COMPARATIVE ANALYSIS OF APPLE AND JICAMA CHEWING ON DEBRIS INDEX REDUCTION IN ELEMENTARY SCHOOL STUDENTS

Arnetty[1*], Cici Idela[2], Zulfikri[3], Ika Ifitri[4], Adinda Salsabila[5]
[1,2,3,4]*Department of Dental Health, Poltekkes Kemenkes Padang, Padang, Indonesia*

**Corresponding author:arnetty@gmail.com*

Abstract

High prevalence of oral health problems in Indonesia is frequently triggered by debris accumulation on tooth surfaces. Mechanical self-cleansing through chewing fibrous and water-rich fruits such as apples and jicama serves as a natural approach to improving oral hygiene. This study aimed to evaluate and compare the differences in the debris index before and after chewing apples and jicama among fifth-grade students at SDN 07 Teladan Bukittinggi. A quasi-experimental research design with a pretest-posttest approach was conducted involving 50 fifth-grade students selected through total sampling. Participants were divided into two equal groups of 25: one group chewed 100 grams of apple and the other chewed 100 grams of jicama, following a standardized 32-cycle bilateral chewing protocol. Debris index was assessed using the Green and Vermillion criteria before and after the intervention. Data were analyzed using Paired Sample T-Test and Independent Sample T-Test with a significance level of $\alpha = 0.05$. Chewing apples significantly decreased the mean debris index from 1.576 (moderate) to 0.620 (good) with a mean reduction of 0.956 ($p = 0.000$). Similarly, chewing jicama significantly reduced the mean debris index from 1.528 (moderate) to 0.556 (good) with a mean reduction of 0.972 ($p = 0.000$). However, the Independent Sample T-Test revealed no statistically significant difference in debris index reduction between the two fruit groups ($p = 0.893$). Both apple and jicama chewing are equally effective as natural self-cleansing mechanisms in significantly lowering the debris index in elementary school students. Incorporating fibrous fruit consumption is highly recommended as a practical preventive measure for maintaining children's oral hygiene.

Keywords: Apple, Chewing, Debris Index, Jicama, Oral Hygiene

1. INTRODUCTION

Oral and dental health issues remain a major global public health burden, affecting billions of individuals worldwide and significantly reducing quality of life through functional impairment and chronic systemic conditions [1, 2]. In developing nations such as Indonesia, the prevalence of oral diseases remains high, with national data from the 2023 Indonesian Health Survey (SKI) indicating that 56.9% of the population suffers from dental issues, while the prevalence in West Sumatra reaches 61.1% [3]. A primary contributing factor to this burden is the rapid accumulation of dental debris—a soft food deposit that adheres to tooth surfaces shortly after eating [4, 5]. If left uncleaned, dental debris accelerates plaque formation and microbial growth, leading to dental caries, halitosis, and periodontal disease [6]. School-aged children are particularly vulnerable to these conditions due to inadequate daily tooth-brushing practices and dietary habits high in refined carbohydrates [7, 8].

While conventional tooth-brushing remains the primary oral hygiene practice, natural mechanical self-cleansing through chewing fibrous and water-rich fruits has emerged as an accessible complementary strategy [9, 10]. Prior studies have demonstrated that chewing fruits such as apples or jicama stimulates salivary flow and provides a mechanical scrubbing action that dislodges debris from enamel surfaces [10, 11]. However, most existing literature focuses either on isolated fruit interventions [12] or on specific target populations such as hearing-impaired children [11]. Comparative evidence evaluating the relative efficacy of different local fibrous fruits—specifically apples (Malus sylvestris Mill.)

and jicama (Pachyrhizus erosus)—under standardized chewing protocols within standard elementary school environments remains limited [11, 13]. This creates a clear research gap regarding which specific fibrous fruit yields optimal natural debris reduction in primary school settings.

