COMPARISON OF ORAL HYGIENE STATUS FOLLOWING XYLITOL AND NON-XYLITOL CHEWING GUM USE AMONG STUDENTS OF SMP NEGERI 1 PADANG PARIAMAN

Aflinda Yenti[1*], Eka Sukanti[2], Damhuji[3], Ika Ifitri[3]
[1,2,4]*Politeknik Kesehatan Padang*
[3] *Politeknik Kesehatan Pontianak*

**Corrresponding author: yenti.aflin*@gmail.com

Abstract

Dental and oral health problems are among the most common health issues experienced by the community, with dental caries being the most prevalent. One of the main causes of dental caries is the accumulation of dental plaque. One effort to control plaque formation is chewing gum. This study aimed to determine the differences in oral hygiene status (Plaque Index) between chewing xylitol gum and non-xylitol gum among seventh-grade students of SMP Negeri 1 V Koto Kampung Dalam, Padang Pariaman Regency. This study employed a quasi-experimental design with a pre-test and post-test approach. The study population consisted of all seventh-grade students at SMP Negeri 1 V Koto Kampung Dalam, Padang Pariaman Regency, totaling 91 students. A total sampling technique was applied, and 80 students who met the inclusion criteria were selected as participants. Data were collected through plaque index examinations. Data analysis included univariate and bivariate analyses. Prior to hypothesis testing, a normality test was conducted and revealed that the data were not normally distributed. Therefore, the non-parametric Mann-Whitney U test was used for statistical analysis. The results showed that the mean oral hygiene score in the xylitol gum group decreased from 1.665 before intervention to 0.652 after intervention, with a mean difference of 1.013. In the non-xylitol gum group, the mean oral hygiene score decreased from 1.702 to 1.152, with a mean difference of 0.55. The findings indicated a significant difference in oral hygiene status between respondents who chewed xylitol gum and those who chewed non-xylitol gum, with an Asymp. Sig. value of less than 0.05. Xylitol gum was more effective in reducing the Plaque Index than non-xylitol gum, as evidenced by a greater mean reduction (1.013 compared to 0.55).

Keywords: Oral Hygiene, Chewing Gum, Plaque, Xylitol.

1. INTRODUCTION

Health is fundamentally one of the most essential aspects of human life, encompassing both physical and mental well-being.[1] Health can be achieved through health development efforts aimed at increasing awareness, willingness, and the ability of individuals to lead healthy lives, thereby attaining an optimal level of health.[2] In addition to general physical health, oral and dental health also requires significant attention.[1] Oral and dental health refers to a healthy condition of the hard and soft tissues of the teeth, as well as related structures within the oral cavity.[3] Poor oral and dental health can negatively affect daily life, including a decline in general health, reduced self-confidence, and disruptions in school and workplace activities.[4]

According to data from the World Health Organization (WHO), nearly 3.5 billion people worldwide suffer from oral and dental diseases.[5] Meanwhile, data from the Indonesian Basic Health Research (Riskesdas) 2013 indicated that 25.9% of the Indonesian population reported oral and dental health problems.[6] This figure increased substantially to 57.6% in 2018.[7] In West Sumatra Province, the

prevalence of oral and dental health problems rose from 22.2% in 2013 to 58.5% in 2018.[8] In Padang Pariaman Regency, the prevalence reached 27.6%.[6]

Adolescence is a transitional developmental stage between childhood and adulthood, characterized by biological, cognitive, and socio-emotional changes.[8] During this period, adolescents often experience various health problems, including oral and dental health issues.[9] Data from Riskesdas 2018 showed that the prevalence of oral and dental health problems among children aged 10-14 years reached 55.6%.[7] This represented an increase compared to Riskesdas 2013, which reported a prevalence of 25.2% in the same age group.[6] Among the various oral health problems, dental caries remains the most prevalent.[10] One of the primary causes of dental caries is dental plaque.[1]

