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Patanjali Dant Kanti: Is it worth all the hype!? Comparative evaluation with other herbal dentifrices for efficacy against *S. mutans*

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Abstract

Introduction: The world is shifting towards natural products for a healthier lifestyle. Today the market is flooded with herbal products and dentistry is no exception to this.

Aim: To compare and evaluate the effectiveness of the popular herbal dentifrices in fighting against the oral microorganisms.

Materials and methods: This *in-vitro* study evaluated the antimicrobial efficacy of popular commercially available herbal toothpastes against *S. mutans*. The antimicrobial property of the popular commercially available herbal toothpastes was tested using the disk diffusion method against *S. mutans*. The resulting inhibition halos were compared, which determined their effectiveness.

Results: The bacteria were sensitive to all the toothpastes tested to varying degrees.

Conclusion: All herbal dentifrices tested had antimicrobial activity. Patanjali Dant Kanti was most effective amongst all.

Keywords: Antimicrobial activity, dentifrices, herbal, toothpastes, Himalaya, Patanjali

Introduction

One of the commonest infectious microbial diseases of the world since ages is dental caries and has an increased incidence in recent past due to drastic changes in lifestyle habits [1]. According to Keyes triad (1960), dental caries depends upon the factors such as oral flora, teeth, and diet. Time was added later as another factor by Newbrun (1982), the interaction between these primary factors over a specified period of time is important for the initiation and progression of caries. Hence, if any one of the factors is eliminated, the prevalence of dental caries can be reduced [2].

Fitzgerald, Jordan, and Achard (1964) demonstrated that dental caries will not occur in the absence of microorganisms. It is impossible to completely eliminate the microbes from oral cavity, but reduction in microbial count can be done. This would reduce the caries incidence.² Caries, though creates permanent damage to the individual which cannot be healed, this infectious disease can be effectively avoided by simple inexpensive and easy to practice personal hygiene habits like brushing, flossing and rinsing [1].

Mutans streptococci (MS) have been commonly associated as major cariogenic bacteria. Among MS, *Streptococcus mutans* and *Streptococcus sobrinus* are certainly connected with human dental caries (Loesche, 1986). *S. mutans* is present in oral flora and has been demonstrated to be a causative organism for dental caries because of its capacity to metabolize fermentable carbohydrate into organic acids. These acids can cause a fall in pH, which can lead to an increase of enamel solubility that is dental caries (Hui *et al.*, 2013). *S. mutans* is more prevalent in dental caries subjects than *S. sobrinus* (Franco *et al.*, 2007; Yoo *et al.*, 2007) [3].

Nature has provided a complete store house of remedies to cure all the ailments of mankind. Various medicinally important herbs have been used for centuries in the traditional system of medicine. In India along with Ayurveda and Yoga; Unani, Siddha and Homeopathy, are practiced under the system of Ayush as a well established branch of medicine [4].

The world consumers are seeking natural products for a healthier lifestyle. This change along with marketing of herbal products led to increased use of these compounds in food, cosmetic, and pharmaceutical products.

Dentistry is no exception to this shift. In India, most of the families the members share the same toothpastes irrespective of their age. Unaware of their efficacy the consumers are often induced to buy these products [2]. Rising popularity of natural and herbal products, has mandated the dental professionals to evaluate the effectiveness of these products and provide evidence based suggestion to their patients to make a better choice [1].

The claims of herbal dentifrices though attractive cannot be substantiated by the dental professionals due to sparse knowledge of various indigenous herbal contents. Thus to fill this lacuna of knowledge, an *in vitro* study was designed to evaluate the antibacterial efficacy of various herbal dentifrices available on the counter in caries prevention by standard diffusion method.

Materials and methods

Based on the popularity across the counter, four commercially popular herbal toothpastes were selected namely, Patanjali Dant Kanti (Patanjali Ayurveda Limited), Himalaya Complete Care (The Himalaya Drug Company), Dabur Red (Dabur India Limited) and Dabur Meswak (Dabur India Limited) toothpastes (figure 1).

The bacterial strains of *Streptococcus mutans* (MTCC497) were used for antimicrobial tests. The selective medium used was Mitis Salivarius Bacitracin agar (HiMedia Laboratories Pvt. Ltd) for culturing. The procedure was performed in the Department of Microbiology, Holkar Science College, Indore (M.P.) (Figure 2)

Microbiological test

The disk diffusion method was used for the experiment. The samples of toothpaste and saline solution (1:3) were prepared (Figure 3). Inert paper discs of uniform size were dipped in this solution and placed in the plates after inoculation (Figure 4). All plates were done in triplicate, and they were incubated at 35–37 °C for 16–18 h. At the end of the incubation period, the inhibition halos (Figure 5) were measured in millimeters (mm).

Statistical analysis

The results were organized and analyzed statistically with the program SPSS® 11.0, SPSS Inc., Chicago, IL, USA. Mann Whitney test was applied to assess the results. (Table no. 1)

Results

All the dentifrices showed substantial antibacterial activity against *S. mutans*. Of these, dentifrice Patanjali Dant Kanti had highest, followed by Dabur Meswak, Himalaya Complete Care and Dabur Red toothpaste had the least.

