials Used:

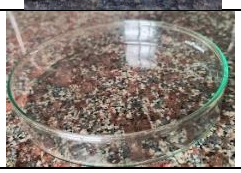
Table.1

SL. No	Materials	Materials suppliers details	Uses
1.	Neem powder	Ayurvedic Store	Antiseptic, Antibacterial
2.	Clove	Pure Organic	Dental analgesic,Anti-microbial
3.	Rocksalt	Ayurvedic Store	Cleaning of teeth
4.	Alum	Ayurvedic Store	Anti inflammatory
5.	Tamarind seed powder	Ayurvedic Store	Strengthner and cleaning of teeth
6.	Charcoal	Pure Organic	Teeth whitening agent
7.	Liquorice	Ayurvedic Store	Anti-Ulcer Agent

Table 2

Equipments Used:

SL. NO	Equipments	Diagrams
1	Weighing Balance	
2	Mortar and Pestle	
3	Hot Air Oven	

4	Autoclave	
5	pH Meter	
6	Petri Dish	

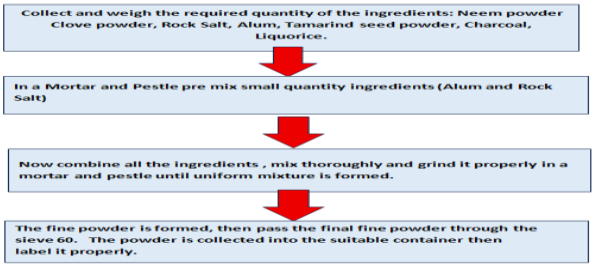
II. METHODOLOGY

Comparitive Formulation And Development:
Table 3

Si No	Ingredients	F1 (W/W)	F2 (W/W)	F3 (W/W)	F4 (W/W)
1	Neem Powder	0.5gm	0.5gm	0.5gm	0.5gm
2	Clove Powder	0.5gm	0.5gm	0.5gm	0.5gm
3	Rock Salt	4gm	4gm	4gm	4gm
4	Alum	0.5gm	0.5gm	0.5gm	0.5gm
5	Tamarind Seed Powder	0gm	4gm	4gm	4gm
6	Charcoal	0gm	0gm	0.5gm	0.5gm
7	Liquorice	0gm	0gm	0gm	4gm

Table : Formulation Of Herbal Dentifrice

Method Of Preparation :
Four different formulation were prepared with varying quantity/concentration of all ingredients named as F1,F2,F3 and F4. Formula used to prepare individual preparation by using each of the ingredients is mentioned in table



Procedure:

III. EVALUATION OF HERBAL TOOTH POWDER

- Organoleptic evaluation.
- Phytochemical Evaluation.
- Physico-chemical Evaluation.
- Rheological Evaluation.
- Anti-Microbial Activity Evaluation.
- Stain Removal Evaluation.

- **Organoleptic evaluation:**
- The powder and raw medications were examined independently based on morphological and organoleptic characteristics, such as color, texture, appearance, and odor.
- **Color:** The prepared tooth powder's color was assessed.
- **Odor:** The product's odor was assessed by sniffing it.
- **Taste:** The product's taste was manually assessed by tasting it.(14)
- **Stability:** To test the product's stability, it was kept at room temperatures.
- **Abrasiveness:** This refers to the degree of powder fineness that, when applied to the surface of teeth, removes adhered food particles and preserves the teeth's glossy, smooth surface. It is measured by using a fingertip to rub a known quantity of powder onto a glass slide for 15 minutes, much like when brushing your teeth. The slide's surface is examined under a microscope, and any scratches that result from rubbing the powder on it are recorded. The outcomes are arbitrary and presented in both positive and negative indicators of glass slide scratches. The more abrasiveness, the more positive the signs.(15)

- Spreadability: The powder was manually spread to assess spreadability.(16) It was uniformly spread.

Fig.14

Phytochemical Evaluation:

The formulation was prepared, Then various Phytochemical test for Alkaloids , Phenols, Saponins, Starch were performed.

- Test for Alkaloids (Dragendorff's Test) :
- Take a small portion of the prepared dental powder in a clean test tube, Add a few drops of Dragendorff's reagent

Observation : Orange / Reddish-Brown Precipitate was seen.

