

CHANGE IN SALIVA PH FOLLOWING INTAKE OF SOME HOMEOPATHIC MEDICATIONS

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ABSTRACT

INTRODUCTION: The role of simple carbohydrates as a major etiological factor for the carious process is well known. Studies have shown that frequent use of conventional sugar-containing medications increases the risk for oral health. Today, a significant proportion of the population chooses alternative medicine and particularly homeopathy for treatment and prophylaxis, considering it effective and safe. However, its influence on oral conditions and its involvement as a risk factor for oral health still remains an under-discussed topic.

MATERIALS AND METHODS: The study included 18 volunteer students in dental medicine. An in vitro saliva test with colored strips was used for four consecutive weeks and after intake of three commonly used homeopathic medications. The following entries were registered: baseline value, 15th, 30th and 60th minute following the intake of the respective homeopathic doses. During the first week, the study was carried out without intake of any homeopathic medicine. The data was subjected to statistical analysis.

RESULTS: There was a fall in saliva pH following intake of homeopathic medications in all studied patients. The pH reduction was most significant at the 15th minute, and the average drop for the three homeopathic medications was - 0.68, 0.94, 1.07, respectively. On the 30th and 60th minute, the mean pH drop remained the highest for the third drug.

CONCLUSION: There was a decrease in saliva pH in all individuals after administration of each medication. In a significant part of the cases the drop was below the critical value of 5.5. The values remained lower than the baseline even an hour following the intake.

Keywords: homeopathy, saliva, salivary pH, homeopathic medications, dental caries

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INTRODUCTION

Homeopathy is a well-defined scientific system, created in 1796 by Samuel Hahnemann, and based on the 'principle of similarity' (*similia similibus curantur*), i.e. like cures like (1-5). It is among the most popular alternative and complementary medicine approaches in modern times (6). Homeopathy is well accepted by patients as medications are easily avail-

able (over the counter) and are prescribed for acute and chronic conditions (4).

Homeopathic medicines are prepared by repeatedly diluting a chosen substance in alcohol or distilled water, followed by forceful striking (i.e. succession) of the solution on an elastic object at every step of the dilution (1,3,7). It is believed that each dilution, followed by succession, increases the drug potency (1). Usually insoluble substances are fine ground and diluted with lactose (i.e. trituration), the final preparations being in liquid form or impregnated on sugar tablets (3,7). They may be in the form of pellets, tablets, powder or liquid. The liquid, or the mother tincture, consists of an alcoholic extract of the specific drug (6). The liquid is generally placed under the tongue using a dropper, but since it contains alcohol it should not be given to children (6). The globules, tablets and pellets, which are made with a lactose base, dissolve in the mouth without chewing. For infants they can be dissolved in water and administered with a dropper (6). They are usually provided without prescription, made from natural extracts, are not toxic and have no potential side effects (4).

The role of sugar in dental caries etiology is clearly proven. After intake of fermentable carbohydrates, oral microorganisms, especially *S. mutans*, metabolise them and produce acids. They in turn reduce the local pH of the tooth biofilm to a level where the demineralisation processes prevail and a carious process begins (8-14). There are opinions that sugar content in homeopathic medications can also affect oral health (4). Consumer requirements for 100% natural products have increased significantly. For this reason, healthcare professionals are meeting more and more patients using complementary and alternative medicine, including homeopathy (15). These facts determine the need for more in-depth studies on the effects of homeopathic medications on the oral environment and hence on oral health (4).

This study aims to evaluate the dynamics of pH values change in unstimulated saliva following the intake of three commonly used homeopathic medications. The scientific hypothesis is that the intake of these homeopathic drugs shall result in a rapid drop in saliva pH under the critical value of 5.5 and such drop will remain within an hour time.

MATERIALS AND METHODS

The study includes 18 volunteer students in dental medicine. Criteria for inclusion are candidates to be completely healthy and not to be subject to any kind of medication that would change the saliva characteristics. A week prior to the start of the study, every volunteer underwent professional oral hygiene procedures. Participants were given the same instructions for conducting oral hygiene and the same toothpaste was recommended. All volunteers had sanitised dentition and no gingival inflammation. Prior to the study, its essence was explained to participants so that they could provide an informed consent.

The study was conducted once a week on a selected day for four consecutive weeks. To avoid the effects of circadian rhythms, the tests were done in the morning, at least one hour after breakfast and standard oral hygiene, between 8 and 11 am. Until the beginning and during the study, volunteers did not take any food or drink.

