

Journal of Pharmaceutical Advanced Research**(An International Multidisciplinary Peer Review Open Access monthly Journal)**Available online at: www.jparonline.com**Development and evaluation of multi herbal toothpaste****Prabhu K. Halakatti^{*1}, Anita Desai¹, Mahantesh Moogi², Mahantesh Patted², Ashok Gumtaj², Pallavi Jakati²**

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ABSTRACT: Background: Oral hygiene is one of the major necessities for human beings. The day-to-day life of human beings starts with oral cleaning. So, in this process, toothpaste plays an important role. Various natural herbs can be incorporated to overcome some disadvantages of synthetic cleansing agents. **Aim:** The present work was focused on carrying out the preparation of toothpaste and its evaluation which contained multiple herbs. **Method:** The laboratory scale multi herbal toothpaste formulations were prepared by trituration method whereas initially herbal extracts of neem, clove, betel leaf, peppermint, and turmeric were prepared and suitable excipients were triturated along with herbs to get the consistent mass of multi herbal toothpaste. **Results:** The developed toothpaste formulations were shown good consistency and almost acceptable *in vitro* evaluation results compared to marketed formulations. The pH of the formulations was around 6.8 and the viscosity of formulation F3 was found around 5645 cps which is a more viscous formulation that showed good extrudability of around the range of 86.2 to 90.4 %. The foamability of all the formulations was found good. The spreadability of F2 was found to be maximum at 57.01 g.cm/s. Along with these F1, F2, and F3 formulations showed good abrasiveness and homogeneity properties. **Conclusion:** Considering all the *in vitro* evaluation results the laboratory-made multi herbal toothpaste formulations showed good and almost equivalent results compared to that of marketed toothpaste formulations. So, the incorporation of herbs into toothpaste formulations is one of the major advantages while maintaining oral hygiene.

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INTRODUCTION:

Toothpaste formulations are semisolid formulations mainly used for cleaning the oral cavity and maintaining oral hygiene. Nowadays toothpaste is considered a basic need of human beings since the day starts with cleaning the oral cavity. There are many marketed toothpaste formulations available that are developed using synthetic excipients but some formulations are developed using herbal extracts. Various herbs are available around our environments which have the potential to treat various

discomforts. Among them, some herbs are also used for oral cleansing purposes. They may be used as antibacterial, antiseptic, odor masking, and teeth whitening. The importance of various herbs was mentioned in Ayurveda. Among the number of available herbs, some suitable herbs have been selected for the development of herbal toothpaste. The incorporation of two or more herbal extracts in a single formulation may yield combined therapeutic effects of those individual herbs. So, it has been more important to incorporate plant-based ingredients in day-to-day life to avoid various side effects from synthetic ingredients [1-3].

The role of toothpaste formulation is to clean and polish the teeth. It keeps oral cavity hygiene clean. Toothpaste has an agreeable taste, and pleasant odor and freshens the breath. Every dentist suggests brushing twice a day for good oral health. Since toothpaste is essential for keeping the oral cavity very hygienic. In herbal toothpaste, various herbs are used and the role of the herbs is to reduce dental plaque, and calculus, freshening the breath. A typical herbal toothpaste should not cause any irritation or pungent feeling during the brushing. Along with herbs some typical toothpaste ingredients also have been essential and those categories are antibacterial agents, fluoride, desensitizing agents, abrasives, and teeth whiteners. Initially, the multiple herbal extracts were well defined for their individual therapeutic uses and selected on the respective categories. In the present study Neem, Clove, Peppermint, Betel, and Turmeric were selected for the development of multi herbal toothpaste formulation. Along with these herbs, some of the excipients like calcium carbonate, tragacanth gum, sodium chloride, glycerine, sodium lauryl sulfate, sorbitol, propylparaben, carboxymethyl cellulose, and distilled water are been used [4-7].

