

REVIEW ARTICLE

OPEN ACCESS

Manuscript received April 14, 2023; revised May 21, 2023; accepted May 21, 2023; date of publication June 30, 2022

Digital Object Identifier (DOI): <https://doi.org/10.35882/ijahst.v3i3.249>

Copyright © 2023 by the authors. This work is an open-access article and licensed under a Creative Commons Attribution-ShareAlike 4.0 International License ([CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/))

How to cite: Isnanto, Ajeng Nurzilullahningtiyas, Silvia Prasetyowati, "Comparative Effectiveness of Binahong Decoction and Betel Leaf Decoction Solutions on Plaque Index in Deaf Children: A Study at SDLB Karya Mulia Surabaya", International Journal of Advanced Health Science and Technology, vol. 3, no. 3, pp. 180-185, June. 2023.

Comparative Effectiveness of Binahong Decoction and Betel Leaf Decoction Solutions on Plaque Index in Deaf Children: A Study at SDLB Karya Mulia Surabaya

Isnanto, Ajeng Nurzilullahningtiyas, and Silvia Prasetyowati

Dental Therapist Department, Poltekkes Kemenkes Surabaya, Indonesia

Corresponding author: Isnanto (e-mail: nanto@poltekkesdepkes-sby.ac.id)

ABSTRACT Deaf children are children who have impaired senses of hearing. Limitations in communication and lack of knowledge lead to poor behavior. Poor oral hygiene behavior leads to poor plaque index values. The problem in this study is that the plaque index value of deaf students at SDLB Karya Mulia Surabaya is poor. Plaque control can be done mechanically and chemically. Chemical control of dental plaque can be done by gargling. Gargling using natural ingredients such as binahong leaves and betel leaves helps reduce plaque because they contain good antibacterial properties. The study aims to determine the comparison of the effectiveness of gargling a decoction solution of binahong leaves and betel leaves on the plaque index in deaf children at SDLB Karya Mulia Surabaya. The type of research used was Pre-experimental design with pretest-posttest design, with 51 students as research subjects. Data collection methods by observation. Data analysis technique using Independent Sample T-test. The results showed that the Asymp.sig. (2-tailed) value was 0.012 which means that the p (significance) value is smaller than α (0.05), thus it can be concluded that there is a comparison of the effectiveness of gargling binahong leaf decoction solution and betel leaf against plaque index in deaf children at SDLB Karya Mulia Surabaya and betel leaf decoction solution is more effective in reducing plaque index values than binahong leaf decoction solution.

INDEX TERMS Bihanong Leaf, Betel Leaf, Plaque Index, Deaf Children.

I. INTRODUCTION

Deaf children are children who have a hearing impairment. The basic deficiency of language possessed by deaf children causes delays in language, limitations in communication, lack of knowledge level, poor health and psycho-social problems arise [1]. According to the World Health Organization (WHO) in Riskesdas, as many as 34 million children have hearing loss.

The dental health status of deaf children is different from that of children without special needs. Deaf children have limitations in hearing and speaking so they lack information and knowledge that influence actions in maintaining healthy teeth and mouth. Even though their physique is the same as children who do not have special needs, their limitations affect their low dental and oral hygiene status. One of the dental and oral health problems

that occur in deaf children is dental caries. Dental caries can occur due to the interaction between dental plaque and the acidic environment that is fermented by [2].

Dental plaque is a soft and thin layer made of a combination of extracellular matrix, inorganic, germs, and food residue left in the oral cavity. Streptococcus mutans bacteria are present in dental plaque because they are bacteria that cause dental plaque formation. Dental plaque that is left in the oral cavity for a long time can cause dental caries and periodontal disease [3]. Binahong leaves contain many active chemical compounds that function to reduce bacteria, namely flavonoids, alkaloids, terpenoids, tannins, and saponins. Ethyl acetate of binahong leaf extract has inhibitory power against Streptococcus mutans bacteria.

Deaf children at SLBN 1 Bantul and SLBB Wiyata Dharma 1 Sleman Yogyakarta in 2019 found that 46% of

students had poor Personal Hygiene Performance (PHP) index scores [4]. Based on research conducted by Budiningtyas at Karya Mulia Surabaya Special School, it was found that 27.59% of students had a moderate plaque index value and 72.41% had a bad plaque index value.