The unstimulated saliva was tested. The volunteers provided 1-2 spit samples in a sample cup. An in-vitro GC Saliva Check test was applied with a test strip that changed its colour depending on the pH level. The saliva pH of each participant was measured then at baseline and at the 15th, 30th and 60th minute after the homeopathic medication intake.

Three of the most frequently used homeopathic remedies were selected (according to our survey). These are homeopathic pellets to stimulate the immune system (№1); a homeopathic cough syrup (№2); and homeopathic granules with pain relief, soothing effect and often used in case of teeth eruption discomfort (№3). The first one contains animal derived sources - heart and liver and added sugars - sucrose and lactose. It is taken 2-3 times daily, 15 minutes before or one hour after a meal. The second one contains components of plant and animal origin with added ethanol and sucrose. The intake is 3-5 times a day between meals. The third medication is chamomile-based and 3-5 granules are usually taken unlimited times during the day.

During the first week of the study, saliva pH was measured at the appropriate time intervals without medication intake. Thus, the saliva pH values serving as baseline control (control group - group 1)

were determined. During the second week, on a given day, after measuring the baseline pH, one dose of pills of medication №1 was administered under the tongue until complete dissolution and then the pH was measured at the 15th, 30th and 60th minute. The measured saliva pH values following the administration of medication № 1 constituted data defined as group 2. During the third week, on the given day, the same schedule was repeated as in the second week but with a dose of 15 ml of the homeopathic syrup (drug № 2). The registered values formed the data of group 3. On the designated day of the fourth week, 5 granules of the homeopathic preparation № 3 were placed and kept under the tongue until complete dissolution. The measured saliva pH values formed the data of group 4. All results were documented in an individual card for each volunteer. Based on the knowledge of the saliva buffer capacity and the quick drop in pH below the critical values after intake of simple carbohydrates and its slow rise to baseline, requiring 15 to 40 minutes (demonstrated by the Stefan curve), we decided to register the change in saliva pH at the 15th, 30th and 60th minute. The objective was to represent in a better way the dynamics of pH change and its possible role as a risk factor for the development of dental caries based on the prolonged acidity that develops after taking a homeopathic medication.

The statistical processing of the results included the determination of the number of existing drops in different groups, as well as their percentage to the total number in the groups. An ANOVA analysis was performed to verify the differences between the calculated mean values - relative proportion and mean value of the observed drop in saliva pH. For level of significance was adopted the *p* value - sig. <0.05. The data was analysed using SPSS-19 software.

RESULTS

Table 1 shows the relative proportion of individuals with a drop in saliva pH with and without a homeopathic medication intake and the corresponding minute of the measurement.

At the 15th minute following the intake of each of the three tested homeopathic preparations, a decrease in saliva pH was observed in 100% of the volunteers (group 2, 3 and 4, Table 1). A drop was reported in two subjects from the control group (Table 1). The pH level following the intake of a homeopathic drug remained lower than the baseline value until the end of the study (60th minute) in over 80% of the cases, while for group 4 the saliva pH remained lower in all subjects (Table 1). At the 30th minute recovery of baseline pH was observed in two subjects from

Table 1. Average proportion of individuals with a drop of salivary pH within an hour, with and without intake of homeopathic medication

Groups	15 th min.	30 th min.	60 th min.
	number % indiv.	number % indiv.	number % indiv.
Group 1 (control)	2 – 11.1%	1 – 5.6%	1 – 5.6%
Group 2 (medication 1, pellets)	18 – 100%	16 – 88.9%	16 – 88.9%
Group 3 (medication 2, syrup)	18 – 100%	18 – 100%	15 – 83.3%
Group 4 (medication 3, granules)	18 – 100%	18 – 100%	18 – 100%
Total	56 – 77.8%	53 – 73.6%	50 – 69.4%

Table 2. Average level of salivary pH drop in all groups in the relevant time intervals

GROUP	Average level of salivary pH drop						
	Basic level	15 th min.	Difference	30 th min.	Difference	60 th min.	Difference
Group 1	6.59	6.61	+0.02	6.63	+0.04	6.64	+0.06
Group 2	6.64	5.96	-0.68	6.15	-0.49	6.23	-0.41
Group 3	6.67	5.72	-0.94	5.90	-0.77	6.20	-0.47
Group 4	6.61	5.54	-1.07	5.79	-0.82	6.02	-0.59
Total	6.63	5.96	-0.67	6.12	-0.51	6.27	-0.35

Group 2 and at the 60th minute such recovery of baseline pH was recorded in three subjects from group 3.