MATERIALS AND METHODS:

Chemicals and reagents:

The excipients calcium carbonate, glycerine, and sodium lauryl sulfate are been purchased from Loba Chemie (Mumbai). Tragacanth gum and, sodium chloride is purchased from SD fine chemical Ltd (Mumbai). Sorbitol, propylparaben, and carboxy methyl cellulose are purchased from Hi-Media laboratories (Mumbai). All the chemicals used are of analytical grade.

Herbal Extracts:

The herbs used in present formulations and their typical role in toothpaste were depicted in Table 1 [8-12]. Fig 1 to

5 represents the herbs used in the development of multi herbal toothpaste formulations.

Table 1. Information on Herbs used in toothpaste formulations.

Herbs	Scientific name	Effect
Neem	<i>Azadirachta indica</i>	Anti-inflammatory, Antibacterial, Anti-hemorrhagic effects.
Clove	<i>Eugenia caryophyllus.</i>	Analgesic, Anticancer effects
Peppermint	<i>Mentha piperita.</i>	Antiviral, Antispasmodic effects
Betel	<i>Piper betle.</i>	Antiulcer, Anti-diabetic effects
Turmeric	<i>Curcuma Longa Linn.</i>	Antioxidant, Antimutagenic, Antimicrobial, Antibacterial, Antifungal Effects



Fig 1. The leaves of Neem.



Fig 2. The dried clove buds.

➤ Collection of herbs:

- Neem leaves are collected from the B.V.V.S campus and then the leaves are dried in a hot air oven for 2 days at 40° C. Then the dried leaves were collected and triturated using mortar and pestle until the fine powder is obtained.

- Clove, Peppermint, and Betel are purchased from the grocery shop and then properly cleaned. Then all herbal drugs are dried and triturated using mortar and pestle until the fine powder is obtained.
- Pure and fresh Turmeric powder is purchased from the grocery shop. All the powdered herbs are then kept aside until further use ^[13].



Fig 3. The fresh Peppermint leaves.



Fig 4. The betel leaves.



Fig 5. The dried turmeric powders.

Method of preparation of toothpaste:

Trituration Method:

All the herbal extracts (powders) were collected and used to prepare the multi herbal toothpaste. The exact quantities of ingredients were weighed using a digital weighing balance (FB 600 Essae, Teroka). Then the weighed herbal powders of Neem, Clove, Turmeric, Peppermint, and Betel were added to the mortar in increasing order of their proportion. Then properly triturated with the help of pestle. Then sodium lauryl sulfate, calcium carbonate, and sorbitol are added and properly mixed. Further glycerine, tragacanth gum, and carboxymethylcellulose are added and mixed well. Finally, sodium chloride and propylparaben are added to the above mixture. Then this powder mixture is converted to the paste consistency by adding demineralized water and the trituration lasts until a thick paste is obtained ^[14]. The quantities of ingredients were mentioned in Table 2.

Table 2. Toothpaste Formulation Chart.

Excipients	Quantity (g)		
	F ₁	F ₂	F ₃
Neem extract	1	1.5	1
Clove	0.5	1	1
Peppermint	1.5	1	1
Betel	1	0.5	1
Turmeric	1	1	1
Calcium carbonate	12.5	12.5	12.5
Glycerine	2.5	2.5	2.5
Sodium lauryl sulfate	0.5	0.5	0.5
Tragacanth gum	0.25	0.25	0.25
Sodium chloride	0.25	0.25	0.25
Sorbitol	0.25	0.25	0.25
Propylparaben	0.5	0.5	0.5
Carboxy methylcellulose	0.25	0.25	0.25
Distilled water (ml)	10-20	10-20	10-20

Evaluation of herbal toothpaste:

Physical examination:

The developed multi herbal toothpaste formulations were examined for organoleptic parameters like color, taste, and odor, and the results were reported ^[15].

pH determination:

The pH of the formulation was determined by pH paper. 1 gm of prepared herbal toothpaste was diluted with 100 ml of distilled water and one drop of the diluted paste was poured on pH paper and color change is compared with the standard color strip. Then the pH of the formulation is noted ^[16].