Poor plaque index values in deaf children can have an impact on the health of their teeth and mouth. The impact that can occur is dental caries. The prevalence of dental caries in deaf children was 79.1% with an average Decay Missing Filled Teeth (DMFT) of 5.69 with high criteria. In addition, the dental and oral disease that can occur in deaf people is gingivitis [5]. According to research shows that 98% of deaf people experience inflammation of the gums with an average Gingival Index of 1.17 with moderate gingivitis criteria [6][7][8].

The way to prevent dental and oral health problems is to diligently clean your teeth and mouth. Regular dental plaque control can help maintain oral hygiene to prevent caries and periodontal disease. Plaque control can be done in two ways, namely mechanically and chemically. Mechanical plaque control can be done by brushing your teeth twice a day and chemical plaque control by using mouthwash. Gargling using natural ingredients is believed to be safe by the public because it has small side effects. Natural mouthwash can help prevent dental and oral health problems [3].

One of the herbal plants used for mouthwash is the binahong plant (*Anredera cordifolia*). Binahong leaves contain many active chemical compounds that function to reduce bacteria, namely flavonoids, alkaloids, terpenoids, tannins, and saponins. Ethyl acetate of binahong leaf extract has inhibitory power against *Streptococcus mutans* bacteria. Binahong leaf rinse solution with concentrations of 75%, 50%, 25%, 12.5%, and 6.25% can inhibit the growth of *Streptococcus mutans* bacteria [9].

Previous research conducted on patients with chronic periodontitis stated that the contents of these compounds were successful in helping to inhibit bacteria so as to reduce dental plaque. Various compounds such as saponins, alkaloids, phenolics and flavonoids are contained in binahong leaves which function as antibacterial, anti-inflammatory and antioxidants [10]. A high concentration of binahong leaf extract can suppress the growth of *Streptococcus mutans* bacteria. Natural mouthwash solution from binahong leaves is a good antibacterial that can reduce dental plaque.

Betel leaves have been known for a long time as an ingredient for chewing, besides that betel leaves are also used for gargling which is believed to strengthen teeth. Betel leaves contain essential oils that function as good antiseptics. Betel leaf extract can inhibit the growth of *streptococcus mutans* bacteria [3]. Gargling with green betel leaf water (*Piper betel* L.) can reduce the plaque index value because green betel leaves contain essential oils, catechins, and tannin compounds up to 4.2%. These compounds have strong antibacterial and antifungal properties and can inhibit the growth of various bacteria

such as *E. coli*, *Staphylococcus aureus*, *Klebsiella pasteurilla*, and kill *Candida albicans* which causes plaque [11].

Based on previous research, it is proven that there is a decrease in the value of the dental plaque index before and after gargling mouthwash containing betel leaf (*Piper betel*) in users of fixed orthodontic devices. This change in plaque index value occurs because betel leaf mouthwash (*Piper betel*) has antibacterial, antifungal and antiprotozoa activities [12]. Previous studies conducted showed a decrease in plaque index values before and after gargling betel leaf solution. The plaque index category before gargling the betel leaf solution was poor and after gargling the betel leaf solution showed a decrease to a moderate category.

Previous studies were conducted on non-disabled patients with a history of chronic periodontitis and orthodontics patients. In addition, it is more directed at testing bacterial preparations, while this study was conducted on children with special needs, namely deaf children with healthy gingival conditions and not using orthodontics. This study was also conducted to determine the decrease in plaque index value directly.

Based on the initial examination conducted by researchers at SDLB Karya Mulia Surabaya, it was found that the average plaque index value in deaf children was 3.7 with poor criteria. Based on the description above, the problem in this study is that the plaque index value of deaf students at SDLB Karya Mulia Surabaya is poor.

This study contributes to the application of knowledge about oral health. Poor plaque index values in deaf children must be controlled by chemical plaque control using mouth rinses made from natural or chemical ingredients. Natural ingredients are proven to be safer to use as mouth rinses. Binahong leaf and betel leaf can be alternatives as mouth rinses. The use of this mouth rinse is expected to reduce the plaque index value in deaf children. This aims to improve the status of dental and oral hygiene in deaf children.

This study aims to determine the comparison of the effectiveness of gargling a decoction solution of binahong leaves and betel leaves on the plaque index in deaf children at SDLB Karya Mulia Surabaya.

II. METHOD

This research was conducted at SDLB Karya Mulia Surabaya from January to March 2023. This type of research was a pre-experimental design with a one-group pretest-posttest design. The population in this study was 58 students with a total sample of 51 deaf students at SDLB Karya Mulia Surabaya. The data collection method used in this research is the observation method using observation sheets as data collection instruments.