Table 2 shows the mean value of saliva pH drop in each group at the measured minute intervals.

The highest mean drop in saliva pH, by 1.07, was recorded at the 15th minute in group 4 (Table 2). This trend was retained for the same group even at the 60th minute, with a mean value of pH drop by 0.59 (Table 2).

Table 3 also shows the drop in saliva pH for the tested minute intervals, indicating the number (and relative proportion) of patients in the relevant group with saliva pH below 5.5 and in the range 5.5-6.0.

Table 3. Number of individuals in the relevant groups with a drop of salivary pH under 5.5 and in the range of 5.5-6 at different time intervals

Group	Drop 15 th				Drop 30 th				Drop 60 th			
	under 5.5		5.5 – 6.0		under 5.5		5.5 – 6.0		under 5.5		5.5 – 6.0	
	num- ber	%	num- ber	%	num- ber	%	num- ber	%	num- ber	%	num- ber	%
1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
2	2	11.1%	4	22.2%	1	5.6%	4	22.2%	0	0.0%	5	27.8%
3	8	44.4%	2	11.1%	2	11.1%	7	38.9%	0	0.0%	5	27.8%
4	10	55.6%	5	27.8%	4	22.2%	9	50.0%	2	11.1%	4	22.2%

In group 4 at the 15th minute a mean drop in salivary pH below the critical value (5.5) was recorded in 10 subjects. At the 30th minute this number was 4, and at the 60th minute two persons indicated a value below the critical pH. The highest incidence was of subjects with a pH drop in the range of 5.5-6 for the same group and for all control time intervals (Table 3). In group 3, eight volunteers showed minute drop in saliva pH below 5.5 at the 15th and two of the subjects - at the 30th minute. In seven of the subjects in the same group a drop to the range of 5.5-6 was recorded at the 30th minute. At the 60th minute, this number dropped to five, with no registered values below 5.5. In group 2, at the 15th minute, two volunteers showed a drop below 5.5, though at the 60th minute none was in this range. In the same group at the 15th minute four of the respondents had a saliva pH drop to 5.5-6, and on the 60th minute for five individuals it remained in the same range.

An ANOVA analysis was also used to verify the differences between the calculated mean values of sa-

liva pH drop for the individual groups. The results obtained are shown in Table 4.

A significant drop in mean saliva pH values was recorded in groups 3 and 4 compared to the other two groups. The differences between group 3 and 4 are statistically insignificant. Group 2 ranked second in terms of drop in the mean pH values. In group 1, only one drop was recorded and therefore it was excluded from the analysis.

The comparison in pairs between all groups established the following dependencies: statistically significant difference in the mean pH drop at the 15th minute ($p < 0.00$, Table 4) was found in all oth-

er groups except for group 1. Statistically significant drops in pH were found at the 15th minute between group 2 and group 4 ($p < 0.003$). A difference in the mean pH drop between group 2 and group 3 ($p < 0.036$, Table 4) and between group 2 and group 4 ($p < 0.00$, Table 4) at the 30th minute was determined as significant. At the 60th minute the recorded mean values of pH drop in groups 2, 3 and 4 were statistically insignificant.

DISCUSSION

According to statistical analyses, on average 60% of the population in developed countries takes some form of medicine, of which about half are taken without prescription (16). In regard to children, 17% of them are given non-prescription cough medicines (17). Analgesics, cough medicines and multivitamins are the most commonly used non-prescription liquid medications (16, 18). It has been shown that these present a risk factor for the development of a dental caries process (19-23). The characteristics determining the cariogenic potential of the medication are the

Table 4. Difference in the average levels of salivary pH drop between the groups in the relevant time intervals

Time interval	Group	Compared with group	95% confidence interval		p*
			Lower limit	Upper limit	
15 th minute	Group 1	Group 2	0.286159	0.680507	0.000
		Group 3	0.456699	1.032190	0.000
		Group 4	0.646301	1.087032	0.000
	Group 2	Group 3	-0.069112	0.591334	0.185
		Group 4	0.105422	0.661244	0.002
		Group 3	Group 4	-0.219574	0.464019
30 th minute	Group 2	Group 3	0.013373	0.407460	0.036
		Group 4	0.068929	0.463016	0.009
	Group 3	Group 4	-0.135605	0.246718	0.561
60 th minute	Group 2	Group 3	-0.065230	0.286897	0.211
		Group 4	-0.041932	0.294710	0.137
	Group 3	Group 4	-0.155710	0.186821	0.856

*Empirical level of scientific significance (ANOVA)

sucrose content, the acidic nature of the drug and the individual salivation and salivary buffer capacity (20,24,25). Pierro et al. (21) mention the following characteristics as defining for the cariogenic potential of the drug: sugar content, frequency, dose, and route of administration.