- Test for Phenols (Ferric Chloride Test) :
- Take a small portion of the prepared dental powder in a clean test tube Add a few
- drops of freshly prepared Ferric Chloride ($FeCl_3$) solution

Observation: Green Coloration was seen.

- **Test for Saponins (Foam Test) :**
- Take a small portion of the prepared dental powder with water in a clean test tube Shake the test tube vigorously for a few minutes Allow the tube to stand still for 10– 15 minutes
- Observation: Stable froth/foam was seen.
- **Test for Starch (Iodine Test) :**
- Take a small portion of the prepared dental powder with water in a clean test tube Add a few drops of Iodine solution
- Observation: Blue–Black coloration was seen.

Physico-chemical Evaluation:

To ascertain the herbal tooth powder's pH, moisture content, and amount of inorganic matter, its physical and chemical characteristics were assessed.

- **Ph:** The pH of the powder was determined using pH meter. The most accurate common means of measuring pH is through a lab device called a probe and meter, or simply a pH meter.
- Moisture Content: 10 grams of tooth powder were weighed, dried at 105°C degrees Celsius, and then cooled. Using the provided formula, the weight loss is expressed as a percentage of the moisture content.
- The moisture content formula is: % moisture content is calculated by subtracting the dry sample weight from the original sample weight.

- Stability Evaluation: All formulations(F1 to F4) were stored at room temperature since 3 months. Their evaluation results reported that there are no remarkable changes found in the product till now and the product was stable. (17)
- Foaming Index: About 5g of the sample was taken using a measuring cylinder with a sufficient amount of water. The initial volume was noted and then shaken foe 10 mins.
- The final volume of foam was noted and calculated by using the given formula.
- Foaming power= V1-V2
- V1 = Volume in mL of foam with water V2= Initial volume with water

Rheological Evaluation:

For the formulation, physical parameters such as bulk density, foaming test, angle of repose, tapped density, porosity, and flow property were measured and computed.

Flow Aspects:

Bulk Density: The tooth powder is freely poured into a 100 ml measuring cylinder until it reaches the desired level using its natural flow. A spatula is used to level the powder's upper surface. The weight is expressed as bulk mass, and the volume that the powder occupies is recorded as bulk volume. The powder's bulk density rises as its bulk volume does. Mass of powder divided by bulk volume occupied by powder is the bulk density.

Tapped Density: A tapped density test device is used to measure it. The powder collected in the device's 50 ml measuring cylinder is compressed to a constant volume by tapping it up and down for the designated distance. Aluminum foil is placed over the measuring cylinder's open end to stop lines from being lost to dusting while tapping. The increased bulk density that results from mechanically tapping a container holding the powder sample is known as the "tapped density." Density falls as the tapped volume rises.

The mass of the powder divided by the bulk volume that the powder occupies is the tapered density. (18)

Porosity: This is the empty space that the powder's mass and trapped air occupy. The results indicate that porosity decreases with increasing powder density.

% porosity is equal to 1 - tapped volume/bulk volume * 100(19).

Angle of repose: A funnel was grabbed and clamped to the stand. A graph paper was placed beneath the funnel, and the distance between the graph paper and the funnel's bottom was measured. Ten grams of powder were then weighed and run through a modified funnel. The angle of repose is then measured.(20)

Angle of repose: The greatest angle that can exist between the powder pile's surface and the horizontal flow is known as the angle of repose.(21)

Then, the angle of repose was calculated by following formula. Tan 0 = H/R

H = Height of powder

R = Radius of graph paper. Table No: 3 : Angle of Repose.

ANGLE OF REPOSE	TYPE OF FLOW
<25	EXCELLENT
25-30	GOOD
30-40	PASSABLE
>40	VERY POOR

The table shows,

The powder having angle of repose 25 exert an excellent powder flow.

The powder having angle of repose between 25-30 exert good powder flow. The powder having angle of repose between 30-40 exert passable powder flow.

The powder having angle of repose greater than 40 exert very poor powder flow.

Fig. 15. Angle of repose

Anti-Microbial Activity:

Antimicrobials activity was determined by agar well diffusion method-Preparation of Agar Media.