Dental plaque is a soft deposit that accumulates on tooth surfaces and consists of various microorganisms that live and proliferate within the oral cavity. Plaque formation commonly occurs when individuals neglect proper oral hygiene practices.[11] Plaque can be removed through both mechanical and chemical methods.[12] Mechanical methods include toothbrushing with toothpaste, whereas chemical methods involve the use of anti-plaque agents.[14]

One anti-plaque agent that has gained considerable attention is xylitol-containing chewing gum. Chewing gum serves as a delivery medium, while xylitol functions to reduce harmful bacteria that accumulate and contribute to plaque formation.[14] Xylitol is a naturally occurring five-carbon sugar alcohol derived from birch trees. It interferes with the metabolism of *Streptococcus mutans* by preventing the fermentation process, thereby reducing bacterial growth and activity.[14] As an alternative sweetener, xylitol possesses a sweetness level comparable to sucrose and exhibits anticariogenic properties.[15] In addition, xylitol inhibits plaque-forming bacteria, promotes remineralization, and stimulates salivary flow.[16]

Chewing xylitol gum increases salivary secretion within the oral cavity. Enhanced salivary flow helps reduce bacterial populations, thereby maintaining oral cleanliness and protecting teeth from decay. Previous studies have shown that consuming xylitol gum at a dosage of 3.9-30 g/day for 1-3 years can reduce the incidence of dental caries by 30-82%.[15] Furthermore, chewing xylitol gum three to four times daily for at least five minutes after meals has been reported to inhibit plaque accumulation.[17]

Previous studies investigating the effectiveness of xylitol gum in plaque reduction demonstrated that chewing xylitol gum at a dosage of 3.4-10 g/day is effective in decreasing plaque formation. These findings suggest that consuming approximately three to seven pieces of xylitol gum per day is beneficial for oral health.[18] Another study reported a reduction in the mean plaque index from 15.00 before intervention to 8.36 after chewing xylitol gum, indicating a decrease of 6.64 points in plaque index scores.[19]

SMP Negeri 1 V Koto Kampung Dalam is located on Bagindo Enong Street, Campago, V Koto Kampung Dalam District, Padang Pariaman Regency, West Sumatra Province, Indonesia. The school has a total enrollment of 309 students, consisting of 175 male and 134 female students. Students aged 11-14 years are primarily enrolled in Grade VII, with a total of 91 students in this grade level.

The school is located approximately 900 meters from the Kampung Dalam Community Health Center (Puskesmas), with an estimated travel time of about two minutes. Although the school receives annual visits from the health center for health education and examinations, including dental caries screening, eye examinations, ear examinations, and measurements of height and weight, students have never undergone an assessment of oral hygiene status. Therefore, research evaluating oral hygiene status and the effectiveness of xylitol chewing gum among Grade VII students at SMP Negeri 1 V Koto Kampung Dalam is considered necessary.

2. METHODS

This study employed a quasi-experimental research design with a pre-test and post-test approach. One day prior to data collection, participants were instructed not to eat or brush their teeth for two hours before the study commenced, although drinking plain water was permitted.

Data collection was assisted by three trained enumerators. Before the study began, the researcher conducted a calibration session with the enumerators to standardize the assessment of oral hygiene status using the Plaque Index. The study was initiated with the group assigned to chew xylitol gum.

In the first stage, participants were divided into four groups, with each group supervised by one enumerator. In the second stage, baseline plaque index measurements were obtained. In the third stage, participants were instructed to chew two pieces of xylitol gum for five minutes. The chewing process was performed sequentially using the right posterior teeth, anterior teeth, and left posterior teeth. After five minutes, participants were instructed to discard the gum and continue their regular classroom learning activities. During the following hour, participants were instructed not to eat, drink, or rinse their mouths.

In the fourth stage, a post-intervention plaque index assessment was conducted one hour after gum consumption using the same examination procedures as the baseline assessment. On the second day, the same procedures were repeated with the non-xylitol gum group. Participants chewed two pieces of non-xylitol gum, and both pre-test and post-test plaque index assessments were performed following the identical protocol used in the xylitol gum intervention.