Homeopathy is one of the most commonly used alternative medicine systems (5). Clinical experience in this field suggests that homeopathy is effective, relatively inexpensive, and patients are satisfied and rarely experience side effects (26). This type of medication has a convenient form, sweet and pleasant taste. The intake of a homeopathic medication should be at least 15 minutes before or after meals (6). During homeopathy treatment toothpastes without sweeteners, synthetic deodorants, bleaching agents, artificial colors or fragrances, detergents, and mint should also be used (6). The toothpastes should not contain fluorides (6). Homeopathic medications are prescribed with frequent intake - usually 3-4 times a day, and sometimes every two hours, on a regular basis and at night before bedtime (4). The results we obtained indicate that in such a situation this will cause drop in the saliva pH and maintenance of a long-lasting acidity over a long period of time (Tables 2 and 3).

According to Subramaniam and Kumar (4), the sugar content of homeopathic medical products can also affect oral health. Sugar in homeopathy, according to the authors, cannot be defined exactly as "hid-

den sugar". It is rather "ignored", "missed". Five pellets, taken 4 times a day, contain a total of 1 gram of sugar (28).

It has been found that adult patients prefer taking a homeopathic remedy instead of an antibiotic because they believe that the latter will suppress the immune system and prevent their healing. Many of them are mothers who apply the same beliefs to the treatment of their children (27). Children are more prone to recurring colds, and many parents prefer homeopathic remedies to allopathic ones because of the absence of side effects (4). In many families, homeopathy is a choice of treatment in the case of recurrent illnesses and/or chronic ones (colds, runny nose, diarrhea, asthma, nausea and vomiting, headache, mucosal inflammation, colic in babies, etc.) (4). Although parents are aware of the sweetness and taste of homeopathic medications, they probably do not pay attention to the possible effects that these granules may have on their children's oral health (4).

Subramaniam and Kumar have conducted a similar to our study to find the change in saliva pH after taking homeopathic drugs (4). Some of the drugs they studied are the same as ours. The drugs they use are chamomilla 2x and arsenic 2x. The results show a significant drop in saliva pH (below the critical 5.5), which coincides with the values we have obtained (Table 3). Prolonged maintenance of low salivary pH<5.5 when taking individual doses of

the homeopathic drug may be a potential threat to the dentition (Table 3). Depending on their composition, frequency of application, and length of therapy, the oral health of children undergoing regular homeopathic treatment should be monitored (4). For comparison between our study and Subramaniam and Kumar's, we have used the common chamomilla medication. The mean values of pH drop after use in their study are higher than those observed in ours: 1.07 (15th minute), 0.82 (30th minute), 0.59 (60th minute), while by Subramaniam and Kumar these are 1.72 (15th), 1.13 (30th), 0.88 (60th). Probably the reason is the different methodology used for collecting saliva samples and defining its pH.

We found a drop in saliva pH in 100% of the cases, and lower values remained in over 80% at the end of the first hour. Thus, we have confirmed the studied scientific hypothesis that the intake of these homeopathic drugs results in a rapid drop in salivary pH values and this drop remains within one hour. This also provides grounds to doubt a possible negative effect following the intake of certain homeopathic medications on the conditions in the oral cavity. We also found cases where recovery of baseline pH is observed - in two cases at the 30th minute and in three - at the 60th minute (Table 6 and 7). This fact

Table 5. pH changes within one hour – control

Subject	Initial value	15 th minute	30 th minute	60 th minute
1	6.2	6.4	6.2	6.2
2	6.8	6.8	6.8	6.8
3	6.4	6.6	6.6	6.6
4	6.4	6.4	6.6	6.6
5	6.6	6.6	6.6	6.8
6	6.4	6.4	6.4	6.4
7	6.8	7.0	7.0	7.0
8	6.6	6.6	6.6	6.6
9	7.0	7.0	6.8	7.0
10	6.2	6.2	6.4	6.2
11	6.4	6.4	6.4	6.4
12	6.4	6.4	6.6	6.6
13	6.6	6.6	6.6	6.6
14	6.6	6.4	6.6	6.6
15	6.8	6.8	6.8	7.0
16	6.6	6.8	6.6	6.6
17	7.0	6.8	7.0	6.8
18	6.8	6.8	6.8	6.8