Preparation Of Nutrient Agar Media:

Suspend 7gm of nutrient agar in 250ml conical flask and 250ml of distilled water was added. It was heated to boiling to dissolve the media completely. Then the media was sterilized in an autoclave at 15 lbs pressure at 121°C for 1 hour. Later it was Cooled to 40-50min. Mix well and pour into sterile petri plate.

Procedure Of Agar Well Diffusion Method:

Approximately 25ml of Nutrient agar was poured into a sterile Petri dish and allowed to Solidify.1ml of inoculum Streptococcus mutans was poured on sterile solidified agar and swabbed evenly using sterile Cotton swab. Using sterile cork borer Two wells were prepared onto the agar. Then the concentration of the formulated herbal dentifrice and conventional dentifrice was added separately into wells using syringe. It was allowed to diffuse at room temperature for half an hour. Later these plates were incubated for 24 hours at 37°C and zone of inhibition was observed.

Determining the Activity of Tooth Powder:

Aqueous extract of formulated herbal tooth powder was prepared and tested for anti microbial activity by agar diffusion method.

Bacteria	Conventional Dentifrice
Streptococcus mutans	Dabur

Stain Removal Evaluation:

Many abnormalities of the oral cavity Have been identified, one of which is discoloration and color changes of the teeth. Indeed, tooth Discoloration is a major concern of dentists as it has a high prevalence in society. Extrinsic stains are linked with the adsorption of materials into the acquired pellicle On the enamel surface. Factors influencing extrinsic stain formation include poor tooth brushing Technique, areca nut chewing, smoking, dietary intake of colored foods (e.g., red wine, coffee and tea consumption).

Teeth whitening products can Be roughly classified into two main categories that include peroxide-containing bleaching agents And dentifrices. Bleaching agents can be used at home or done by a dentist. Typically, they are associated with tooth sensitivity and mild irritation of the soft tissue. On the other hand, dentifrices operate either by polishing, chemical chelation, or some other non-bleaching action, so they are considered much milder but less effective. In this study, formulated herbal tooth powder is used to test its stain removal property.

Staining of teeth model:

An artificial teeth model was bought from the available local store.The artificial staining protocol used for the study was strictly followed, the specimens were immersed In a coffee solution. The coffee solution was prepared with Sunrice coffee mixed in 200 ml water at boiling temperature., the teeth model was immersed into the coffee for 5 days. Then, the teeth were rinsed And stored at 37°C for 48hrs.

(a) (b) (c)

III. RESULTS AND DISCUSSIOIN

Organoleptic Evaluation :

SL NO.	PARAMETERS	F1	F2	F3	F4
1.	Color	Brownish Grey color	Light Brown color	Blackish Brown color	Sage Green color
2.	Odor	Characteristics	Characteristics	Characteristics	Characteristics
3.	Taste	Astringent	Astringent	Astringent	Astringent
4.	Appearance	Free Flowing Dry Powder	Fine,Homogeneous free flowing powder	Fine,Free Flowing,Homogeneous Slightly Dark powder	Homogeneous, Free flowing, Fine powder, Uniform Blend no lumps.
5.	Texture	Smooth and Slightly Gritty	Smooth and Slightly Gritty	Smooth and Slightly Gritty	Smooth and Slightly Grittiness
6.	Abrasiveness	Mild Abrasiveness	Mild Abrasiveness	Mild Abrasiveness	Moderate- Gentle scrubbing without harshness

Table 4

SL NO. PARAMETERS F1 F2 F3 F4

1. Color Brownish Grey color Light Brown color Blackish Brown color Sage Green color
2. Odor Characteristics Characteristics Characteristics Characteristics
3. Taste Astringent Astringent Astringent Astringent
4. Appearance Free Flowing Dry Powder Fine,Homogeneous free flowing powder Fine,Free Flowing,Homogeneous Slightly Dark powder Homogeneous, Free flowing, Fine powder, Uniform Blend no lumps.
5. Texture Smooth and Slightly Gritty Smooth and Slightly Gritty Smooth and Slightly Gritty Smooth and Slightly Grittiness
6. Abrasiveness Mild Abrasiveness Mild Abrasive ness Mild Abrasiveness Moderate- Gentle scrubbing without harshness

The prepared herbal tooth powder was discovered to have a good texture, nice colour and fresh mouth feel after taste.