To address this gap, this study aimed to evaluate and compare the effectiveness of chewing apples versus jicama in reducing the debris index among fifth-grade elementary school students at SDN 07 Teladan Bukittinggi . By applying a controlled, bilateral chewing protocol, this research determines whether a statistically significant difference exists between the two dietary interventions [3]. The findings provide evidence-based insights into cost-effective, culturally suitable natural self-cleansing methods that can be integrated into school-based oral health promotion programs and daily preventive care habits for children [3, 9].

2. METHODOLOGY

This study employed a quantitative research approach with a quasi-experimental pretest-posttest design. The study was conducted on May 12–13, 2026, in the fifth-grade classrooms at SDN 07 Teladan Bukittinggi, West Sumatra, Indonesia.

The study population comprised all fifth-grade students at SDN 07 Teladan Bukittinggi, totaling 50 students. Total sampling (saturation sampling) was utilized, selecting all 50 students as research participants (17 males and 33 females). Participants were randomly allocated into two equal treatment groups of 25 students each: the apple-chewing group ($n = 25$) and the jicama-chewing group ($n = 25$).

Primary data consisted of individual debris index scores measured before and after the fruit-chewing interventions. Clinical examinations were performed using the Green and Vermillion Debris Index criteria across six index teeth: 16 (buccal), 11 (labial), 26 (buccal), 36 (lingual), 31 (labial), and 46 (lingual). The debris index scores were categorized into three levels: Good (0.0–0.6), Moderate (0.7–1.8), and Poor (1.9–3.0). Diagnostic instruments included dental mirrors, explorers, tweezers, personal protective equipment (PPE), and standardized examination forms [2].

Before intervention, baseline debris indices (pretest) were examined and recorded for all participants. Each participant was then provided with 100 grams of fresh fruit (either Malus sylvestris Mill. or Pachyrhizus erosus cut into 10 uniform pieces). Participants underwent standardized chewing instruction to chew the fruit 32 times across both sides of the jaw (16 cycles on the right side and 16 cycles on the left side). Examinations were overseen by the principal investigator and four calibrated enumerators. Post-intervention debris indices (posttest) were measured immediately after complete consumption [2].

Data underwent editing, coding, entry, and cleaning prior to statistical computation. Data normality was evaluated using the Shapiro-Wilk test. Univariate analysis was presented as mean scores and categorical frequency distributions of the debris index before and after intervention. Bivariate analysis was conducted using the Paired Sample T-Test to evaluate within-group differences in debris index before and after chewing. The Independent Sample T-Test was applied to compare the mean reduction of debris index between the apple and jicama groups. All statistical analyses were performed with a significance threshold set at $\alpha = 0.05$ ($p < 0.05$) [2].

3. RESULTS

A total of 50 fifth-grade students completed the study and were equally divided into the apple group ($n = 25$) and the jicama group ($n = 25$).

1.1 Debris Index Before and After Chewing Apple

As presented in Table 1, the mean debris index of participants in the apple group before intervention was 1.576, which corresponds to the moderate category. After chewing 100 grams of apple, the mean debris index significantly decreased to 0.620, improving to the good category. This intervention resulted in a mean score reduction of 0.956.

Table 1. Mean Debris Index Before and After Chewing Apple

Treatment Group	N	Mean Debris Index	Debris Category	Score Reduction
Before Chewing Apple	25	1,576	Moderate	0.956
After Chewing Apple	25	0,620	Good	

1.2 Debris Index Before and After Chewing Jicama

As shown in Table 2, the baseline mean debris index in the jicama group was 1.528 (moderate category). Following the jicama-chewing intervention, the mean debris index dropped to 0.556 (good category), yielding a mean reduction of 0.972.

Table 2. Mean Debris Index Before and After Chewing Jicama

Treatment Group	N	Mean Debris Index	Debris Category	Score Reduction
Before Chewing Jicama	25	1.528	Moderate	0.972
After Chewing Jicama	25	0.556	Good	

1.3 Statistical Analysis of Within-Group and Between-Group Differences

The Paired Sample T-Test demonstrated a statistically significant difference in debris index scores before and after intervention in both the apple group ($\boldsymbol{p = 0.000}$) and the jicama group ($\boldsymbol{p = 0.000}$) (Table 3).