Table 6. pH changes within one hour – pellets

Subject	Initial value	15 th minute	30 th minute	60 th minute
1	6.2	5.5	5.8	5.8
2	6.6	6.0	6.2	6.2
3	6.4	5.4	5.8	5.8
4	6.6	6.2	6.4	6.4
5	6.8	6.2	6.4	6.4
6	6.6	5.8	6.2	6.2
7	7.2	6.0	6.2	6.2
8	6.4	6.0	6.4	6.4
9	7.0	6.8	7.0	7.0
10	6.2	5.5	5.5	5.8
11	6.6	6.0	6.0	6.2
12	6.4	5.4	5.4	5.8
13	6.6	6.0	6.2	6.4
14	6.6	6.2	6.2	6.2
15	6.8	6.2	6.2	6.4
16	6.6	5.5	5.8	5.8
17	7.0	6.0	6.2	6.4
18	7.0	6.6	6.8	6.8

we attribute to differences in the saliva properties in different individuals - speed, quantity, composition, and buffer capacity.

Low saliva pH levels are detected after the intake of the homeopathic syrup. We suppose this is

Table 7. pH changes within one hour – syrup

Subject	Initial value	15 th minute	30 th minute	60 th minute
1	6.8	5.4	5.6	6.2
2	6.6	6.2	6.4	6.8
3	6.2	5.2	5.4	5.8
4	6.8	6.0	6.2	6.4
5	6.8	5.4	5.6	5.8
6	7.0	6.2	6.4	6.8
7	6.4	6.2	6.2	6.4
8	6.6	5.4	5.8	6.2
9	7.4	6.0	6.2	6.4
10	6.2	5.4	5.8	5.8
11	6.4	5.8	6.0	6.4
12	6.6	5.2	5.4	5.8
13	6.4	6.0	6.0	6.2
14	6.6	5.4	5.6	6.0
15	6.6	5.8	5.8	6.0
16	6.8	6.2	6.2	6.4
17	6.8	5.2	5.6	5.8
18	7.0	6.0	6.0	6.4

Table 8. pH changes within one hour – granules

Subject	Initial value	15 th minute	30 th minute	60 th minute
1	7.6	6.4	6.8	6.8
2	6.4	5.4	5.8	5.8
3	6.2	5.0	5.2	5.4
4	6.0	5.2	5.4	5.8
5	6.8	5.4	5.8	6.4
6	6.6	5.4	5.6	6.0
7	6.4	5.8	5.8	6.0
8	6.4	6.0	6.0	6.2
9	6.8	5.8	6.0	6.0
10	7.0	6.0	6.4	6.4
11	6.6	5.4	5.6	6.0
12	6.6	5.0	5.4	5.8
13	6.2	5.2	5.2	5.4
14	6.8	5.4	5.8	6.0
15	6.8	5.4	5.8	5.8
16	6.2	5.6	5.6	6.0
17	6.8	5.8	6.2	6.4
18	6.8	5.6	5.8	6.2

due to its high sucrose content, its low viscosity, and its acidic endogenous pH. These factors have been proven to be crucial in a number of similar studies of conventional medications and especially pediatric liquid ones (19-25). The most significant drop in pH we determined was that following intake of homeopathic chamomile extract granules. Perhaps the reason for this is the longer retention in the oral cavity until full absorption. These facts provide an idea for a future study in this field and such on homeopathic medications - their composition, endogenous pH, titratable acidity, effects of different viscosity and form of medications.

There is a high incidence of pH drops below the critical 5.5 with most cases after chamomile use - more than 50% at the 15th minute, and in some volunteers this low value remains an hour later (Tab. 3). Therefore there is predominance of demineralisation processes in the oral cavity, which is a precondition for the initiation of a dental caries process. We believe that, combined with poor eating habits, poor oral hygiene and/or genetic predisposition, this could help increase the risk of dental caries.

CONCLUSION

The present study finds a significant drop in salivary pH following the intake of some homeopathic medications. An alarming fact is also the failure of pH to recover its baseline values even 60 minutes after taking the medication, and in a significant number of cases the pH remains in the range of 5.5 to 6. This, along with the specific rules for the intake of homeopathic medications and their use at the patient's own discretion without prescription, makes them a factor in the risk assessment system for the development of a caries process. Healthcare professionals and patients should apply prophylactic measures to limit the potential side effects that sugar-containing medications, including homeopathic ones, may have on the oral health.

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