Phytochemical Evaluation:

Table 7

SL NO.	TEST	RESULT	FIGURE

1.	Alkaloid	Positive	Fig.A
2.	Phenols	Positive	Fig.B
3.	Saponins	Positive	Fig.C
4.	Starch	Positive	Fig.D

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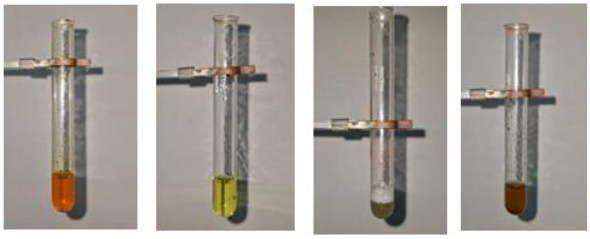


Fig. A Fig. B Fig. C Fig. D

Fig.18 Results of Phytochemical Evaluation

Physicochemical Evaluation :

Table 5

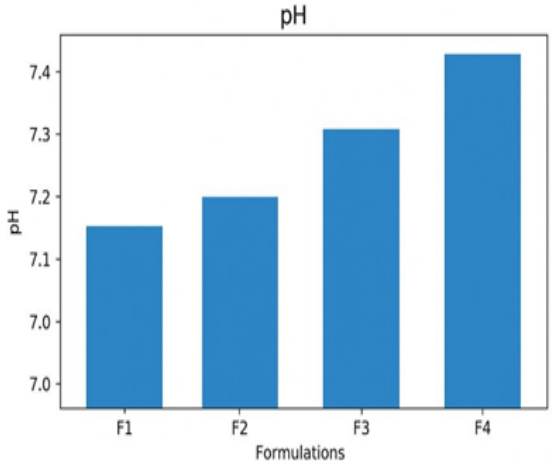
SL NO.	PARAMETERS	F1	F2	F3	F4
1.	PH	7.2	7.2	7.3	7.4
2.	Foaming Index	Mild foaming	Mild foaming	Mild foaming	Mild foaming
3.	% Moisture content	4% W/W	4% W/W	5% W/W	5.8% W/W
4.	Stability	Stable	Stable	Stable	Stable

Stability Stable Stable Stable Stable

The prepared formulation was proved to have mild foaming index.

pH: The ph of the powder was determined using pH meter and found to have a suitable pH of 7.4

Fig.19 Graphical representation of pH



Moisture Content: Moisture content of the powder was determined and was found to be 5.8%W/W

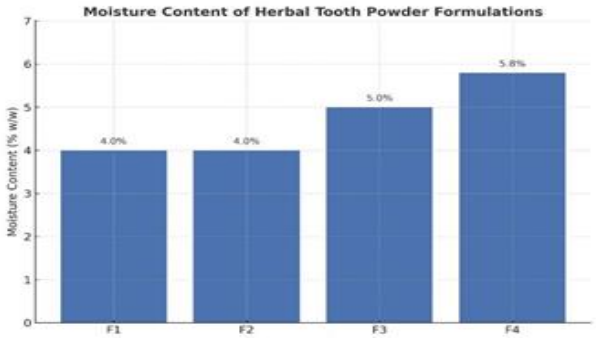


Fig.20 Graphical representation of Moisture content

C) STABILITY: The stability evaluation results reported that there are no remarkable changes

found in the product till now and the product was stable.

Fig.21 Stability evaluation of Herbal Tooth Powder

Rheological Evaluation:

Table 6

SL NO.	PARAMETERS	F1	F2	F3	F4
1.	Bulk density	0.4 g/mL	0.46 g/mL	0.46 g/mL	0.48 g/mL
2.	Tapped density	0.6 g/mL	0.6 g/mL	0.63 g/mL	0.65 g/mL
3.	Porosity	35%	38%	41%	41%
4.	Angle of Repose	27°	27°	28°	28°

According to the rheological evaluation prepared herbal tooth powder showed good compressibility, good flow character and good angle of repose.

