Effect of Xylitol Chewing Gum on Salivary Mutans Streptococci

Soeherwin Mangundjaja, Ibrahim-Auerkari Elza, Resti, Agustina, Prihadini
Department of Oral Biology Faculty of Dentistry Universitas Indonesia

ABSTRACT
In the attempt to lower the sugar consumption in population is to exchange the number of sugar sweeteners which manufacture produced for used in foods, drinks and candy with non-sugar sweetener as xylitol. Xylitol is effective as non-cariogenic substitutes for use in place of glucose. Objectives: A clinical trial was carried out to investigate the effect of sugar candy containing xylitol inhibiting the growth of the salivary mutans streptococci for a period one week consumption. Methods: Twenty respondents participated as the subjects on the clinical trial, conducting two times of treatment as follows: twenty as treatment groups before and after chewing xylitol chewing gum and the twenty subjects as control groups before and after chewing with a non-xylitol chewing gum. Saliva samples were collected before and after chewing xylitol chewing gum and with a non-xylitol chewing gum. A serial dilution was made, followed by inoculating on TYS20B medium (Shaeken, M.J.M, van der Hoeven, J.S and Franken, H.C.M, 1986). Data which were obtained from colony forming units of salivary mutans streptococci grew on the TYS20B medium before and after chewing xylitol chewing gum were analyzed in a descriptive and “t” test. Results: showed that there is no significance in the average amount of Streptococcus mutans colonies between before and after chewing non-xylitol chewing gum. However, a significant difference was found respectively as results before and after chewing with xylitol chewing gum. Conclusion: Therefore it could be concluded that xylitol chewing gum is effective in inhibiting the growth of the salivary mutans streptococci. Hence, it can be used in preventing caries risk in the future.(This study was supported by The PT Lotte Indonesia).

Key words: Xylitol Chewing Gum - Salivary Mutans Streptococci

INTRODUCTION
Manufactures produced the number of sugar sweeteners that are proved for used in foods, drinks and candy. These sugar sweeteners are generally classed as cariogenic. It is known that consumptions of sugar sweeteners play a role in developmental of caries.
Dental caries, which is known the most common ailment of the mouth, is found to be caused by mutans streptococci. Streptococcus mutans has long been associated with the ability to form plaque on its ability to synthesize extra cellular polysaccharides from sucrose. Sucrose could be fermented by mutans streptococci which harbored in the dental plaque and acid production of mutans streptococci could possibly lead to demineralization of the teeth.
Xylitol is un-fermentable artificial sugar. It is simple sugar alcohol(polyol) of five carbons or pentitol type, occurring naturally in small quantities in fruits,
berries, other plant parts as well as a normal intermediate metabolite of the human carbohydrate metabolism\textsuperscript{2,3,4}.

Xylitol is isocaloric with sucrose and have cooling taste. At present, it is used as sweeteners in candies, chewing gum, substitute sugar, pharmaceuticals and dentifrices.

**OBJECTIVE**

The aim of this study is to investigate the effectiveness of xylitol chewing gum on the growth of salivary mutans streptococci for a period one week consumption.

**MATERIAL and METHODS**

This study using Xylitol chewing gum Lotte as xylitol containing candy and sucrose containing candy as control. The analyzed unit was Salivary mutans streptococci. TYS20B medium (Shaeken, M.J.M, van der Hoeven, J.S and Franken, H.C.M, 1986)\textsuperscript{5} for the growth of *Streptococcus mutans*.

Twenty respondents were participated as research subject: 20 subjects treated two times with twenty as treatment groups before and after consuming anchovy of *Stelophorus commersonii* and the twenty subjects as control groups before and after consuming non-anchovy of *Stelophorus commersonii*.

**The collecting data mechanism as below:**

1. Respondents fill and signature the informed consent.
2. Before and after chewing with non-xylitol chewing gum and Xylitol chewing gum, non-anchovy of *Stelophorus commersonii*

Respondents chew sterile paraffin to obtain considerable amount of saliva and the saliva is collected. Two hours after chewing the gum, saliva are collected.

3. Saliva samples, then make a serial dilution
4. 1 ml of saliva is diluted with 9 ml sterile saline to make a serial dilution and from the tube of 1000 fold dilution, is then take 0.1 ml of solution to inoculate in the selective medium of TYS20B (Shaeken et al, 1986)
5. All samples are incubated in anaerobic jar at temperature of 37\textdegree Celsius for 3 X 24 hours..
6. Subjects were treated with Lotte xylitol chewing gum and sucrose-containing candy, 3 X 3 candies daily for a period of one week consumption.
7. The Colony Forming Units (CFU) of *Streptococcus mutans* which grew in the TYS20B medium are then counted and recorded.
Statistical analysis

Data which were obtained from colony forming units of salivary mutans streptococci grew in TYS20B medium before and after treatment were analyzed in a descriptive and “t” test.

RESULTS

The results of analyzed colony forming units (CFU) amount of *Streptococcus mutans* which grew on TYS20B media before and after chewing with xylitol containing candy and non-xylitol containing candy are shown in table 1.

Table 1. Mean and Standard Deviation (SD) of CFU *Streptococcus mutans* on treatment with xylitol containing candy and non-xylitol.