The initial procedure of this study was to make a solution of binahong leaf and betel leaf decoction. Making a solution of binahong leaf decoction is done by boiling. Prepare binahong leaves about 7-9 leaves and wash with running water then rinsed with sterile distilled water, bring

850ml of water to a boil in a saucepan. Boil the binahong leaves until half (15 minutes) to a temperature of 90°C. Filter the solution with sterile filter paper and store the solution in 20ml bottles at 0-8°C.

Making betel leaf decoction solution is done by boiling. Prepare 30 grams of fresh betel leaves that have been washed, rinse the betel leaves with sterile distilled water 3 times, cut the betel leaves with a size of 2-3 cm, boil 100ml of water in a pot at 90°C, boil the betel leaves for about 30 minutes and filtering is done using sterile filter paper and stored in sterile bottles with a temperature of 0-8°C.

The research steps were to divide the sample into 2 groups. Group 1 (26 students) gargled using binahong leaf decoction solution and group 2 (25 students) used betel leaf decoction solution, then applied disclosing solution on the index teeth. Measured the Personal Hygiene Performance (PHP) index value. before gargling the binahong leaf and betel leaf decoction solutions. Instructed the deaf children to brush their teeth before treatment. Instructed the binahong leaf decoction gargle group and the betel leaf solution gargle group to gargle for 30 seconds. After gargling, deaf children were instructed not to eat and drink for up to 2 hours, after 2 hours, re-measuring the PHP index value after gargling binahong leaf decoction solution and betel leaf decoction solution. Analyzing research data using Independent Sample T-Test data analysis techniques.

III. RESULT

The research data were obtained from the calculation of the PHP index before and after gargling with binahong decoction and betel leaf decoction in deaf children at SDLB Karya Mulia Surabaya with a sample of 51 samples.

TABLE 1

Distribution of Research Subjects

Characteristics	Frequency	Percentage (%)
Gender		
Boy	30	58,8
Girl	21	41,2
Total	51	100
Age		
7-10 years old	26	51
11-13 years old	25	49
Total	51	100
Grade of Elementary		
School	23	45,1
Grade 1-3	28	54,9
Grade 4-6		
Total	51	100

Based on the results of the data in **TABLE 1**, it shows that the distribution of research subjects based on the characteristics of male gender as many as 30 people (58.8%) and female as many as 21 people (41.2%), based on age in children aged 7-10 years as many as 26 people (51%) and age 11-13 years as many as 25 people (49%) and based on the level of education in grades 4-6 as many as 28 (54.9%) and grades 4-6 as many as 28 (54.9%).

TABLE 2

Results of Plaque Index Data Collection Before and After Gargling Binahong Leaf Decoction Solution

Category of Plaque Index	Before gargling		After Gargling	
	Frequency (N)	%	Frequency (N)	%
Very Good	0	0	0	0
Good	0	0	6	23.1
Moderate	8	30.8	14	53.8
Poor	18	69.2	6	23.1
Total	26	100	26	100

Based on **TABLE 2**, it was found that the category of plaque index values before gargling is as many as 0 students (0%) are included in the excellent and good categories, as many as 8 students (30.8%) are included in the moderate category and as many as 18 students (69.2%) are included in the bad category. The category of plaque index values after gargling is as many as 0 students (0%) are included in the excellent category, as many as 6 students (23.1%) are included in the good category, as many as 14 students (53.8%) are included in the moderate category, and 6 students (23.1%) are included in the bad category.

TABLE 3

Results of Plaque Index Data Collection Before and After Gargling Betel Leaf Decoction Solution

Category of Plaque Index	Before gargling		After Gargling	
	Frequency (N)	%	Frequency (N)	%
Very Good	0	0	0	0
Good	0	0	9	36
Moderate	11	44	16	64
Poor	14	56	0	0
Total	25	100	26	100

Based on **TABLE 3**, it was found that the category of plaque index values before gargling is as many as 0 students (0%) are included in the excellent and good categories, as many as 11 students (40%) are included in the moderate category and as many as 14 students (56%) are included in the bad category. The category of plaque index values after gargling is 0 students (0%) included in the excellent category, 9 students (36%) included in the good category, 16 students (64%) included in the moderate category, and 0 students (0%) included in the bad category.

