



Short Communication

Efficacy of herbal toothpastes on salivary pH and salivary glucose – A preliminary study



Mahesh R. Khairnar^{*1}, Arun S. Dodamani, G.N. Karibasappa², Rahul G. Naik, Manjiri A. Deshmukh³

Department of Public Health Dentistry, JMF's ACPM Dental College, Dhule, Maharashtra, India

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ABSTRACT

Due to dearth of literature on the effect of herbal toothpaste on saliva and salivary constituents, the present study was undertaken to evaluate and compare the effect of three different herbal toothpastes with the focus on salivary pH and salivary glucose. Forty five subjects in the age group of 19–21 years were randomly divided into 3 groups (15 in each group) and were randomly intervened with three different herbal toothpastes (Dant Kanti, Himalaya Complete Care and Vicco Vajradanti). Unstimulated saliva samples were collected before and after brushing and salivary glucose and pH levels were assessed at an interval of one week each for a period of 4 weeks starting from day 1. All the three toothpastes were effective in reducing the overall ($p < 0.05$) levels as well as levels of salivary glucose from pre-brushing to post-brushing at each interval ($p < 0.05$) and in increasing the overall levels as well as levels of salivary pH ($p < 0.05$) from pre-brushing to post-brushing at each interval. Herbal toothpastes were effective in reducing salivary levels of glucose and improving pH of the saliva.

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1. Introduction

Mechanical oral hygiene procedures employing proper use of toothbrushes along with dentifrices seem to be the most effective form among all oral hygiene measures. Dentifrices serve as an ideal vehicle for any active therapeutic ingredient [1]. Among dentifrices, various types of toothpastes serve as the most common and accessible preventive oral health care tool available. It has been proven that modern toothpastes can help prevent dental caries and limit the regrowth of dental plaque & gingivitis [2].

Due to certain side-effects of routinely used non-herbal toothpastes such as mucosal ulceration, circumoral dermatitis, etc., people are resorting to herbal toothpaste which do not contain any synthetic ingredient [3,4]. Consumers who gravitate towards using herbal products often view these products as being safer than products that contain chemicals. Their efficacy can be attributed to various properties such as anti-inflammatory, anti-microbial, astringent action, anti-diabetic, anti-fungal, analgesic and antiseptic properties. However there is lack on professional consensus regarding use of herbal dental products due to lack of sufficient clinical research and literature on the efficacies of herbal based toothpastes.

Salivary components like pH, glucose which play an important role in maintaining oral health [5,6]. But scientific studies assessing the effect of non-herbal as well as herbal toothpastes on these salivary components are lacking. Most of the available literature has focused mainly on antimicrobial properties of herbal toothpastes [7]. The three toothpastes used in the study i.e., Patanjali Dant-Kanti Dental Cream, Himalaya Complete Care Toothpaste and Vicco Vajradanti Toothpaste were selected based on their popularity. Hence, the present study evaluates and compares the effect of these toothpastes on salivary pH and salivary glucose.

* Corresponding author. Department of Public Health Dentistry, Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli, Maharashtra, India.

E-mail address: kmahesh222@gmail.com (M.R. Khairnar).

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¹ Department of Public Health Dentistry, Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli, India.

² Department of Public Health Dentistry, Dr. DY Patil Dental School, Pune, India.

³ Department of Public Health Dentistry, Swargiya Dadasaheb Kalmegh Smruti Dental College & Hospital, Nagpur, India.

2. Material and methods

The present study was a double blind randomized study conducted on 45 BDS students (2nd and 3rd BDS students in the age group of 19–21 years old). Ethical clearance for the study was obtained from the Institutional Ethical Review Board and informed consent was obtained from all the participants prior to the study. Three herbal toothpastes tested were: Group A – Patanjali Dant Kanti Dental Cream; Group B – Himalaya Complete Care Toothpaste and Group C – Vicco Vajradanti Toothpaste.

2.1. Inclusion criteria

Participants in the age group of 19–21 years with good general health following routine oral hygiene procedures and agreement to comply with the study visits were included in the study.

2.2. Exclusion criteria

Participants suffering from systemic diseases, currently using antibiotics, undergoing orthodontic treatment, using additional oral hygiene aids other than toothbrush & toothpaste, having adverse habits like smoking, alcohol consumption were excluded from the study.

2.3. Study design

Since this was a pilot study, it was decided to include 15 participants in each group [8]. Forty-five participants from all the dental students who fulfilled inclusion and exclusion criteria were selected by simple random method and were randomly divided into three groups of 15 each. Three different toothpastes were assigned to three groups by simple random method.