Discussion

Oral cavity is an ecological niche, which contains 500–1000 different types of bacteria along with fungi, protozoa, and occasionally viruses. Dental plaque is key role player in initiation of dental caries. Once colonized the pioneer bacteria adhere and produce acidic environment which in due course along with series of microenvironment alterations progress to cavitations [4].

Effective prevention of these infections can be achieved by mechanical removal of dental plaque by proper tooth brushing and flossing. However the majority of individuals particularly children, aged individuals and the ones with

special needs may not perform mechanical plaque removal sufficiently, thus antimicrobial ingredients in a toothpaste would limit these plaque related oral infections [4]. The mechanical measures used in our daily routine, such as tooth brushing dental flossing, etc. if complimented with a dentifrice having antimicrobial efficacy, can reduce the microbial count of the oral cavity on a daily basis and, thus, reduce the prevalence of dental caries. Hence antibacterial efficacy of dentifrices is one of the key factors in selection of the tooth paste. The ingredients of tooth paste with antibacterial properties kill the microbes and reduce their growth and colonization on tooth surface [5]. Of various microorganisms, *S. mutans*, were chosen as test microorganisms as they have been implicated in the initiation and progression of dental caries respectively [1].

The use of antimicrobial agents like triclosan and fluorides has been used for more than thirty years as active agents in toothpaste and mouthrinses. Herbal medicine has contributed significantly to the modern day medicine practice. The present shift of the world towards nature based products led to the use of various herbs with antimicrobial activity in dentifrices and mouthrinses as well to reduce oral infections [13].

Acharya *et al.* [3] assessed the antimicrobial activity of different toothpastes against oral isolates by conducting zone of inhibition test and concluded that antimicrobial agent is present in various test dentifrices [2]. Similar standard disk diffusion method was used to evaluate the efficacy in our study. As a result all the four herbal toothpastes showed substantial antimicrobial activity against *S. mutans*. Out of these, dentifrice Patanjali Dant Kanti had highest followed by Meswak, Himalaya and Dabur Red had the least antibacterial activity.

There is variation in antibacterial efficacy against *S. mutans* among various herbal toothpastes which can be attributed to the effect of various components, their varying concentrations in the dentifrices and their efficacy to inhibit various organisms.

Dabur Meswak contains *Salvadora persica* (Pilu/Meswak) which is known to have antiplaque, analgesic, antibacterial, antimycotic, cytotoxic properties and used as an astringent [11]. It should be noted that *Salvadora persica* was present in three out of four test dentifrices, exception being Dabur Red toothpaste.

Himalaya Complete Care has *Punica granatum* (Pomegranate) extract and *Vitex negundo* (analgesic) as its constituents. Pomegranate is one of its active ingredient, which is known to have bactericidal, fungicidal, antioxidant, antiparasitic, anticancerous and anti-inflammatory properties [12]. Other ingredients like *Embelia ribes*, *Azadirachta indica*, *Acacia arabica*, *Xanthoxylum alatum* and *Mimusops elengi* are also present in the Patanjali Dant Kanti.

Dabur Red contains *Piper nigrum* (Black pepper: antibacterial, antioxidant, antiinflammatory properties), *Piper longum* (Pipali), *Xanthoxylum alatum* and *Zingiber officinale* (ginger).

It was observed that Patanjali had multiple herbal components (figure 6) and was found to be more effective in inhibiting the *S. mutans*.

Following are various herbal constituents along with their medicinal properties:

- **Anacyclus pyrethrum:** Used almost exclusively as a sialogogue, in headache, neuralgic and rheumatic

affections of the face, toothache, etc., or as a local stimulant in palsy of the tongue or throat, or relaxation of the uvula.

- ***Azadirachta indica***: Antiseptic, Antibacterial and Antifungal activity
- ***Acacia arabica* (Babbula)**: Acts as Astringent in treating ulcers. Different parts babbula plant are used for treating leprosy, typhoid, tuberculosis, smallpox
- ***Xanthoxylum alatum* (Tomar)** : The essential oil is said to possess antiseptic, disinfectant and deodorant properties.⁶
- ***Syzygium aromaticum* (Clove)**: Numbing agent. Antiseptic, Antibacterial, Antifungal effects.
- ***Piper sylvaticum* (Pippali)**: to relieve cough, asthma, anemia, cardiac disorders, anemia, for rheumatoid arthritis and intestinal worm infestation. Long pepper is very useful to improve lung strength, because it is rejuvenative and anti-aging, and because it improves appetite, it helps to avoid weight loss associated with tuberculosis and its treatment. It also helps to prevent liver damage that sometimes results from the medicines used in tuberculosis management.
- ***Barleria prionitis* (Vajradanti)**: Astringent, Antibacterial, Antiinflammatory and Antioxidant [7]
- ***Mimusops elengi* (Bakul)**: It possess activities like antibacterial, antihemorrhoidal, antifungal, anticariogenic, free radical scavenging antihyperglycemic, antineoplastic, gastroprotective, antinociceptive & diuretic effects, antiviral, cognitive enhancing activity and cytotoxic activities. indicated for stomatitis, halitosis, appetizer, anorexia, spongy gums and on pharyngeal affections.^[8]
- ***Embelia ribes* (Vidang)**: Antibacterial, antifungal and antiinflammatory^[9]
- ***Curcuma longa* (Turmeric)**: Anti-inflammatory, analgesic, antihelminthic, carminative and have been used for respiratory and liver diseases, urinary disorders. It also has Antitumor and anticancerous activity^[10].
- ***Salvadora persica* (Pilu/Meswak)**: antiplaque, analgesic, anticonvulsant, antibacterial, antimycotic, cytotoxic, antifertility, deobstruent, carminative, diuretic, astringent, and also used in biliousness, and rheumatism^[11].
- ***Quercus infectoria* (Majuphal)**: Astringent and hemostatic.

