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COMPARATIVE EVALUATION OF HERBAL TOOTHPASTE WITH POPULAR COMMERCIAL TOOTHPASTE; AN IN-VITRO STUDY

GAYATRI S* AND SATHYA S

Sri Ramachandra Faculty of Pharmacy, Sri Ramachandra Institute of Higher Education and
Research (DU), Porur, Chennai-600116

*Corresponding Author: Dr. S. Gayatri: E Mail: gayatrisru@yahoo.co.in

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ABSTRACT

Background: Toothpaste has evolved over time, addressing oral health needs. Herbal formulations, rooted in historical practices, are gaining popularity for their perceived safety. The study explores the creation and evaluation of herbal toothpaste with various plant-based ingredients. Purpose: To prepare herbal toothpaste, and evaluate it as per standards. Methods: Herbal tooth paste was prepared using homogenization & trituration. It was evaluated for organoleptic parameters, pH, foaming power, stability, loss after drying, spreadability and abrasive property. Results: The herbal toothpaste, incorporating clove and neem leaves, adhered to quality standards outlined by the Drug and Cosmetic Act of 1940. Both lab-made and commercial samples met BIS standards for pH, foaming, spread ability, and moisture content. The lab-made toothpaste had a neutral pH of 7.9, falling within the 5.5-10.5 range, while commercial toothpaste exhibited alkaline nature. Stability was maintained without evidence of separation or degradation during storage. Conclusion: The formulated herbal toothpaste is a reliable and affordable option for oral hygiene, demonstrating effectiveness comparable to commercial counterparts. Its stability and promising results suggest potential for future use in natural dental treatments.

Keywords: Spreadability; Neem Leaves; Clove; BIS

INTRODUCTION

Most people use toothpaste on a daily basis. Good dental hygiene is essential for maintaining a nice appearance, making a good first impression, and feeling confident. By keeping the mouth and teeth clean, practicing good oral hygiene helps prevent dental issues [1, 2]. The crown, root, enamel, dentine, and pulp make up the anatomical portion of a tooth. Bad smell, decaying teeth, gingivitis, sensitive teeth, calculus, cavity formation, and plaque are just a few of the dental issues that can arise. Food particles on the teeth are small, white, and easily washable. Dental plaque is a thin layer of germs that adheres to teeth and has a yellow colour that cannot be removed by rinsing [3-5].

When used with a toothbrush, a dentifrice's principal purpose is to clean the surface of the teeth. A dentifrice aids in cleaning food residue off of teeth, removing surface plaque or stains, polishing the tooth's surface, and improving breath. With the aid of excipients found in toothpaste, the toothbrush is mechanically employed to clean the majority of the mouth [6-9]. Previous research has shown that dental plaque can be physically removed and managed by using a variety of pharmacological formulations, such as antimicrobial toothpastes and mouthwashes [2, 4, 5]. Toothpaste is a substance with a gel or paste formulation that is used to clean and

maintain oral hygiene. Since ancient times, people have used toothpastes, which are now one of the essential and indispensable parts of oral healthcare. From 300 to 500 BC, formulas for toothpaste were developed in China and India. Since ancient times, chewing sticks have been widely utilised in the Middle East, Africa, and the Indian subcontinent [10].

Modern toothpaste formulations emerged in the nineteenth century. Chalk and soap were subsequently incorporated to the formulation. From 1945, sodium lauryl sulphate was used for its foaming and emulsifying property [11,12]. Fluoride has been a component of practically all commercially available toothpaste formulas since the 1980s. One of the main reasons for their increased use is the oral health care sector's aggressive promotion of fluoridated toothpastes. In recent years, there has been a greater emphasis on releasing active compounds during formulation development to prevent and/or treat oral sickness. The release of active ingredient to prevent and/or treat oral sickness has become more of a focus in recent years. The control of plaque and the reduction or prevention of oral illness are two benefits of a number of chemicals and preventative agents [13,14].