TABLE 4

Plaque Index Value Before and After Gargling Binahong Leaf Decoction Solution

Plaque Index	Mean	Sig.	Std.Deviation	N
Before	3.72	0.000	0.58	26
After	2.68	0.000	0.86	26
Average of reduction	1.03			

Based on **TABLE 4**, the average plaque index value before rinsing with a solution of binahong leaves was 3.72 (std.deviation 0.58). The plaque index value after rinsing with a decoction of binahong leaves is 2.68 with a difference of 1.03 (std.deviation 0.86). The Sig.(2-tailed)

value from the results of the Paired T-Test was 0.000 which means the p-value (significance) is smaller than α (0.05) so that there is a decrease in the plaque index value after rinsing the binahong leaf decoction solution.

TABLE 5**Plaque Index Value Before and After Gargling Betel Leaf Decoction Solution**

Plaque Index	Mean	Sig.	Std.Deviation	N
Before	3.52	0.000	0.67	25
After	2.10	0.000	0.73	25
Average of reduction	1.42			

Based on **TABLE 5**, the average plaque index value before rinsing using betel leaf was 3.52 (std.deviation 0.67) and after rinsing it was 2.10 (std.deviation 0.73) with a difference of 1.42. The Sig.(2-tailed) value of the Paired T-Test was 0.000, which means that the p value (significance) is smaller than α (0.05) so that there is a decrease in the plaque index value after rinsing the betel leaf boiled solution.

TABLE 6**Independent T-Test Test of comparative Effectiveness of Gargling Binahong Leaf and Betel Leaf Decoction on Plaque Index**

Gargling Groups	N	Sig.
PHP Index After Gargling Binahong Leaf Solution	26	0.012
PHP Index After Gargling Betel Leaf Solution	25	

Based on **TABLE 6** the results of the Independent T-Test test obtained an Asymp.sig. (2-tailed) value of 0.012 which means that the p value (significance) is smaller than α (0.05), thus it can be concluded that H_0 is rejected and H_1 is accepted, so there is a significant comparison in the effectiveness of gargling binahong leaf decoction solution and betel leaf decoction solution on plaque index in deaf children at SDLB Karya Mulia Surabaya. Both groups were equally effective in reducing plaque index, but the betel leaf decoction solution gargling group was more effective in reducing plaque than the binahong leaf decoction solution gargling group because the average value of the decrease before and after gargling the betel leaf group was greater.

IV. DISCUSSION

Deafness is a condition where a person experienced hearing loss. Hearing limitations in deaf children result in a lack of information, including information about dental and oral health [13]. Lack of information about how to maintain healthy teeth and mouth in deaf children will shape wrong behavior that can affect dental and oral health and contribute to limited and poor maintenance of oral health [14]. Children with hearing and speech impairments receive less treatment dental health and tends to discriminate [15][16].

Deaf children tend to have a prevalence of dental and oral diseases compared to non-deaf children. The average dental and oral hygiene status of deaf children was included

in the bad criteria [17][18]. Efforts to maintain dental and oral hygiene in deaf children must be carried out using plaque control.

The results showed that there was a significant comparison between the effectiveness of gargling binahong leaf decoction solution and betel leaf decoction solution on plaque index in deaf children at SDLB Karya Mulia Surabaya. There was a decrease in plaque index value before and after gargling binahong leaf decoction solution and betel leaf decoction solution from poor category to moderate category. Based on the mean value between the two groups, betel leaf decoction solution is more effective in reducing plaque when compared to the group gargling binahong leaf solution.

Plaque control can be done mechanically as well as chemically. This plaque control serves to reduce the value of the dental plaque index, thereby preventing dental and oral health problems. Plaque control by chemical means can be done by gargling [19][20]. Gargling using natural ingredients is believed to be safe by the public because it has minimal side effects. Natural ingredients such as binahong leaves and betel leaves can be an alternative as a mouthwash [21].

Binahong leaves (*Anredera cordifolia* Steenis) contain active substances such as flavonoids, alkanoids, terpenoids, and saponins. The active components of flavonoids act directly as antibiotics by interfering with the function of microorganisms such as bacteria and viruses. Binahong contains active antibacterial substances, which can prevent the growth of bacteria. *Streptococcus mutans* is a bacterium that causes tooth decay. Inhibiting bacterial growth can prevent the development of plaque on the teeth, resulting in a decrease in the plaque index value after gargling with a solution of binahong leaf decoction [10].

