

Change in salivary pH following use of homeopathic medicines: A preliminary study

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ABSTRACT

Objective: Homeopathic preparations are popular and well accepted by parents and children. These preparations are easily available and are prescribed for acute and chronic conditions. However, their sugar content may affect oral health. **Aims and Objectives:** This preliminary study assessed salivary pH following administration of homeopathic medicines commonly prescribed for children. **Materials and Methods:** Forty-five normal and healthy children were divided into 3 groups of 15 children each: Group 1 was given a placebo, group 2 was given chamomilla (2x), and group 3 was given arsenicum (2x). Each child was given 2 pellets to be placed below the tongue and allowed to dissolve completely. Unstimulated saliva samples were collected at baseline, and following 5, 15, 30, and 60 minutes of administration. The saliva samples were suitably transferred to the laboratory for recording of pH using a digital pH meter. The titratable acidity of both homeopathic medicines was assessed. Data was subjected to statistical analysis. **Results:** Mean salivary pH at 15 minutes was 5.40 in group 1, 5.16 in group 2 and 5.42 in group 3, which was significant. ($P=0.000$) At 30 and 60 minutes, pH in groups 2 and 3 remained lower than that of group 1. The titratable acidity of chamomilla and arsenicum was found to be 0.14 mmol and 0.018 mmol, respectively. **Conclusion:** There was a significant reduction in salivary pH at 5, 15, and 30 minutes in groups 1 and 2. In all groups, salivary pH did not return to baseline values even after one hour of administering the homeopathic pellets.

Key words

Homeopathy, lactose, pellets, salivary pH

INTRODUCTION

Homeopathy is a system of medicine using highly diluted preparations of different plant, mineral, and animal substances to heal many different types of illnesses. The word “homeopathy” is derived from the Greek- “homeo,” which means similar, and “pathos” meaning suffering. It was developed by the German physician, Samuel Hahnemann, more than 200 years ago. It is founded on the principle ‘Similia Similibus Curentur,’ which means ‘like cures like.’ The theory is that these medicines produce the expression of similar symptoms as those we are trying to treat. Minute (actually infinitesimal) doses

are designed to stimulate the body’s natural response to self-heal. In homeopathy, a medicine is chosen based on its ability to produce the patient’s symptoms, if given to a healthy person. They support the body’s own healing capacity and do not interact with other medications, so they can be given alongside conventional medications without any interactions.^[1,2]

Children often resist taking conventional medicines. Nutritional supplements and other natural preparations, even when disguised, often do not pass the taste test of youngsters. Homeopathic medicines can be easily administered to patients who cannot swallow tablets or capsules. They are more suitable for autistic children who are well-known for their narrow range of acceptable flavors, textures, and odors. Hence, many patients using homeopathy are children. Homeopathic medications are widely available as over the counter medications and are commonly purchased without prescription for children. They are safe to use and can be easily administered even at homes. These medicines are made from natural extracts of plants, animals, and minerals, which make it

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a non-toxic substance. Since they are commonly available in the form of sweet-tasting pellets, powders, or liquids, they are palatable and acceptable to most children.

Homeopathic medicine is one of the safest medicines to consume, as it has no potential side-effects. It can be consumed for a long period without the fear of being addicted to the drug. These medicines are known to be gentle on the body mechanisms and act as catalysts. It helps to boost the functions of the biological systems in the body.^[3]

A homeopathic medicine is believed to be more effective when its active ingredient is diluted: This is the minimum dose approach of homeopathy. These dilutions are called potency. The purpose of potency is to dilute the active ingredient until it can do no harm and to invigorate the base substance with energy such that the qualities are preserved while the substance itself is diluted.^[4]

Homeopathic therapy is associated with improvement in a range of chronic and recurring pathologies.^[5] Homeopathic medicines have been known to treat both dental conditions and the anxious child.^[6]

The role of sugar in the etiology of dental caries is well established. The frequency of sugar intake is more important than the total amount consumed is also well documented.^[7,8] Several studies have addressed the issue of high sugar content in allopathic or conventional pediatric liquid medicaments.^[9-12] It is now widely accepted that sugar-containing medicines are a cause of dental caries in chronically sick children.^[13]

Among the homeopathic preparations, arsenica album, belladonna, and chamomile are routinely prescribed for dental problems. Although parents and caretakers are aware of the sweetness and palatability of homeopathic medicines, they may not pay attention to the possible effect that these homeopathic globules could have on their child's oral environment.