India has an extensive tradition of utilising local medicinal products to treat a

variety of ailments. People are increasingly turning to non-alcoholic toothpastes and herbal formulations after learning about the drawbacks of commercial toothpastes. Formulations containing natural substances are more acceptable because they are perceived to be safer than synthetic ones [15]. The guava leaves, neem and banyan bark has been utilised for decades to uphold oral hygiene, prevent cavities, gingivitis, and periodontitis [16]. Clove and aloe Vera are having antibacterial and analgesic activity

The prevalence of dental caries is rising significantly in developing and impoverished nations. Promoting traditional preventative measures that are likeable, accessible, and economical is therefore urgently needed. Main ingredient like Neem Antibacterial, Guava-Anti-inflammatory, and other ingredient, Glycerine-Humectant, Calcium Carbonate-Abrasive, Sodium lauryl sulphate-Detergent, sodium chloride and distilled water were used in the preparation of tooth paste. The current study

examines the creation and assessment of herbal toothpaste made with a variety of plant derived products, specifically, the organoleptic parameters, pH, foaming power, stability, moisture content, spreadability, and abrasive property.

MATERIALS AND METHODS

After collecting guava leaves, it was washed and allowed to dry in air for 10 days. Using a blender, the dried leaves were crushed in to coarse powder; transferred into an air tight container and stored in a cool dry area protected from sunlight. In a similar way, Neem and Banyan bark were also collected, washed and air dried for 10 days before being crushed in a home grinder into a coarse powder. It was then sieved and stored in an air tight container in a cool dry place protected from sunlight. Different parts from the selected medicinal plants were used for the preparation of tooth paste. The botanical name and parts used is given in **Table 1**. Other chemical used were of analytical grade and obtained from Merck.

Table 1: Botanical name and parts of the plant used

Common name	Botanical name	Parts used
Neem	<i>Azadirachta indica</i>	bark
Guava	<i>Psidium guajava</i>	leaves
Banyan	<i>Ficus benghalensis</i>	bark
Clove	<i>Syzygium aromaticum</i>	flower
Aloe vera	<i>Aloe barbadensis</i>	Steam gel

Homogenization method was used for the preparation of tooth paste. The binder was blended with solid abrasives and triturate, which was then mixed with the

liquid phase containing humectant oil, then preservative added to it, after the development of a homogeneous paste. The flavour and detergent were added last under

slow speed agitation to reduce foaming and mixed, milled, and tubed. It was then evaluated along with some marketed

products as per the guidelines [17, 18]. The chemicals used for the preparation of toothpaste are given in **Table 2**.

Table 2: Chemicals used their uses

Name of the compound	Use
Calcium carbonate	Abrasive
Glycerine	Humectant
Sodium lauryl sulphate	Surfactant
Peppermint	Flavouring agent
Sodium chloride	Abrasive
Carboxyl methyl cellulose sodium salt	Thickening agent

The prepared herbal tooth paste was tested for organoleptic parameters. The colour was visually assessed. Odour was detected by smelling the product, as each ingredient has its own distinct odour that allows them to be identified. Taste was assessed manually by consuming the product.

To measure the pH, weighed 1g of toothpaste, mixed with 10 ml of boiled and cooled water taken in a 100 ml beaker. Before measuring the pH of the suspension, the contents were stirred vigorously.

To determine the foaming power, 5 g of toothpaste was mixed with 10 ml of water in a 100 ml glass beaker. The beaker was concealed with a watch glass and allowed to stand for 30 minutes. The contents were mixed thoroughly, poured in to a 50 ml measuring cylinder along the residue. Additional water was added to reach 50 ml mark. With a gentle up-down movement, the suspension was mixed uniformly at 30 ° C and then kept aside for 5 minutes. Finally noted the measurement

along with foam and water. Foaming power is the difference between final volume and initial volume in ml.