Based on the researchers' observations, it was seen that there was a decrease in the plaque index value before and after rinsing the mouth with binahong leaf decoction solution from poor to moderate category. This is because the binahong leaf decoction solution has a good antibacterial content, so it can inhibit bacterial growth and can reduce the plaque index value. Dental plaque can occur due to the formation of microorganisms by bacteria, so an antibacterial mouth rinse is needed to inhibit bacterial growth so that it can reduce the plaque index on teeth [22].

Betel leaves have benefits such as anti-diabetic, anti-mutagenic, anti-inflammatory, antibacterial, antioxidant, and anti-hemolytic. The content of flavonoids, polyphenols, and catechol, is useful as a high antioxidant. This antibacterial property can prevent the growth and development of plaque on the teeth. After gargling with a betel leaf decoction solution, there was a decrease in the plaque index value. Betel leaf essential oil and tannins are strong antiseptics that can inhibit or stop the growth of *Streptococcus mutans* [23].

According to the researchers' observations, the decrease in the plaque index value before and after rinsing the betel leaf decoction from poor to moderate categories was due to

the betel leaf containing essential oil compounds produced in the secretory cells. Gargling with green betel leaf (*Piper betel* L.) water can reduce plaque index values because green betel leaves contain essential oils, catechins, and tannin compounds up to 4.2%. This compound has strong antibacterial and antifungal properties and can inhibit the growth of various bacteria such as *E. coli*, *Staphylococcus aureus*, *Klebsiella pasteurilla*, and kill *Candida albicans* that causes plaque [11].

Testing of essential oil antibacterial mouthwash preparations on betel leaves using the diffusion method against *Streptococcus mutans* showed an inhibitory effect. The mouthwash formulation using betel leaf essential oil has a direct inhibitory effect on the growth of *Streptococcus mutans*. Ethyl acetate extract of green betel (*Piper Betel* L) at concentrations of 1%, 3%, 5%, 7%, and 9% has bactericidal activity which can inhibit the growth of *Streptococcus mutans* bacteria and a concentration of 9% is the optimal concentration in killing *Streptococcus mutans* bacteria [24].

Betel leaf has properties as a stimulant, antifungal, antioxidant, and antimicrobial agent due to its high concentration of phytochemicals. In addition, it has potential bioactivity due to metabolite compounds such as phenols, flavonoids, and tannins which act as antibacterial agents. This antibacterial agent can help reduce plaque on the teeth. A previous study has shown that betel leaf extract can inhibit bacteria [25].

A decrease in plaque index values before and after gargling with betel leaf solution. The plaque index category before gargling betel solution was bad and after gargling betel solution showed a decrease to the moderate category. There was a decrease in the dental plaque index before and after rinsing mouthwash containing betel leaf (*Piper betel*) in users of fixed orthodontic appliances. This change in plaque index value occurred because betel leaf mouthwash (*Piper betel*) has antibacterial, antifungal, and antiprotozoal activity [12].

There are some weaknesses of this study, namely the condition of the solution which is not durable and tastes bitter, especially in the betel leaf decoction solution. In addition, the research process in deaf children was slightly hampered by the communication factor. Good communication is needed so that they understand the procedures that must be done. This study was only specialized in reducing the plaque index value, but no testing of bacterial inhibition on binahong leaves and betel leaves was carried out.

It can be concluded from the results of the above study that there is a significant comparison between the effectiveness of mouthwash using binahong leaf decoction and betel leaf decoction on plaque index in deaf children. The betel leaf decoction solution was more effective in reducing plaque when compared to the binahong leaf gargling group. This is in line with the theory that controlling plaque chemically using natural mouthwashes can help reduce the dental plaque index. The antibacterial

content in betel leaves is stronger in reducing dental plaque because betel leaves contain essential oils which are good antiseptics and antibacterials [26].

V. CONCLUSION

The purpose of this research is to determine the comparison of the effectiveness of gargling binahong leaf and betel leaf decoction solution on plaque index in deaf children at SDLB Karya Mulia Surabaya. Based on the results of data analysis and discussion above, it can be concluded that there is a comparison of the effectiveness of gargling binahong and betel leaf decoction solutions on plaque index in deaf children at SDLB Karya Mulia Surabaya because p-value of 0.012 is smaller than α (0.05).