Hence, the objective of this preliminary *in vivo* study was to assess the effect of two commonly prescribed homeopathic preparations, chamomilla and arsenicum, on the salivary pH of children.

MATERIALS AND METHODS

Prior to the study, a homeopathic doctor was consulted, and the study protocol was explained. Permission to conduct the study was taken from the ethical committee and institutional review board. Forty-nine normal and healthy children aged 3-4 years, visiting the department of Pedodontics and Preventive Dentistry for a dental check-up, were selected. To be included in the study, all children had to have a $\text{dft} \leq 3$. Only those children

who were not on long-term allopathic medication and not on any medication/therapy that would alter the properties of saliva were included. Two children did not meet the inclusion criteria. Prior to the study, the nature of the study was explained to parents of the children. Written signed consent was taken from the parents for participation of their child in the study. The parents of three children declined for participation in the study. Thus, forty-five children formed the study group. On the day of saliva collection, the parents were asked to perform regular oral hygiene procedure after breakfast, following which they were not allowed to eat or drink. To minimize the effect of circadian rhythms, all whole saliva samples were collected one and a half hours after breakfast. Unstimulated saliva was collected from each child. In order to simulate unstimulated conditions, the child was made to sit in a room with a calm atmosphere. The head of the child was kept at 45 degrees flexion, and a sterile graduated cup was held to the lower lip by the parent/caretaker. For each child, saliva was allowed to drip into the cup for about 2 minutes. If the saliva sample was insufficient, collection was continued until 2 ml of saliva per subject was obtained. Immediately after collection, this initial baseline sample was frozen in dry ice and transported to the laboratory for pH analysis.^[14] The children were then randomly assigned to 3 groups, of 15 children each; according to the medications to be administered. This was done by asking the children to draw balls of different colors from a dark bag. The medications were dispensed in bottles by the homeopathic doctor and suitably labeled as G1, G2, G3, for administration to groups 1, 2, and 3, respectively. Participants and the investigator were blinded to contents of the bottles. Each child was administered a single dose of two pellets, to be placed under the tongue, and they were instructed to allow it to remain until it dissolved completely. Following complete dissolution of the pellets, salivary samples were a similar manner at 5, 15, 30, and 60 minutes. The saliva samples were kept in an ice bucket and sent to the laboratory for analysis within one hour of collection. The pH reading was recorded with a digital pH meter (Model PE-133, Elico Pvt. Ltd.) by a person who was also blinded to the saliva samples. In order to reduce intra-examiner variability, the recording of pH was repeated twice for each sample. A kappa value of 0.92 was obtained for intra-examiner reproducibility. At the end of the study, the content of each bottle was revealed to the investigator. Group 1 was given a placebo (only sugar pellet), group 2 was given chamomilla (2x), and group 3 was given arsenicum (2x) [Figure 1].

The titratable acidity of chamomilla and arsenicum was assessed using the method described by Maguire and co-workers.^[15] Using the manual method of titration, each sample was titrated by adding 0.1 M sodium hydroxide (NaOH) solution until an endpoint pH of 7 was obtained. Endpoint pH and volume of 0.1 M NaOH added was recorded. This measurement was done

in triplicate, and a mean value recorded. The mean titratable acidity in millimoles was calculated using the formula: $[(a/2) \times 5] \times 0.1$ (mmol) where, volume of 0.1 M NaOH needed to reach pH (7.0) = a (ml); divided by 2 since the sample was 2 ml; multiplied by 5 for standard 5 ml dose; and multiplied by 0.1 for titratable acidity expressed in mmol. One-way ANOVA was used to analyze the salivary pH among the three groups. The inter-group comparison was analyzed using Student 't' test. The data was analyzed using the software SPSS version 18.