Under normal storage conditions and regular usage, the toothpaste should not deteriorate, segregate and no fermentation should take place. To determine the stability, the toothpaste was filled in a container for storage and stored for 45 days at room temperature. After the said period, upon opening the container, there should not be any liquid component separated in the container. To determine the moisture content, around 5 g of a sample was spreaded in a porcelain dish having 6-8 cm diameter and 2-4 cm depth. Dried the sample in an oven at 105°C.

For determining spreadability, the toothpaste (1 g) was placed in between two glass slides (10 x 10 cm), a 2 kg weight was placed carefully on the covered glass slide without any sliding. After 3 mins, toothpaste spreaded area was measured in cm. Average value was determined by repeating the experiment. To determine the sharp edged

abrasive particles the content was taken on the finger-and scratched on the butter paper on 15-20 cm length. The process was repeated to get average value.

RESULTS

As per BIS standard the toothpaste need to have smooth texture and semisolid in consistency. Thus lab made toothpaste falls under it and commercials obey the standard. The lab made is bitter in taste as it does not contain any sweetening agent in the formulation. Results of the organoleptic properties of formulated and marketed herbal toothpaste was presented in **Table 3**.

pH range of commercial tooth paste was found to be between 9.2 to 9.9. As per BIS standard the pH range of toothpaste is

5.5 to 10.5. The lab made toothpaste has 7.9 neutral value which falls in between the range. The commercial toothpastes were alkaline in nature. Foamability of the marketed preparation and lab made preparation was presented in **Figure 1** and spreadability **Figure 2**.

As per standard the moisture content ranges from 20-39 %. The moisture content of all the evaluated tooth pates were given in **Figure 3**. From the test for abrasiveness, it was found that there was no abrasive particles in the lab made and commercial toothpaste. Also there was no evidence of phase separation, fermentation, or degradation under typical storage circumstances.

Table 3: Organoleptic Properties of Formulated and Marketed Herbal Toothpaste

Parameter	lab made	brand 1	brand 2	brand 3	brand 4
Appearance	semisolid	semisolid	semisolid	semisolid	semisolid
Colour	brownish	grey	whitish	brownish	brownish
Odour	typical	typical	typical	typical	typical
Taste	bitter	sweet	sweet	sweet	sweet
Texture	smooth	smooth	smooth	smooth	smooth