Both, the participants and the investigator were blinded with respect to the study groups. All the study toothpastes were covered with white sticker label indicating only group name and caps of all the toothpastes were replaced with white caps of same uniform size to achieve blinding. The participants were instructed to brush for 3 min twice daily using the toothpaste which was provided to them. They were also asked not to use any other form of oral hygiene aids apart from toothpastes provided to them. Under the observation of the investigator, unstimulated saliva samples were collected in a container by the subjects before and immediately after brushing prior to rinsing with water and were transported to the lab where salivary pH and salivary glucose levels were determined. The study was conducted over a period of 4 weeks on each participant and saliva samples were obtained at weekly intervals starting from day 1 i.e. on 1st day, 7th day, 14th day, 21st day and 28th day.

Table 1
Mean change in salivary glucose (mg/dl).

Interval	Pre-brushing and post-brushing levels in salivary glucose					
	Dant kanti		Himalaya Complete Care		Vicco Vajradanti	
	Pre	Post	Pre	Post	Pre	Post
1st day	5.82 ± 0.4 P = 0.009	5.63 ± 0.5	5.89 ± 0.64 P < 0.001	5.60 ± 0.61	5.91 ± 0.41 P < 0.001	5.32 ± 0.37
7th day	5.77 ± 0.4 P < 0.001	5.42 ± 0.4	5.93 ± 0.72 P < 0.001	5.56 ± 0.60	5.82 ± 0.42 P < 0.001	5.24 ± 0.34
14th day	5.66 ± 0.4 P < 0.001	5.32 ± 0.4	5.83 ± 0.68 P < 0.001	5.52 ± 0.60	5.76 ± 0.41 P < 0.001	5.19 ± 0.35
21st day	5.57 ± 0.41 P < 0.001	5.24 ± 0.41	5.74 ± 0.73 P < 0.001	5.43 ± 0.66	5.68 ± 0.45 P < 0.001	5.09 ± 0.35
28th day	5.44 ± 0.42 P < 0.001	5.11 ± 0.39	5.62 ± 0.74 P < 0.001	5.26 ± 0.68	5.59 ± 0.44 P < 0.001	5.03 ± 0.37

2.4. Saliva collection and analysis

The required quantity of saliva sample was collected before and after tooth-brushing procedure. The participants were asked to refrain from eating and drinking for 1 h before sample collection. The unstimulated salivary samples (10 ml of saliva for each subject) were collected by the participants in sterile plastic container containing 0.1 ml of sodium fluoride in morning between 7 and 7.30 am before and after brushing by spitting method [9]. Each saliva sample was centrifuged at 3000 rpm for 10 min and clear supernatants were processed immediately for estimation of pH and glucose. Salivary pH was measured using a calibrated pH meter (Vanira Li 613 Digital pH meter) and salivary glucose levels were determined by Glucose oxidase/peroxidase reagent method using Erba Mannheim auto-analyzer as per standard protocol.

2.5. Statistical analysis

Data were analyzed using SPSS software version 16. Mean and standard deviation of the obtained pre (before brushing) and post (after brushing) levels of Salivary Glucose and Salivary pH at 1st, 7th, 14th, 21st and 28th day were compared within three groups by paired 't' test. Overall changes in the levels of salivary glucose and salivary pH on 1st and 28th day between three groups were compared by ANOVA test.

3. Results

3.1. Change in salivary glucose (mg/dl) and pH

All the three toothpastes showed significant change in salivary glucose and salivary pH levels after brushing at each interval (1st, 7th, 14th, 21st and 28th day) (Tables 1 and 2).

3.2. Overall difference in salivary glucose (mg/dl) and pH

Overall change in baseline (pre-brushing) values of salivary glucose from 1st day to 28th (last) day were found to be significant in all the three groups; however salivary pH values were found to be non-significant (Table 3).

4. Discussion

The present study compared the effects of three different herbal toothpastes on salivary pH and salivary glucose. The overall experience with the use of toothpaste reported was good with no adverse reactions. Reduction in salivary glucose levels and an increase in salivary pH levels were seen after use of allotted toothpastes. The present study incorporated only herbal toothpaste

Table 2
Mean change in salivary pH.