3. RESULTS

The study participants were divided into two groups. The first group consisted of 40 respondents who chewed xylitol gum, while the second group consisted of 40 respondents who chewed non-xylitol gum. The allocation of the 80 respondents into the two groups was performed using block randomization (simple computer-generated randomization) to ensure equal group sizes.

The xylitol gum used in this study was Lotte Xylitol. The sweetener composition in every two pieces of gum consisted of xylitol (39%), maltitol (34%), aspartame (0.15%), and maltitol syrup (0.07%), along with gum base, flavoring agents, thickeners, and food colorings.

The non-xylitol gum used was Big Babol, which contains approximately 3 grams of sugar per serving (serving weight approximately 44 grams), equivalent to about 35-45 grams of sugar per 100 grams. Other ingredients include gum base, glucose syrup, sorbitol, glycerin, citric acid, flavoring agents, fruit extracts, and food colorings.

The results of the study are presented as follows.

3.1 Mean Oral Hygiene Status Before and After Chewing Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman

***Table 1**. Mean Oral Hygiene Status Before and After Chewing Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman*

Group	Plaque Index (PI)		Difference
	Before	After	
Xylitol	1,665	0,652	1,013

The mean oral hygiene status before chewing xylitol gum was 1.665, while the mean oral hygiene status after chewing xylitol gum was 0.652, resulting in a mean difference of 1.013.

The reduction in the mean oral hygiene score after chewing xylitol gum may be attributed to the ability of chewing gum to remove food debris adhering to the tooth surface during mastication. The chewing process, which was performed for five minutes, stimulates saliva production in the oral cavity, thereby enhancing the buffering capacity of saliva and reducing plaque acidity. In addition, chewing gum contributes to the mechanical cleaning of tooth surfaces through a self-cleansing effect. Xylitol-containing gum may also reduce the number of Streptococcus mutans by altering its metabolic activity, promoting remineralization, and inhibiting plaque formation.

Chewing gum has been shown to increase salivary flow in the oral cavity. Saliva functions as a natural cleansing agent by removing food residues that can be readily fermented by oral bacteria, thereby reducing bacterial populations and helping to maintain oral cleanliness.[15] Furthermore, saliva possesses buffering properties that help maintain a neutral oral environment, thereby reducing plaque acidity caused by dietary sugars.[20] Xylitol can interfere with the utilization of sucrose by Streptococcus mutans, preventing its fermentation by these bacteria. As a result, xylitol reduces the growth and activity of Streptococcus mutans, promotes remineralization, and inhibits plaque formation.[11]

The findings of the present study are consistent with those of previous research, which reported a reduction in the mean plaque index from 15.00 before chewing xylitol gum to 8.36 after the intervention.[19]

3.2 Mean Oral Hygiene Status Before and After Chewing Non-Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman

***Table 2**. Mean Oral Hygiene Status Before and After Chewing Non-Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman*

Group	Plaque Index (PI)		Difference
	Before	After	
Non *Xylitol*	1,702	1,152	0,55

The mean oral hygiene status before chewing non-xylitol gum was 1.702, while the mean oral hygiene status after chewing non-xylitol gum was 1.152, resulting in a mean difference of 0.550.

The reduction in the mean oral hygiene score after chewing non-xylitol gum may also be attributed to the stimulation of salivary flow during chewing, which helps remove food debris adhering to tooth surfaces. However, the decrease in oral hygiene scores observed after chewing non-xylitol gum was relatively small compared to that of xylitol gum. This may be due to the sugar content of non-xylitol gum, which is sweet and sticky, allowing bacteria to adhere more easily to tooth surfaces after consumption. The sugar contained in non-xylitol gum can serve as a nutrient source for oral bacteria and accelerate plaque formation. Oral bacteria metabolize sugars into acids that can damage tooth enamel.[21]

Sucrose is a readily fermentable sugar that can be converted into sticky macromolecules, enabling plaque to adhere firmly to tooth surfaces and reducing the ability of saliva to neutralize and wash away acids.[15] The findings of this study are consistent with previous research, which reported a smaller reduction in the mean plaque index among individuals who chewed sucrose-containing gum compared to those who chewed xylitol gum.[18]