Viscosity:

The viscosity of all the toothpaste formulations was determined using a Brookfield viscometer (LVDVE Brookfield Engineering Labs, USA) shown in Fig 6. Firstly, in a narrow mouth container, the prepared toothpaste formulation was kept and the spindle of Brookfield viscometer was immersed within it then it was left for 2 min. The viscosity of all the prepared multi herbal toothpaste was determined by using a Brookfield viscometer using the number 64 Spindle and 100 rotations per minute. The dial readings were taken thrice to get the average viscosity of the formulations and results were reported [17].



Fig 6. Brookfield viscometer.

Extrudability:

The prepared multi herbal toothpaste formulations were taken and 5 g of each formulation was accurately weighed and filled in capped aluminum collapsible tubes and the open end of the aluminum tube was sealed with clinching apparatus which is shown in Fig 7.



Fig 7. Aluminium tube sealing machine.

The initial weight is noted. The formulation of filled aluminum tubes was screened for application of gentle pressure and extruded paste is again weighed. Using the formula, the percentage extrudability is been calculated

and the results were compared with standard values [18,19].

$$E = [(W_2/W_1)] \times 100 \dots(1)$$

Where, E = % Extrudability, W_1 = weight of gel taken (g), W_2 = weight of gel extruded out from tubes (g). Percentage extrudability was compared with these standards and how best the formulation can be extruded out is been reported. ≥ 90 % considered as Excellent, ≥ 80 % considered as good, ≥ 70 % considered as Fair.

Determination of Spreadability:

The spreadability of toothpaste formulations was determined by placing one gram of toothpaste on a glass slide and then covering it with another slide of the same length the assembly was shown in Fig 8.



Fig 8. Spreadability apparatus.

The excess toothpaste was scrapped off from the edges, the top slide was subjected to a pull of 50 g with help of string attached to a hook, and the time (s) required by the top slide to cover a distance of 6.5 cm is been noted. The spreadability of each formulation was calculated using the below formula [20,21].

$$S = (m \times L)/t \dots\dots\dots(2)$$

Where S is Spreadability (g.cm/s), m is the load applied (g), L is the length traveled by slide (cm), and t is (s).

Foamability:

The foaming ability of the herbal toothpaste was determined by taking 2 g of toothpaste with 5 ml water in a measuring cylinder, initial volume was noted, and then shaken for 10 times. The final volume of the toothpaste with foam in the measuring cylinder is been noted down and the procedure was repeated thrice to get average values [22].

Determination of Abrasiveness:

The abrasiveness of a toothpaste formulation is greatly affected by the abrasive agents used. Usually, calcium

carbonate, as well as tricalcium phosphate and dicalcium phosphates, are well-known abrasive agents used in toothpaste formulations. The content is scratched over 15 to 20 cm long to check the presence of any abrasive particles present in the formulations. The results were noted for all the formulations [23].

Homogeneity:

Toothpaste shall extrude a homogeneous mass from the transparent collapsible tube by applying of normal force at 27± 2°C. In addition, bulk contents shall extrude from the crimp of the container and then roll it gradually. The observation was reported [24].

RESULTS AND DISCUSSION:

The multi herbal toothpaste formulations were developed with the trituration method and evaluated for various *in vitro* parameters. Further, the *in vitro* characteristic results were compared with marketed toothpaste formulations. In the present study, comparatively equal and rarely better results have been observed with the formulated herbal toothpaste with respect to the marketed herbal toothpaste.

The organoleptic evaluations show that the developed multi herbal toothpaste formulations appear in mud green color, poses pleasant odor smooth in their texture and sweet in taste. The results were depicted in Table 3. The laboratory-made formulations are having typical physical properties of a toothpaste formulation as compared to marketed formulations.

Table 3. Organoleptic evaluations of Toothpaste formulations.