<table>
<thead>
<tr>
<th></th>
<th>N=20</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before-non xylitol</td>
<td>410.50</td>
<td>234.90</td>
<td></td>
</tr>
<tr>
<td>After-non xylitol</td>
<td>397.00</td>
<td>346.12</td>
<td></td>
</tr>
<tr>
<td>Before-xylitol</td>
<td>387.75</td>
<td>320.91</td>
<td></td>
</tr>
<tr>
<td>After-xylitol</td>
<td>89.25</td>
<td>83.08</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 shows that CFU of *S.mutans* after chewing with xylitol chewing gum (X=89.25 +/- SD = 83.08) is lower than before chewing with xylitol chewing gum (X=387.75 +/- SD=320.91). The CFU of *S.mutans* after chewing with xylitol chewing gum (X=89.25 +/- SD = 83.08) is also lower than after chewing with non-xylitol chewing gum (X=397.00 +/- SD= 346.12).

The significance of the effectiveness of xylitol chewing gum, a “t” test analysis was done and the results can be seen in table 2. Significant level was accepted when p –level at 5% was lower than 0.05 (p<0.05).

Table 2. “t” test on treatment with xylitol chewing gum and non-xylitol

<table>
<thead>
<tr>
<th>Difference of Treatment</th>
<th>Df</th>
<th>t</th>
<th>p</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before-After Chewing (non-xylitol)</td>
<td>18</td>
<td>0.295</td>
<td>0.956</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Before-After Chewing (xylitol)</td>
<td>18</td>
<td>3.560</td>
<td>0.005</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Before chewing (non-xylitol – xylitol)</td>
<td>18</td>
<td>0.450</td>
<td>0.810</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>After chewing (non-xylitol – xylitol)</td>
<td>18</td>
<td>2.980</td>
<td>0.010</td>
<td>P&lt;0.05</td>
</tr>
</tbody>
</table>

No significant difference was found between the CFU of *S. mutans* before and after chewing with non-xylitol chewing gum, where p-level at 5% was 0.956 and t-value was 0.295.

As expected the amount of CFU salivary mutans streptococci showed very significant difference the CFU of *S.mutans* before and after chewing with xylitol chewing gum, where p-level at 5% was 3.351 and t-value was 0.005. When CFU of *S.mutans* before and after chewing with non-xylitol chewing gum
compare to before chewing with xylitol chewing gum the t-value 0.450 where p-level at 5% was 0.810 meaning that there is no significant difference.

After chewing with non-xylitol chewing gum compared to after chewing with xylitol chewing gum also showed significant difference (t-value was 2.980 where p-level at 5% was 0.010)

**DISCUSSION**

The results in table 1 had shown that the amount of CFU of *Streptococcus mutans* after chewing with xylitol chewing gum lower than the amount of CFU of *Streptococcus mutans* after chewing with non-xylitol chewing gum.

After chewing non-xylitol chewing gum the CFU of *Streptococcus mutans* decreased comparing with the CFU of *Streptococcus mutans* before chewing with non-xylitol chewing gum. Considering its un-fermentable characteristic, xylitol could prevent bacteria from producing acid.

Due to this condition as un-fermentable sugar, the presence of xylitol in oral might reduce the population of mutans streptococci. This is in accordance to previous findings suggestion that sugar alcohol like xylitol are metabolized poorly or not at all by oral bacteria, and do not produce a pH drop. It was found that the pH drop after chewing xylitol gum was very small or not existing.

The results from table 2 showed that where was highly significance difference in the average amount of *Streptococcus mutans* colonies between before and after chewing with xylitol chewing gum. From the analysis can be conclude that the xylitol chewing gum is effective in habiting the growth of salivary mutans streptocioci.

The detailed mechanism itself which xylitol shows its anti-cariogenic effect is still not well known although several hypothesis have been proposed. If xylitol has replaced sugar in snacks consumption, the frequency of acid production on the enamel has been lowered. If chewing gum containing xylitol, the saliva flow would be stimulated and encouraging re-mineralization.

The other study using chewing gum containing sorbitol was conducted for considering the effect of chewing gum on the growth of plaque mutans streptococci and had concluded that chewing gum containing sorbitol could decreased the amount of *Streptococcus mutans* colonies and caries activity.

Another mechanism is by metabolic inhibition. The microorganism attempt to get rid of the non metabolically xylitol, which demanding on energy, creating a negative energy cycle in which the bacteria loose energy without producing acid.

As this process tend to reduce the growth rate and acid production, it can possibly lead to reduced level of mutans streptococci and caries in habitual users of xylitol containing products.
CONCLUSION

There was highly significance difference in the average amount of *Streptococcus mutans* colonies between before and after chewing with xylitol chewing gum and non-xylitol chewing gum. The Candy containing xylitol is effective in habitating the growth of salivary mutans streptococci. Hence, it can be used in preventing caries risk in the future.

ACKNOWLEDGEMENT

The authors would like to thank PT LOTTE INDONESIA which has been supporting us from the very first beginning of the research.

REFERENCES


12. Xylitol, Sugar substitutes and other Dietary Factors. Available at http://www.db.od.mah.se

Presented at Asian Oral Health Care (AHAC) Scientific Meeting and Exhibition Conjunction with 2nd Asean Meeting on Dental Public Health (AMDPH) Jakarta November 20 – 22, 2008 Balai Kartini Jakarta Indonesia