Table 3. Paired Sample T-Test Results Within Treatment Groups

Treatment Group	N	Mean Debris Index	p-value
Before Chewing Apple	25	1.576	0.000
After Chewing Apple	25	0.620	
Before Chewing Jicama	25	1.528	0.000
After Chewing Jicama	25	0.556	

To compare the relative efficacy between the two fruits, an independent-samples t-test was performed on the mean reduction values. Although the jicama group exhibited a slightly higher mean reduction (0.972) compared to the apple group (0.956), the Independent Samples t-test yielded $p = 0.893$ ($p > 0.05$), indicating no statistically significant difference in debris index reduction between chewing apples and chewing jicama (Table 4).

Table 4. *Independent Sample T-Test Comparison Between Apple and Jicama Groups*

Treatment Group	N	Mean Reduction	p-value
Apple Group	25	0.956	0.893
Jicama Group	25	0.972	

4. DISCUSSION

The findings of this study confirm that chewing both apples and jicama significantly reduces the debris index in primary school children, shifting their oral hygiene status from moderate to good. The observed reductions are attributed to the synergistic combination of mechanical friction, high water content, and stimulated salivary flow during mastication [2].

The significant reduction in debris index following apple consumption ($p = 0.000$) aligns with mechanical cleansing principles. During mastication, the firm texture and high fibrous content of apples sweep across enamel surfaces, physically dislodging loosely attached food remnants. Furthermore, the natural tartness and organic acids present in apples act as gustatory stimuli that enhance salivary gland secretion. Increased salivary flow facilitates the mechanical flushing of the oral cavity and accelerates the dissolution of food particles [2]. These results corroborate previous findings by Nabila et al. [12] and Hartari et al. [14], who reported marked decreases in debris index following apple consumption due to natural self-cleansing mechanisms.

Similarly, jicama consumption demonstrated a significant reduction in debris index ($p = 0.000$). Jicama possesses a dense cellular matrix with high water and dietary fiber content. Chewing 100 grams of jicama requires substantial masticatory effort and muscular engagement, which induces friction against tooth surfaces and stimulates mechanoreceptors in the periodontal ligament, triggering profuse salivary output. The 32-cycle bilateral chewing protocol ensured uniform contact across both right and left dental arches, maximizing salivary distribution and debris clearance [2]. This outcome is consistent with research by Maulina et al. [15] and Trisnawati et al. [16], who observed significant oral hygiene improvements following jicama consumption in elementary school students.

Comparing the two interventions, the Independent Sample T-Test revealed no statistically significant difference between apple and jicama chewing ($p = 0.893$). Although jicama produced a numerically larger reduction (0.972 vs. 0.956), both fruits performed with comparable clinical efficacy. The slight descriptive edge of jicama may stem from its higher fiber density and resistance to initial bite pressure, requiring greater masticatory force. Conversely, apple counterbalances its slightly lower fiber density through gustatory stimulation via mild acidity, which boosts salivary secretion rate. Thus, while the physiological pathways differ slightly—jicama relying more on mechanical force and apple on gustatory stimulation—both achieve equivalent self-cleansing outcomes [2]. This finding supports Noviyanti et al. [17], who similarly reported no significant difference in plaque clearance efficacy between jicama and apple chewing.

These findings carry important practical and clinical implications for public health and school-based oral health initiatives. Because apples and jicama are widely available, affordable, and culturally accepted in regions like West Sumatra, incorporating them into daily dietary habits serves as an effective, non-pharmacological self-cleansing strategy. While fibrous fruits cannot replace regular tooth-brushing with fluoridated toothpaste, they represent a viable complementary approach for children to maintain oral cleanliness after meals during school hours when tooth-brushing facilities may be unavailable [2].