Sl. No.	Evaluation parameters	Observation		
		F1	F2	F3
1	Colour	Mud green		
2	Odour	Pleasant		
3	Taste	Sweet		
4	Smoothness	Smooth		

The pH of the prepared formulations was found in the range of 6.7 to 6.8 which this pH is compatible to formulate a typical toothpaste formulation. The results of pH determination were depicted in Table 4. The results confirm that the extent of pH will not be going to alter the cleansing action of herbal toothpaste.

The viscosity of prepared formulations was found in the range of 5633 to 6345 cps and the results were depicted in table no 4. This viscous property shows a thick consistency of paste. This kind of consistency will hold the paste freely on the toothbrush and this will enhance

the contact time of toothpaste formulation with the outer surface of teeth.

The extrudability of prepared formulations was found in the range of 86 to 90 %. The results were shown in Table 4. Here F1 and F2 have excellent extrudability whereas F3 shows good extrudability properties. Which was good since extrudability affects the maximum utilization of paste. It is nothing but the complete elimination of formulation from the container.

The foamability of the entire laboratory-made toothpaste formulations was found to be good. All the formulations produce the maximum amount of foam on gentle shaking with water. The foamability results were shown in Table 4. The utilization of several surfactants enhances the foaming ability of these toothpaste formulations. The greater the foam more will be the cleansing action.

Parameters	Lab Made Formulations			Marketed Formulations		
	F1	F2	F3	M	P	B
pH	6.7	6.8	6.8	6.5	6.5	6.5
Viscosity (cps)	5633	5639	5645	5845	5736	5825
Extrudability (%)	90	90	86.2	96	97	96
Foamability	Gd	Gd	Gd	Ex	Ex	Ex
Spreadability (g.cm/s)	52	57.0	54.1	60.2	68.2	64.2
Abrasiveness	Gd	Gd	Gd	Ex	Ex	Ex
Homogeneity	Gd	Gd	Gd	Ex	Ex	Ex

Gd – Good, Ex – Excellent, M – Meswak, P – Patanjali, and B – Babool.

Spreadability of the formulations was carried out using glass slide assembly and the results were shown in Table 4 and spreadability of all the formulations was found in the range of 52.41 to 57 g.cm/s. The spreadability of the formulation was defined by how extent can a formulation spread upon gentle pressure. The present formulation has a moderate spreading ability which upon application of simple pressure it spreads to a good extent.

The abrasiveness test of toothpaste formulation confirms that the formulations have good abrasion properties and the results were depicted in Table 4. The good abrasive property indicates homogenous particles present in the particular formulation, which is responsible for the

whitening of teeth upon abrasion. The present formulation has good abrasiveness efficiency.

The results of the homogeneity test were shown in Table 4 and the homogeneity of all the formulations was found to be good. This test was carried out to evaluate the even particle size present in the formulation. This test found that there are no clumps of particulates in the formulation since it has a good and smooth consistency. Since all the herbal extracts were ground thoroughly to get fine powders, the homogeneity of toothpaste was found to be good.

The developed multi herbal toothpaste formulations were evaluated and compared with three different marketed herbal toothpaste formulations such as Meswak, Patanjali, and Babool. The same parametric evaluations were performed for both marketed as well as prepared formulations. Then the parameters were compared thoroughly. The results of physical evaluations of these three marketed formulations are depicted in Table 4 in order to compare the physical characteristics of both laboratory-made formulations and marketed formulations. The laboratory-made multi herbal toothpaste formulations showed almost near or slightly lesser results as compared to marketed products.

CONCLUSION:

Multi herbal toothpaste containing neem, peppermint, clove, turmeric, and betel was prepared using the trituration method. The 3 formulations coded with F1, F2, and F3 were prepared and compared with commercially marketed products. All three formulations showed good viscosity, Spreadability, foamability, extrudability, homogeneity, and abrasiveness properties. All these three formulations showed good evaluation results when compared with marketed products those are Meswak, Patanjali, and Babool. So, from the above studies, it can be concluded that multiple herbs can be successfully incorporated into toothpaste formulation in order to get better and more convenient oral hygiene.

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