3.3 Differences in Oral Hygiene Status Following Xylitol and Non-Xylitol Gum Consumption Among Students of SMP Negeri 1 Padang Pariaman

***Table 3.** Results of the Mann-Whitney U Test on Differences in Oral Hygiene Status Following the Consumption of Xylitol and Non-Xylitol Gum Among Students of SMP Negeri 1 Padang Pariaman*

	Treatment	N	Mean	*Asymp. Sig*
Plaque Index	*Xylitol*	40	30,46	0,00
	Non *Xylitol*	40	50,54	

The results of the Mann-Whitney U test showed an Asymp. Sig. value of less than 0.05, indicating that the null hypothesis (H_0) was rejected and the alternative hypothesis (H_a) was accepted. This finding demonstrates a statistically significant difference in oral hygiene status following the consumption of xylitol and non-xylitol gum among seventh-grade students of SMP Negeri 1 Padang Pariaman.

Both xylitol and non-xylitol gum were associated with improvements in oral hygiene status and reductions in plaque index scores. This effect may be attributed to the chewing process, which stimulates salivary secretion and promotes a self-cleansing effect on tooth surfaces. However, the reduction in plaque index was greater among participants who chewed xylitol gum than among those who chewed non-xylitol gum. This difference may be explained by the sugar content of non-xylitol gum, which can adhere to tooth surfaces and accelerate plaque formation. Plaque can begin to reform as early as one hour after tooth cleaning.[22] Therefore, even after plaque removal, its reaccumulation may occur rapidly.

One effective strategy for preventing or controlling plaque formation is limiting the consumption of carbohydrate-rich foods, particularly those containing sucrose.[11] Foods and products that do not contain sucrose, such as xylitol gum, are considered more beneficial for oral health. Xylitol gum has been shown to possess antibacterial properties that inhibit plaque formation. Furthermore, chewing xylitol gum stimulates salivary flow, facilitating the removal of food debris and reducing plaque accumulation.[1] Chewing sugar-free gum after meals has also been reported to increase salivary secretion, which helps eliminate bacteria from the oral cavity.[23]

The findings of the present study are consistent with previous research demonstrating that chewing xylitol gum reduced plaque accumulation by 46%, whereas only a 9% reduction was observed among individuals who chewed conventional gum. These results indicate that xylitol gum is more effective in reducing plaque accumulation than regular chewing gum.[24] Other quasi-experimental studies have similarly reported a significant reduction in plaque index following the consumption of xylitol gum ($p < 0.05$).[25]

In addition, chewing xylitol gum has been shown to significantly increase salivary pH. An elevated salivary pH contributes to the inhibition of plaque formation and supports the maintenance of oral health.[26] Although all types of chewing gum, including non-xylitol gum, may contribute to plaque reduction through increased salivary flow and mechanical cleansing, their effect on plaque index reduction is generally smaller than that observed with xylitol-containing gum.[27]

4. CONCLUSION

Based on the findings of this study, it can be concluded that there was a statistically significant difference in oral hygiene status following the consumption of xylitol and non-xylitol gum among the respondents, as indicated by an Asymp. Sig. value of less than 0.05. Xylitol gum was found to be more effective in reducing the Plaque Index than non-xylitol gum. The mean reduction in plaque index observed in the xylitol gum group was 1.013, whereas the mean reduction in the non-xylitol gum group was only 0.550.

REFERENCES

[1] Marlindayanti, Nur Adiba, H., Ismalayani, & Yonan. *Manajemen pencegahan karies*. Kediri: Lembaga Chakra Brahmanda Lentera. (2022.

[2] Nugraheni, H., Wiyatini, T., & Wiradona, I. *Buku ajar kesehatan masyarakat dalam determinan sosial budaya*. Yogyakarta: Deepublish. 2018.

[3] Kementerian Kesehatan RI. *Peraturan Menteri Kesehatan Republik Indonesia Nomor 89 Tahun 2015 tentang Upaya Kesehatan Gigi dan Mulut*. Jakarta: Kementerian Kesehatan RI. 2015.