5. CONCLUSIONS RECOMMENDATIONS

This study evaluated and compared the effectiveness of chewing apples (Malus sylvestris Mill.) and jicama (Pachyrhizus erosus) on debris index reduction among fifth-grade elementary school students at SDN 07 Teladan Bukittinggi. Based on the statistical and clinical findings, the conclusions are drawn as follows:

1. Chewing 100 grams of apple significantly reduces the debris index in children from a moderate category (1.576) to a good category (0.620), yielding a mean score reduction of 0.956 ($p = 0.000$).
2. Chewing 100 grams of jicama significantly lowers the debris index from a moderate category (1.528) to a good category (0.556), yielding a mean score reduction of 0.972 ($p = 0.000$).
3. There is no statistically significant difference in debris index reduction between chewing apples and chewing jicama ($p = 0.893$). Both fibrous fruits demonstrate equivalent clinical efficacy as natural mechanical self-cleansing agents for improving oral hygiene in elementary school children

Based on the study findings and inherent limitations, several practical and future research recommendations are proposed. School authorities and healthcare practitioners are encouraged to integrate fibrous fruit consumption (such as apples and jicama) into school-based oral health promotion programs and School Dental Health Initiatives (UKGS). Consuming fibrous fruits after meals serves as an accessible, cost-effective, and enjoyable complementary self-cleansing practice, particularly during school hours when tooth-brushing facilities may be limited.

Future studies should consider extending the observation period to evaluate long-term debris index retention and plaque formation rates. Furthermore, researchers are advised to incorporate additional physiological parameters, such as direct saliva flow rate (salivary volume and pH) measurement, and compare other local fibrous fruits or vegetables to broaden the scope of natural oral self-cleansing strategies.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude and appreciation to the principal, teachers, and staff of SDN 07 Teladan Bukittinggi for their full support, permission, and assistance during the data collection process. Special thanks are extended to all fifth-grade students who participated in this study for their enthusiasm and cooperation. The authors also acknowledge the enumerators for their invaluable assistance during the clinical examinations and data processing.

REFERENCES

[1] S. Rakasiwi and L. A. Kautsar, "Pengaruh Faktor Demografi dan Sosial Ekonomi terhadap Status Kesehatan Individu di Indonesia," Kajian Ekonomi dan Keuangan, vol. 5, no. 2, pp. 100–108, 2021. https://doi.org/10.31685/kek.V5.2.1008.

[2] Kasmiati, Sumarni, and A. R. Metasari, Pengantar Ilmu Kesehatan Masyarakat, 1st ed. Jakarta: CV Tohar Media, 2023.

[3] Kementerian Kesehatan Republik Indonesia, Survei Kesehatan Indonesia (SKI) Tahun 2023, Jakarta: Kementerian Kesehatan Republik Indonesia, 2023. https://peraturan.bpk.go.id/details/258028/uu-no-17-tahun-2023.

[4] A. Novriani and Zainur, "Efektivitas Mengonsumsi Buah Pepaya dan Buah Semangka dalam Penurunan Skor Debris," Jurnal Kesehatan Gigi dan Mulut (JKGM), vol. 2, no. 2, pp. 27–31, 2020.

[5] A. Riska, A. Putri, J. H. Susatyo, and M. T. Abadi, "Pengaruh Mengunyah Tebu terhadap Penurunan Angka Debris Indeks pada Siswa SDN 8 Siantan Kabupaten Mempawah," Journal of Dental Therapist, vol. 1, no. 2, pp. 42–46, 2022. http://jtk.poltekkes-pontianak.ac.id/index.php/JDT/index.

[6] I. Zusuan, A. Bakhtiar, and W. P. Sari, "Perbedaan Efektivitas Konsumsi Buah Nanas dan Pepaya Sebagai Self Cleansing Terhadap Perubahan Debris Index Pada Siswa SDN 10 Sungai Sapih Kota Padang," Padjadjaran Journal of Dental Researchers and Students, vol. 8, no. 1, pp. 80–86, 2024. https://doi.org/10.24198/pjdrs.v8i1.53194.

[7] U. S. Kurniawan, N. S. Akmalia, and Akamlia, "Peningkatan Pengetahuan Kesehatan Gigi dan Mulut Anak di Dusun Botokan, Sendangrejo, Minggir, Sleman," Jurnal Pengabdian kepada Masyarakat, vol. 1, no. 1, pp. 15–21, 2023.