RESULTS

In all three groups, there was a significant reduction in the mean salivary pH values at 5 and 15 minute time-intervals. ($P \leq 0.001$) Significant reduction was also observed at 30 minutes in groups 1 and 2 only. ($P \leq 0.001$) [Table 1] At the end of 30 and 60 minutes, pH in groups 2 and 3 remained lower than that of group 1. The titratable acidity of chamomilla and arsenicum was found to be 0.14 mmol and 0.018 mmol, respectively.

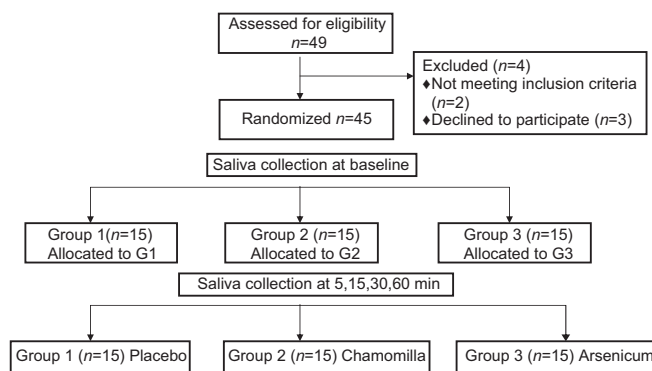


Figure 1: Flow diagram of study protocol

Table 1: Salivary pH of the three groups at different time intervals

Groups	Time interval (minutes)	Salivary pH Mean±SD	Reduction in salivary pH Mean±SD	P value
Group 1	0	6.87±0.27	–	–
	5	5.07±0.16	1.80±0.11	0.000*
	15	5.40±0.47	1.47±0.20	0.000*
	30	5.94±0.38	0.93±0.11	0.000*
	60	6.52±0.28	0.35±0.01	0.003
Group 2	0	6.88±0.23	–	–
	5	4.76±0.46	2.12±0.23	0.000*
	15	5.16±0.53	1.72±0.30	0.000*
	30	5.75±0.67	1.13±0.44	0.001*
	60	6.00±0.37	0.88±0.09	0.003
Group 3	0	6.72±0.38	–	–
	5	5.25±0.71	1.47±0.33	0.000*
	15	5.42±0.48	1.30±0.10	0.000*
	30	5.85±0.53	0.87±0.15	0.003
	60	6.27±0.54	0.45±0.16	0.012

* $P \leq 0.001$ is significant

DISCUSSION

Homeopathy is a rapidly growing area of complementary medicine and one that a growing number of parents are becoming familiar with. Many homeopathic medicines are available without prescription, and parents prefer obtaining them and administering it to their children at will.

A previous investigation at our department showed the cariogenic potential of allopathic pediatric liquid medicines. Many of the homeopathic medicines are essentially sugared pellets and, therefore, the objective of this preliminary study was to assess the effect of homeopathic pellets on oral health, mainly pH of saliva.

The daily use of medications for most children is usually for a short time, but for some, it could be over a prolonged period. The long-term use of prescribed medicines by chronically ill children is known to cause dental caries.^[16-18] A survey of pediatric liquid medicines in New Zealand revealed that over half of prescribed and over-the-counter medicines for children contain sugar.^[19] It has been shown that continuous administration of sucrose-based medicines causes dental caries and related gingivitis.^[20-22]

Homeopathic medicines are usually recognized by round pills, commonly known as globules or pellets. These are vehicles, which deliver the medicine in the shortest, most reliable, and most harmless way. They are manufactured from cane sugar or graded sugar, which can give better shape to globules. The most common homeopathic remedies are liquids or lactose/sugar pellets or wafers impregnated with the liquid remedy. Some liquid forms contain alcohol to preserve the remedy. To qualify as an alcoholic tincture, the extract should have an ethanol percentage of at least 40-60%. Mother tinctures contain alcohol, as do the orally administered drops prepared in an alcohol solution. One hundred drops of 65% mother tincture contain 1.026 grams of pure ethanol.^[2] Non-alcoholic liquids are used whenever possible, or pellets/wafers may be used if alcohol is undesirable. Pellets contain sugar and lactose (milk sugar). Five pellets taken 4 times a day (20 pellets) contain 1 gram of sugar (or 1/5th of a teaspoon). One unit-dose contains 1 gram of sugar (or 1/5th of a teaspoon).^[1] Syrups usually contain more sugar. Homeopathic products have no binders, fillers, or coatings. The globules are made to dissolve almost instantly when placed in the mouth. They are absorbed by the mucous membrane in the mouth and carried directly into the system.