[4] Kementerian Kesehatan RI. *Situasi kesehatan gigi dan mulut*. Jakarta Selatan: Pusat Data dan Informasi Kementerian Kesehatan RI. 2019.

[5] World Health Organization. *Global oral health status report: Towards universal health coverage for oral health by 2030*. Geneva: World Health Organization. 2022.

[6] Badan Penelitian dan Pengembangan Kesehatan. *Riset Kesehatan Dasar (Riskesdas) 2013*. Jakarta: Kementerian Kesehatan RI. 2013.

[7] Kementerian Kesehatan RI. *Hasil Riset Kesehatan Dasar (Riskesdas) 2018*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan. 2018.

[8] Ekasari, M. F. *Latihan keterampilan hidup bagi remaja*. Malang: Wineka Media. 2022.

[9] Wiarto, G. *Memahami pribadi remaja*. Bogor: Guepedia. 2022.

[10] Nismal, H. *Islam dan kesehatan gigi*. Jakarta: Pustaka Al-Kautsar. 2018.

[11] Putri, M. H., Herijulianti, E., & Nurjannah, N. *Ilmu pencegahan penyakit jaringan keras dan jaringan pendukung gigi*. Jakarta: EGC. 2018.

[12] Riolina, A., & Oktaviani, A. *Kesehatan gigi masyarakat*. Yogyakarta: Muhammadiyah University Press. 2022.

[13] Elina, L., & Wahyuni, S. Pengaruh pengunyahan permen karet yang mengandung sukrosa dan permen karet yang mengandung xylitol terhadap indeks plak gigi. *Jurnal Keperawatan, 12*, 5. 2017.

[14] Praja, D. I. *Zat aditif makanan: Manfaat dan bahayanya*. Yogyakarta: Garudhawaca. 2015.

[15] Yulianto, W. A. *Pangan fungsional untuk kesehatan*. Yogyakarta: Deepublish. 2019.

[16] Sutanti, V., *Kariologi dan manajemen karies*. Malang: UB Press. 2021.

[17] Ruslan, E. *Kerusakan gigi pasca perawatan endodontik* (2016 ed.). Surabaya: Airlangga University Press. 2016.

[18] Saputra, B.,Wicaksono, D.A.dan Khoman, J.A. Efektifitas permen karet xylitol dalam menurunkan plak. Jurnal e-Gigi, 9(2), 139–145. 2021

[19] Zulkaidah, U., Arsad, A., Putri, N. M., Dirman, R., & Yulistina, Y. Efektivitas mengunyah permen xylitol dapat mengurangi indeks plak siswa kelas IV. *Journal of Pharmaceutical and Health Research, 4*(2), 265–271. 2023.

[20] Pertiwiningsih, B. I. *Kesehatan masyarakat kesehatan gigi dan mulut*. Surabaya: PT. Borobudur Inspira Nusantara. 2016.

[21] Eka, R. *Rahasia mengetahui makanan berbahaya*. Jakarta: Titik Media Publisher. 2013.

[22] Kasuma, N. *Plak gigi*. Padang: Andalas University Press. 2016.

[23] Naviri, T. *1001 makanan sehat*. Jakarta: PT Elex Media Komputindo. 2015.

[24] Söderling, E., & Pienihäkkinen, K. Effects of xylitol chewing gum and candies on the accumulation of dental plaque: A systematic review. *Clinical Oral Investigations, 26*(1), 119–129. https://doi.org/10.1007/s00784-021-04225-8. 2022.

[25] Naurah SNH, Keumala CR. Pengaruh mengunyah permen karet xylitol terhadap penurunan indeks plak pada siswa di SD Negeri Gue Gajah Kabupaten aceh Besar J. Kesehatan Gigi dan mulut, 7(2), 2025

[26] Asmalinda W, Sapada E, Agustin Y. Peningkatan pH saliva perokok aktif menggunakan permen karet xylitol, j.kesehatan, 2025

[27] Keukenmeester, Effects of sugar-free polyol chewing gums on gingival inflammation: a systemic review