[8] K. Pamewa, M. Febriany, N. R. Hasanuddin, et al., "Perbedaan Indeks Debris Sebelum dan Sesudah Konsumsi Buah Pir Pada Anak 7-9 Tahun," Sinnun Maxillofacial Journal, vol. 2, no. 2, pp. 17–23, 2020.

[9] M. Khafid, A. A. Ananda, D. I. Prasiska, A. Ahmadi, and M. Khabib, "Pencegahan Karies Gigi Anak Pada Masa Geligi Bercampur Dengan Meningkatkan Kebersihan Mulut Melalui Diet Tinggi Serat," Journal of Oral Health Care, vol. 11, no. 1, pp. 8–15, 2023. https://doi.org/10.29238/ohc.v11i1.1767.

[10] E. S. Y. Ngatemi, "Pengaruh Konsumsi Makanan Berserat terhadap Kebersihan Gigi pada Murid Sekolah Dasar Lontar Baru Kota Serang," Jurnal Ilmu Kesehatan Indonesia (JIKSI), vol. 1, no. 1, pp. 1–8, 2020.

[11] A. V. Damayanthy, S. Prasetyowati, and K. Astuti, "Efektivitas Mengunyah Buah Bengkuang dan Buah Apel terhadap Penurunan Angka Debris Indeks pada Siswa Tunarungu," Jurnal Ilmiah Keperawatan Gigi (JIKG), vol. 4, no. 1, pp. 160–170, 2023. http://ejurnal.poltekkestasikmalaya.ac.id/index.php/jikg/index.

[12] N. K. Nabila, I. Fadjeri, T. Purnama, and N. Noviani, "Debris Index Before and After Apple Consumption," Journal Center of Excellent: Health Assistive Technology, vol. 2, no. 1, pp. 22–27, 2024. https://doi.org/10.36082/jchat.v2i1.1521.

[13] N. N. A. Noviyanti, I. G. A. D. Ambarawati, and I. G. A. S. P. BDJ, "Perbandingan efektivitas mengunyah buah bengkuang (Pachyrhizus erosus) dan buah apel manalagi (Malus sylvestris Mill.) terhadap penurunan indeks plak pada anak usia 10-12 tahun di SD Negeri 2 Dauh Puri," Bali Dental Journal, vol. 5, no. 1, pp. 12–18, 2021. http://jkg-udayana.org.

[14] D. Hartari, Lendrawati, and B. Ristiono, "Perbandingan Efektivitas Mengunyah Buah Apel (Malus Sylvestris Mill) dan Buah Semangka (Citrullus Lanatus) Sebagai Self-cleansing Terhadap Perubahan Indeks Debris Pada Siswa Kelas VII SMPN 30 Kota Padang," Andalas Dental Journal, vol. 9, no. 2, pp. 45–52, 2021.

[15] R. Maulina, T. Salfiyadi, A. Mardiah, and C. A. Nuraskin, "Consuming Jicama Fruit on Debris Index Status in Elementary School Students," Journal Center of Excellent: Health Assistive Technology, vol. 3, no. 1, pp. 9–13, 2025. https://doi.org/10.36082/jchat.v3i1.2199.

[16] A. P. Trisnawati, S. Hidayati, S. Prasetyowati, and S. Hadi, "Comparison of the Effectiveness of Chewing Pineapple and Jicama on Reducing Debris Index in Sidoarjo: A Quasi-Experimental Study," International Journal of Advanced Health Science and Technology, vol. 4, no. 4, pp. 261–266, 2024. https://doi.org/10.35882/ijahst.v4i4.381.

[17] N. N. A. Noviyanti, "Perbandingan Efektivitas Mengunyah Buah Bengkuang dan Apel Manalagi Dalam Menurunkan Indeks Plak," Bali Dental Journal, vol. 5, no. 1, pp. 1–7, 2021. http://jkg-udayana.org.