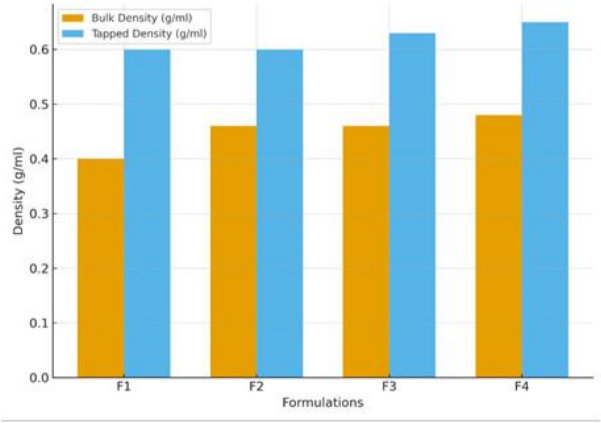


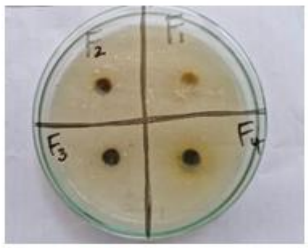
Fig.22 Graphical representation of Bulk and Tapped Density

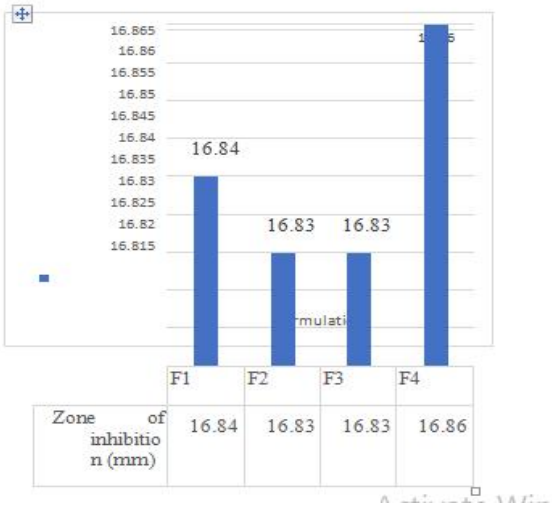
Fig.23 Visual and graphical representation of Angle of repose

Anti-Microbial Evaluation : Sterilization :
The materials such as conical flask, beaker, petridish and agar media were sterilized by using Autoclave for the evaluation of Antimicrobial activity by agar diffusion method.

Sterilization For Anti-Microbial Activity By Using Autoclave

Fig.24 Materials used for sterilization



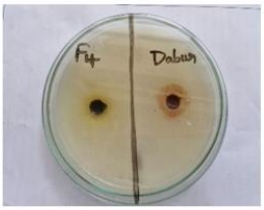


Comparative Antimicrobial Evaluation between four formulations F1, F2, F3, F4 :

Prepared Aqueous extract of herbal tooth powder formulation was tested for antimicrobial potency by agar diffusion method. Four formulations F1,F2,F3,F4 were compared for antimicrobial activity against selected stain (Streptococcus mutans). It was found that the formulation F4 showed moderate zone of inhibition which was clear from the results. Fig.25 In this study, F4 formulation is found has an optimized batch.Fig.25 Visual and graphical representation of four formulations

Comparative Antimicrobial Evaluation of Herbal Dentifrice (F4 formulation) against conventional dentifrice Dabur:

From the above-obtained result it was found that the formulation F4 has an optimized batch. So, for the further antimicrobial activity against the selected stain (Streptococcus mutans). formulation F4 was compared with conventional dentifrice Dabur. It was found that the formulation F4 showed a moderate zone of inhibition where has Dabur also showed moderate zone of inhibition, which was clear from the results. Fig.26



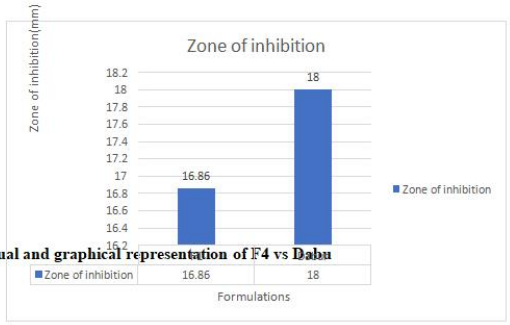


Fig.26 Visual and graphical representation of F4 vs Dabu

Stain Removal Evaluation:

Results of stain removal property by using formulated herbal tooth powders: An artificial stained teeth model was cleaned by using formulated herbal tooth powders (F1, F2, F3 and F4) to see it's stain removal property. It was shown in the table and in Fig.