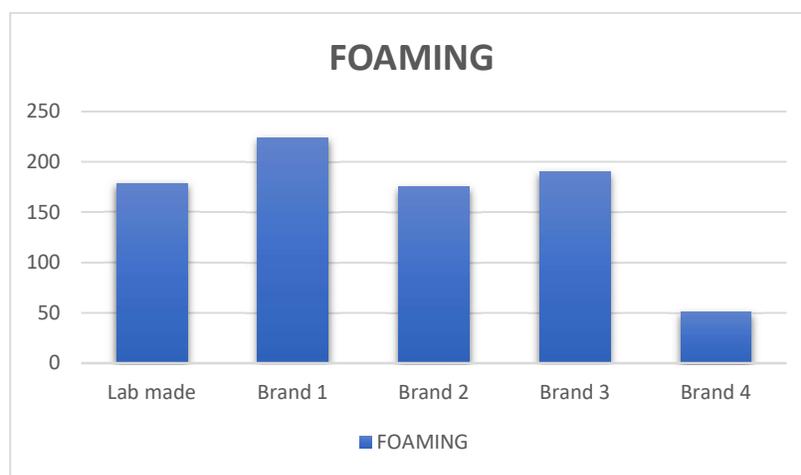


Figure 1: Foaming Result of Formulated and Marketed Herbal Toothpaste

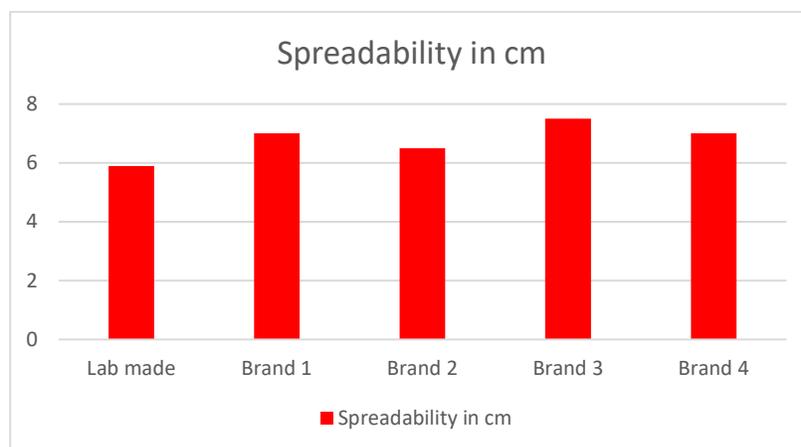


Figure 2: Spreadability Result of Formulated and Marketed Herbal Toothpaste

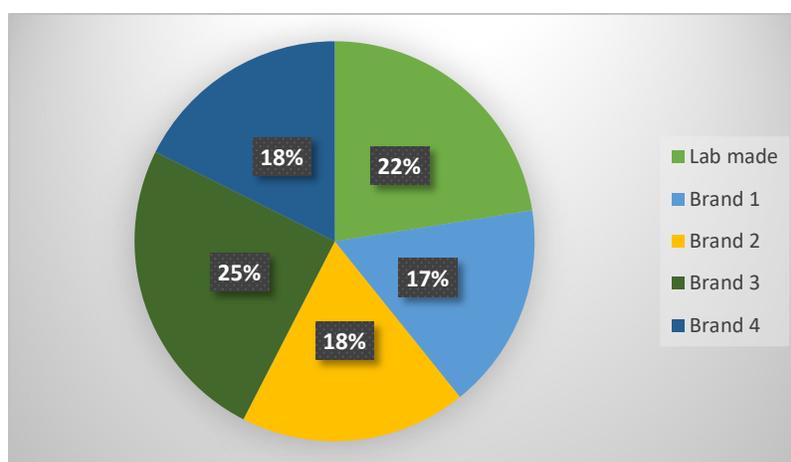


Figure 3: Moisture Result of Formulated and Marketed Herbal Toothpaste

DISCUSSION

Over 60 to 80 % of people worldwide rely on complementary and integrative medicine, according to WHO data, which amply illustrates the importance of traditional medicine in contemporary healthcare. Natural ingredients in toothpaste can enhance dental and oral health care because they can lessen the negative effects that chemicals have on the body.

In the present study, all the marketed formulations and lab made formulations were found to be smooth, semisolid with a

characteristic odour. By the addition of some sweetening agent in the lab made preparation, bitterness can be removed. There is no difficulties in filling and extrusion of toothpaste from the container. For both lab-made toothpaste samples and samples of marketed herbal toothpaste (Colgate, Meswak, Ayush, and Vicco), evaluation was done in accordance with the standards outlined by the Drug and Cosmetic Act of 1940. All of the samples complied and were of high quality. The results are in compliance with other

literatures [10, 11, 14] which show the effectiveness of herbal ingredients in tooth paste.

Plant-based products have enormous potential for developing oral healthcare products due to their antimicrobial, antioxidant, and flavouring properties. Clove and neem leaves were used in the manufacturing of the herbal toothpaste, along with some natural and minimally synthetic ingredients. The prepared formulation was found to have good stability and passes as per the standards. The formulation can be tested on human subjects to evaluate its efficacy in helping with oral hygiene.

CONCLUSION

Using herbal tooth pastes is a dependable, safe, and affordable way to maintain oral hygiene in an effort to stop dental caries. To make the formulation of the lab-made herbal toothpaste more stable, suitable substances were chosen. Evaluation of the results and comparison with commercial herbal toothpaste demonstrates that the laboratory-made toothpaste is just as condensing and captivating as the marketed formulations (meswak, ayush, vicco and colgate). The developed herbal toothpaste offers good potential for the future in the study of natural treatments and public demand.

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