Children are more prone to repeated colds as a result of allergic reactions to pollution and seasonal changes. Many parents prefer homeopathic medicines over allopathic preparations, considering their safety and absence of side-effects. In many families, homeopathy is the choice of treatment in cases of repeated illness

and/or long-standing ailments. Of all of the homeopathic remedies, arsenicum album is most used. In children, arsenicum is given to treat colds, runny nose, fever, and also diarrhea. Arsenicum album usage is considered effective in treating conditions that are aggravated by cold, dry, windy weather such as asthma, inflamed eyes that water and sting, headaches with vomiting and dizziness, inflammation of the mucous membranes, and mouth ulcers.^[1,3] For homeopathic use, arsenicum album is prepared by separating arsenic from iron (as in arsenopyrite), cobalt, or nickel by baking at high temperatures. The powder is then ground and diluted with lactose. In the final dilution, there are normally no atoms of arsenic left. The final product is sold as tinctures (liquid), tablets, pellets, or powder. Homeopathic chamomile, known as chamomilla, is commonly prescribed to infants with teething problems when the child is whiney, restless and wants to be held and pampered. It is also given for relieving colic pain in infants.^[2]

Saliva plays a critical role in maintaining oral homeostasis; it modulates the ecosystem through lubrication of the alimentary bolus, protection against microorganisms, buffer and repair of the oral mucosa, and helps in dental re-mineralization. The impact of saliva on plaque pH *in vivo*, following exposure to a sucrose substrate, was measured in 10 caries-resistant (CR) and 10 caries-susceptible (CS) subjects under varying conditions of salivary access. When the plaque was denied access to saliva, plaque pH levels were found to be similar in the CR and CS groups. As the access to saliva was increased, the observed pH increased to a significantly greater degree in the CR subjects than in the CS subjects. This demonstrates the major role that saliva plays in modifying plaque pH, especially in caries-resistant people.^[23] Hence, the pH of saliva was recorded in the present study.

Unstimulated whole saliva that reflects basal salivary flow rate is present in our mouths for about 14 hours a day and is the secretion that provides protection to oral tissues. Stimulated saliva represents the secretion during food intake (physiologic stimulation) and is present in the oral cavity for up to 2 hours.^[24]

The study of unstimulated salivary secretion is an accurate method to analyze salivary gland status, while stimulated saliva is useful for the study of the functional reserve. Resting saliva has the greatest importance for the integrity of the teeth, as stimulated saliva bathes the mouth for a relatively short time in relation to the many hours with resting saliva. In our study, we measured unstimulated saliva, as it is an easy, non-invasive, and comfortable procedure. Differences in pH can be contributed to by collecting method, dietary consumption, and caries.^[25]

In an earlier study on 3 to 14 years old normal and healthy children, no significant difference was found in the salivary pH under unstimulated conditions. The average pH values obtained were 7.17 for the pre-school group (3-5 years), 7.44 for the elementary school group (6-11 years), and 7.24 for the junior-high school group (12 to 14 years).^[14] According to Brawley, the pH of resting saliva from subjects ranging from 3 weeks to 101 years of age does not vary significantly.^[26]

Homeopathic medicines are prescribed to be taken on an average 3-4 times a day and at times every 2 hours. These sweetened globules are often given to children as the last thing at night. The globules are usually placed beneath the tongue to assist in faster dissolution and entry into the systemic circulation. It would be logical to assume that the sugared substance would be cleared at a rapid rate from the oral cavity. The mechanism of salivary buffering of pH is complex; the capacity of saliva to buffer a low initial pH as well as a potentially sustained low pH because of a high titratable acidity can be increased by stimulation of salivary flow. The present study showed that pH of saliva remained below 5.5 up to 15 minutes following ingestion of only a single dose of the homeopathic medicine. In all groups, an interesting observation was that salivary pH did not return to its original baseline value even at the end of one hour [Figure 2]. Critical pH in saliva is termed as the pH, at which saliva is saturated with respect to enamel apatite.^[27] Unstimulated saliva will generally have a lower critical pH than stimulated saliva, owing to a higher total phosphate concentration in unstimulated saliva. The critical pH of saliva is not a constant, but more of a dynamic variable, which varies around a mean pH value of 5.5.^[28] It has been generally adopted as the critical value, below which enamel may dissolve and thus, it is crucial to reduce the time that the actual pH stays below this value. Continuous lowering of the salivary pH by intake of frequent doses of these homeopathic preparations can be a potential threat to the dentition. An investigation indicated that sucrose-containing medicines produced a significantly greater drop in plaque pH than sucrose-free preparations.^[29] In comparison to sugar-free