There are various challenges which may alter the results in such studies. One factor being the unavailable data regarding the particle size of the herbal extracts present in the toothpastes and their diffusion into the agar. The substantivity and the antimicrobial activity of the active ingredients are also altered by the presence of detergents and abrasive agents. In toothpastes like Dabur Red and Meswak did not specify the concentration of herbs. Hence such factors could not be controlled in our study.

Conclusion

- According to this study the toothpastes with natural compounds have therapeutic potential.
- The differences in the antimicrobial activities of commercial toothpastes with natural compounds were revealed from the results of this study.

- Patanjali dant kanti proved to have maximum antimicrobial activity against *S. mutans*.
- To improve the understanding of the applicability of such products in toothpastes, more studies on these natural compounds are necessary.

Tables and Figures

Table 1

(I) Var00005	(J) Var0005	Mean difference (I-J)	Standard Error	Sig.
P	H	1.97250	0.51536	0.011
	M	0.93250	0.51536	0.316
	D	1.99750	0.51536	0.010
H	P	-1.97250	0.51536	0.011
	M	-1.04000	0.51536	0.235
	D	0.02500	0.51536	1.000
M	P	-0.93250	0.51536	0.316
	H	1.04000	0.51536	0.235
	D	1.06500	0.51536	0.219

The mean difference is significant at the level of 0.005.

P: Patanjali Dant Kanti toothpaste; H: Himalaya toothpaste; M: Meswak toothpaste; D: Dabur Red toothpaste



Fig 1: Test sample herbal toothpastes



Fig 2: Materials used

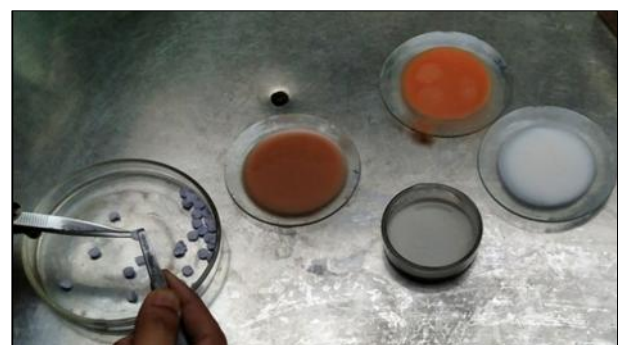


Fig 3: Uniform size paper discs dipped in toothpaste slurry

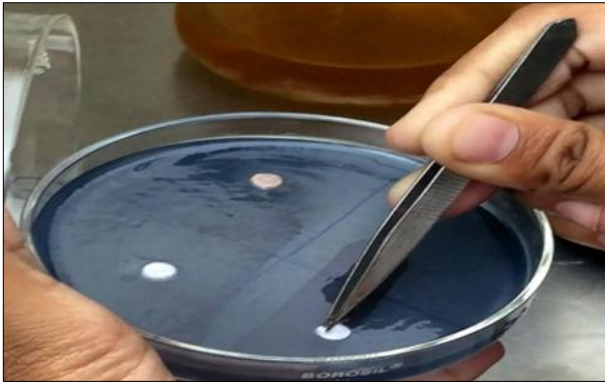


Fig 4: Soaked discs transferred to the Mitis salivarius agar plate



Fig 5: Zone of inhibitions presented as halo around the discs

Composition: Each 10 g contains extract of-		
Akarkara (अकरकरा)	Anacyclus pyrethrum	20 mg
Neem (नीम)	Azadirachta indica	10 mg
Babool (बबूल)	Acacia Arabica	20 mg
Tomar (तोमर)	Xanthoxylum alatum	20 mg
Pudina (पुदीना)	Mentha spicata	10 mg
Laung (लौंग)	Syzygium aromaticum	10 mg
Pipli (पीपली छोटी)	Piper sylvaticum	10 mg
Vajradanti (वज्रदंती)	Barleria prionitis	10 mg
Bakul (बकल)	Mimusops elengi	10 mg
Vidang (विडंग)	Embelia ribes	10 mg
Haldi (हल्दी)	Curcuma longa	10 mg
Pilu (पीलू)	Salvadora persica	10 mg
Majuphal (माजूफल)	Quercus infectoria	5 mg

Fig 6: Contents of Patanjali Dant Kanti Toothpaste.

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