(A) (B) (C) .(D)

Fig. 27 Results of stain removal

Table 7

Sl.No	Stain removal property	Results	Figure
1	F1 formulation	Slight changes in the stain is seen	Fig. A

2	F2 formulation	Mild stain removal is seen	Fig. B
3	F3 formulation	Moderate stain removal is seen	Fig. C
4	F4 formulation	Moderate stain removal is seen	Fig. D

IV. DISCUSSION

Herbal products are increasingly preferred due to concerns about chemical
additives, synthetic foaming agents, and long-term side effects associated with
conventional formulations. In this context, the successful preparation and

evaluation of F1–F4 contribute to the growing field of natural oral-care solutions.
The physicochemical profile observed good porosity, adequate flowability, and
mild foamingsupports the stability. The relatively low moisture content and neutral
pH reduce the chances of product spoilage and help maintain oral comfort without
causing irritation.
The antimicrobial results are particularly meaningful. Since Streptococcus mutans
is a key organism responsible for dental caries, the ability of the formulations—
especially F4—to inhibit its growth demonstrates real potential for preventive oral
care. Although Dabur's slightly larger inhibition zone shows that commercial
formulations remain highly effective, the herbal dentifrice still performed
comparably well without synthetic additives.
The presence of multiple phytochemicals in F4 likely contributed to its superior
antimicrobial and stain-removal performance. Phenols and alkaloids offer
antimicrobial actions, while saponins assist cleaning and mild foaming. Charcoal
and tamarind seed powder in F3 and F4 enhanced abrasive cleansing, making them
more efficient for stain removal.
However, the study was limited to in vitro conditions. Therefore, clinical studies
would be useful to confirm the long-term effects and real-time performance of this
herbal dentifrice. Further research may focus on optimizing herbal tooth powder
against different strains to enhance overall performance of anti microbial activity,
on increasing the period of staining to check stain removal property. Additionally,
further exploration into commercializing the herbal tooth powder which includes
natural ingredients may Increase its marketability and consumer satisfaction.

V. CONCLUSION

The study concludes that a herbal dentifrice can effectively promote oral hygiene, exhibit stain-removal properties, Physicochemical and provide acceptable organoleptic attributes. Among the four formulations, F4 showed optimal performance, supported by desirable phytochemical constituents and favourable physical characteristics. While the antimicrobial effect of F4 (16.86 mm) was slightly lower than that of the conventional dentifrice Dabur (18 mm), it still exhibited significant inhibitory action against Streptococcus mutans. The herbal formulation is promising as a natural dentifrice and warrants further optimization and in vivo evaluation. The optimal use of natural ingredients made the herbal tooth powder safe, effective and beneficial. The purpose was to harness the natural properties of the ingredients that is available in nature. As consumers increasingly seek natural and sustainable herbal tooth powders, it offers a valuable, eco-friendly, safe and effective optimal use. Herbal tooth powders has been used for many centuries and it is widely Regarded as an essential part of an effective oral care routine. It plays a very important role in today's world because, consumers prefer Natural products over conventional synthetic products. So with a regular use can maintain oral hygiene.