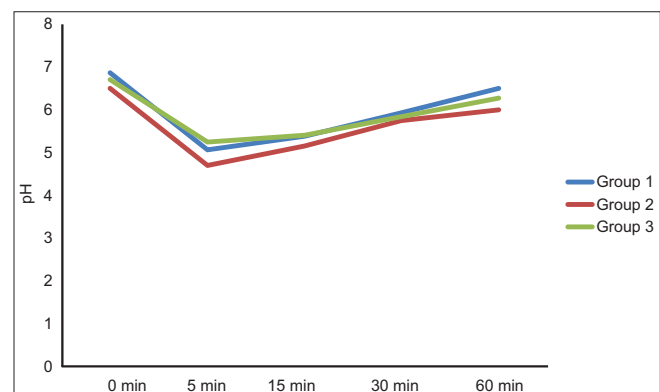


Figure 2: Salivary pH changes observed among the groups

pediatric medicines, the pH of plaque was found to remain below 5.7 for one hour, following rinsing with sugared-medicines. According to Menten, changing of sucrose to non-acidogenic sweeteners was essential to prevent the cariogenic potential of pediatric medicines.^[30]

Hellwig and Lussi emphasized that consumers should be aware of the potential for tooth erosion from medicines, particularly chewable formulations, and in those patients experiencing reduced salivary flow.^[31] Three properties of an acid contribute towards its erosive potential: (1) The amount of acid available (titratable acidity); (2) the amount of acid actually present (concentration of the H⁺ ion or pH); and (3) the relative strength of the acid or the ease, with which the acid will give up free H⁺ ions (pKa).^[32] In our study, titratable acidity of chamomile *per se* was found to be higher than that of arsenicum album *per se*, but was not significant. All homeopathic medicines that are soluble in alcohol or water are first prepared in the form of a mother tincture, which is the extract of the original drug substance. This extract is made with alcohol or water in certain proportion. Further potencies are prepared from the mother tincture. In the present study, reduction in salivary pH was greater with both medicated homeopathic pellets, especially with Chamomile, and continued to remain lower than that observed with the placebo. This could be due to the action of the active ingredient in the pellets.

It has been shown that children aged 3-7 years have larger variations and slower salivary sugar clearances and also lower salivary flow rates than older children and adults.^[33] Due to differences in enamel structure and salivary conditions, primary teeth are more susceptible to caries. Reduced salivary flow during sleep limits the natural cleansing and buffering, thereby increasing the risk of caries significantly.

Medical and dental professionals should be aware of potential problems related to sucrose-based medications. Reducing the cariogenic potential of children's medications, whether allopathic or any other alternative medication, should be of concern to all health professionals. Unlike pediatric liquid medicines, the sugar that is widely used in homeopathic preparations cannot be referred to as "hidden sugars." Rather, it is a source of "overlooked sugars" or "ignored sugars" for pediatric patients, especially the chronically ill who may receive a greater sugar load than healthy children. They may be at higher risk of developing dental caries at an early age. The data obtained in this study is preliminary. Longitudinal studies investigating the effect of these medications on oral health of children are necessary for further validation.

The increase in both prescribed medicine intake and of self-medication exposes a growing number of children to medication caries and should be considered a public dental health issue. Due to their composition, frequency

of administration, and duration of therapy, the oral health of children on regular homeopathy needs to be monitored.

CONCLUSION

There was a significant reduction in salivary pH following consumption of homeopathic medicines. Salivary pH did not return to baseline values following one hour of administration.

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