Interval	Pre-brushing and post-brushing levels in salivary pH					
	Dant kanti		Himalaya Complete Care		Vicco Vajradanti	
	Pre	Post	Pre	Post	Pre	Post
1st day	6.67 ± 0.28 P < 0.001	7.42 ± 0.23	6.56 ± 0.36 P < 0.001	7.08 ± 0.36	6.55 ± 0.39 P < 0.001	7.17 ± 0.42
7th day	6.68 ± 0.25 P < 0.001	7.4 ± 0.23	6.54 ± 0.37 P < 0.001	7.08 ± 0.35	6.57 ± 0.38 P < 0.001	7.20 ± 0.41
14th day	6.70 ± 0.27 P < 0.001	7.42 ± 0.21	6.53 ± 0.35 P < 0.001	7.10 ± 0.35	6.56 ± 0.39 P < 0.001	7.26 ± 0.43
21st day	6.69 ± 0.26 P < 0.001	7.4 ± 0.22	6.57 ± 0.36 P < 0.001	7.07 ± 0.36	6.57 ± 0.37 P < 0.001	7.18 ± 0.42
28th day	6.71 ± 0.26 P < 0.001	7.43 ± 0.21	6.59 ± 0.36 P < 0.001	7.13 ± 0.34	6.56 ± 0.38 P < 0.001	7.18 ± 0.42

Table 3
Overall difference in salivary glucose (mg/dl) and salivary pH.

Toothpaste	Mean difference in salivary glucose	Mean difference in salivary pH
Dant Kanti	0.38	−0.04
Himalaya Complete Care	0.27	−0.03
Vicco Vajradanti	0.32	−0.01
ANOVA	p<0.001	p>0.05

– This sign denotes increase in salivary pH.

because of effectiveness and increased public interest in the usage of Alternative Health Care, including use of natural or herbal health care products [10].

Salivary pH showed increase in all the three groups after brushing. This transient increase in salivary pH level immediately after brushing might be due to increased salivary secretion due to stimulation of parotid gland secretion by substances present in the toothpastes such as Pilu (*Salvadora persica*), Neem (*Azadirachta indica*) which are present in Dant Kanti and Himalaya Complete Care toothpaste [11]. Organoleptic properties of liquorice (*Glycyrrhiza glabra*) and cinnamon (*Cinnamomum verum*) which are present in Vicco Vajradanti stimulate the salivary flow and this in turn helps to raise the pH of the saliva [12,13]. Salivary stimulation due to act of brushing increases salivary flow rate; also release of calcium and phosphorous ions from toothpastes itself as well as antibacterial activity against acid producing bacteria in saliva might have helped to raise the pH of the saliva [14]. Increase in mean pH was more (in the range of 0.50–0.75) in present study as compared to previous study (in the range of 0.24–0.47) [14].

Reduction seen in salivary glucose after use of allotted toothpastes might be attributed to the presence of various anti-diabetic ingredients present in toothpastes tested. Dant Kanti contains Neem (*Azadirachta indica*), Babool (*Acacia nilotica*) & Vajradanti (*Barleria prionitis*) which have sugar lowering effect. Himalaya Complete Care contains Neem, Pomegranate (*Punica granatum*) and Triphala as anti-diabetic substances. Vicco Vajradanti contains Jamun (*Syzygium cumini*), Cinnamon, Liquorice, Anantmul (*Hemidesmus indicus*), Amla (*Phyllanthus emblica*) and Vajradanti which have anti-diabetic properties [15]. These ingredients present in the toothpaste get absorbed through oral-transmucosal route and directly enter into blood circulation. This might result in lowering the glucose level in saliva through various pathways such as initiating the release of insulin from pancreatic beta cells, decreasing postprandial glycemic response, glycogenolytic effect due to blocking of epinephrine action, etc [16]. Valid and accurate comparison of results for salivary glucose in the present study could not be done with other scientific studies, as no previous research work

has conducted to assess the efficacy of herbal toothpastes on these salivary parameters.

Previous literature has shown effectiveness of herbal toothpastes in maintaining gingival and periodontal health [17]. It can be seen from the available literature that increased salivary glucose levels are associated with increased dental caries prevalence in normal individuals as well as diabetic patients [18]. Also salivary pH has an influence on caries process. Demineralization and remineralization processes of the tooth are dependent on pH of the saliva [19]. The present study has shown positive influence of herbal toothpastes on these two salivary parameters.

Long term clinical trials involving larger samples of different age groups and incorporating a proper control need to be conducted to assess the efficacy of herbal toothpaste.

5. Conclusion

Based on our study, there is a trend to believe that the herbal toothpastes possess significant salivary glucose inhibitory activity and favor transient increase in salivary pH.

Conflict of interest and source of funding

None.

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