REFERENCES

1. Badrinath B. Sanap, 2Rutuja P. Khalpe, 3 Sudarshan D. Ichche, 4 Pallavi S. Patil, 5Krushna R. Kale and 6 Piraji S. Devkar. World Journal of Pharmaceutical Research
2. Miss Dikole Komal Mallikarjun, Miss Dahiwade Vaishnavi Kisan, Mrs. Jalak Dipali Ganesh, Mr.Kodalkar Bapuso Bira, Miss Mujawar Payal Raju. International Journal Of Novel Research And Development. Volume 9, Issue 7 July 2024.
3. Yogita A. Ladgaonkar and Dr. Bhaskar Vaidhun. World Journal of Pharmaceutical Research. Volume 12, Issue 16, 725-730.
4. Vidhi Yadav, Komal Verma, Sudha Maurya, Ranjeet Kumar , Kumari Uma and Dr. Alok Kumar Shukla. World Journal of Pharmaceutical Research. Volume 13, Issue 12, 291-300.
5. Miss Dikole Komal Mallikarjun, Miss Dahiwade Vaishnavi Kisan, Mrs. Jalak Dipali Ganesh, Mr.Kodalkar Bapuso Bira, Miss Mujawar Payal Raju. International Journal Of Novel Research And Development. Volume 9, Issue 7 July 2024.
6. Vidhi Yadav, Komal Verma, Sudha Maurya, Ranjeet Kumar , Kumari Uma and Dr. Alok Kumar Shukla. World Journal of Pharmaceutical Research. Volume 13, Issue 12, 291-300
7. Vidhi Yadav, Komal Verma, Sudha Maurya, Ranjeet Kumar1 , Kumari Uma2 and Dr. Alok Kumar Shukla3. World Journal of Pharmaceutical Research. Volume 13, Issue 12, 291-300.
8. Nisha Devi1 , Dr. Bharat Parashar1 and Mohit Kaushal2. World Journal of Pharmaceutical Research. Volume 8, Issue 7, 2225-2238.
9. Yogita A. Ladgaonkar and Dr. Bhaskar Vaidhun. World Journal of Pharmaceutical Research. Volume 12, Issue 16, 725-730.
10. Shilpa Pandharinath Dakhurkar1 , 2 Priya Vishwanath Mijgar, 3 Snehal Dilip Wani and 4 Prachi Madhukar Murkute. World Journal of Pharmaceutical Research. Volume 8, Issue 10, 944-948.
11. Syed Zubair Atif1 and S. M. Shahidulla. EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH. ejpmr, 2024, 11(5), 577-
12. Miss Dikole Komal Mallikarjun, Miss Dahiwade Vaishnavi Kisan, Mrs. Jalak Dipali Ganesh, Mr.Kodalkar Bapuso Bira, Miss Mujawar Payal Raju. International Journal Of Novel Research And Development. Volume 9, Issue 7 July 2024.
13. 1Badrinath B. Sanap, 2Rutuja P. Khalpe, 3 Sudarshan D. Ichche, 4 Pallavi S. Patil, 5Krushna R. Kale and 6 Piraji S. Devkar. World Journal of Pharmaceutical Research. Vol 13, Issue 21, 2024.
14. Yogita A. Ladgaonkar and Dr. Bhaskar Vaidhun. World Journal of Pharmaceutical Research. Vol 12, Issue 16, 2023.
15. Syed Zubair Atif 1 and S. M. Shahidulla. European Journal of Pharmaceutical and Medical Research. Vol 11, Issue 5, 2024.
16. 1Badrinath B. Sanap, 2Rutuja P. Khalpe, 3 Sudarshan D. Ichche, 4 Pallavi S. Patil, 5Krushna R. Kale and 6 Piraji S. Devkar. World Journal of Pharmaceutical Research. Vol 13, Issue 21, 2024.
17. Yash Patel, Twinkal Patel, Sanjana Patel, Shilpa Patel and Nikunj Patadiya. International Journal of Pharmacognosy and Pharmaceutical Sciences 2024; 6(2): 60-63.
18. Vidhi Yadav, Komal Verma, Sudha Maurya, Ranjeet Kumar1 , Kumari Uma2 and Dr. Alok Kumar Shukla3. World Journal of Pharmaceutical Research. Volume 13, Issue 12, 291-300.
19. Yash Patel, Twinkal Patel, Sanjana Patel, Shilpa Patel and Nikunj Patadiya. International Journal of Pharmacognosy and Pharmaceutical Sciences 2024; 6(2): 60-63.
20. Miss Dikole Komal Mallikarjun, Miss Dahiwade Vaishnavi Kisan, Mrs. Jalak Dipali Ganesh, Mr.Kodalkar Bapuso Bira, Miss Mujawar Payal Raju. International Journal Of Novel Research And Development . Volume 9, Issue 7 July 2024.
21. . Syed Zubair Atif 1 and S. M. Shahidulla. European Journal of Pharmaceutical and Medical Research. Vol 11, Issue 5, 2024.