Betel leaf decoction solution is more effective in reducing plaque index values than binahong leaf decoction solution with an average decrease after gargling binahong leaf decoction solution of 1.03 and an average decrease after gargling betel leaf decoction solution of 1.42. This happens because betel leaves have essential oil content that is better at inhibiting bacterial growth so that it is more effective in reducing plaque index. Gargling using betel leaf solution is recommended for students after brushing their teeth for 30 seconds because it is proven to be more effective in reducing plaque on the teeth.

Suggestions for future researchers are further research is needed for the manufacture of betel leaf mouthwash solution of good quality and long-lasting mouthwash solution and further research on the testing of inhibition on binahong leaf decoction solution and betel leaf decoction solution against bacteria.

VI. REFERENCES

- [1] A. Howerton-Fox and J. L. Falk, "Deaf children as 'english learners': The psycholinguistic turn in deaf education," *Educ. Sci.*, vol. 9, no. 2, 2019, doi: 10.3390/educsci9020133.
- [2] B. X. Ávila-Curiel, C. J. Solórzano-Mata, J. A. Avendaño-Martínez, B. Luna-Vásquez, and R. Torres-Rosas, "Playful Educational Intervention for Improvement of Oral Health in Children with Hearing Impairment," *Int. J. Clin. Pediatr. Dent.*, vol. 12, no. 6, pp. 491–493, 2019, doi: 10.5005/jp-journals-10005-1701.
- [3] R. Siregar, S. S, and N. J. Aritonang, "the Effectiveness of Red Betel (*Piper crocatum*) Leaf Ethanol Extract Mouthwash in Reducing Dental Plaque Index," *Asian J. Pharm. Res. Dev.*, vol. 9, no. 1, pp. 5–7, 2021, doi: 10.22270/ajprd.v9i1.902.
- [4] F. Dwi, A. Quroti, and S. Hidayati, "The relationship between the method of brushing teeth and the PHPM index in deaf children," *J. Kesehat. gigi*, vol. 9, no. 1, pp. 43–50, 2021, doi: 10.31983/jkg.v7i1.5865.
- [5] M. Todkar, H. Pandya, M. Panwar, A. Sharma, and M. Das, "Comparison of oral health status and DMFT score of special children and normal children in Burhanpur city," *Int. J. Appl. Dent. Sci.*, vol. 5, no. 1, pp. 219–222, 2019, [Online]. Available: www.oraljournal.com.
- [6] F. H. Alkahtani *et al.*, "Oral health status, treatment needs and oral health related quality of life among hearing impaired adults in Riyadh City, Saudi Arabia," *J. Contemp. Dent. Pract.*, vol. 20, no. 6, pp. 743–749, 2019, doi: 10.5005/jp-journals-10024-2590.
- [7] Y. Nakai and Y. Mori-Suzuki, "Impact of Dietary Patterns on Plaque Acidogenicity and Dental Caries in Early Childhood: A Retrospective Analysis in Japan," *Int. J. Environ. Res. Public Health*, vol. 19, no. 12, 2022, doi: 10.3390/ijerph19127245.
- [8] A. Johannsen, C. G. Emilson, G. Johannsen, K. Konradsson, P. Lingström, and P. Ramberg, "Effects of stabilized stannous fluoride

- dentifrice on dental calculus, dental plaque, gingivitis, halitosis and stain: A systematic review," *Heliyon*, vol. 5, no. 12, 2019, doi: 10.1016/j.heliyon.2019.e02850.
- [9] G. A. Dohude and F. C. Ginting, "The effectivity of binahong (*Anredera cordifolia* (ten.) steenis) leaves extract for growth inhibition of streptococcus mutans in oral cavity," *J. Dentomaxillofacial Sci.*, vol. 6, no. 3, p. 151, 2021, doi: 10.15562/jdmfs.v6i3.1040.
- [10] I. Syahfery, A. H. Nasution, D. Satria, I. Ervina, and O. A. Hanafiah, "Evaluation of il-6 levels after subgingival application Binahong leaf extract gel 3% on patients of chronic periodontitis," *Int. J. Appl. Dent. Sci.*, vol. 6, no. 3, pp. 615–618, 2020, doi: 10.22271/oral.2020.v6.i3i.1016.
- [11] L. Heliawati, S. Lestari, U. Hasanah, D. Ajiati, and D. Kurnia, "Phytochemical Profile of Antibacterial Agents from Red Betel Leaf (*Piper crocatum* Ruiz and Pav) against Bacteria in Dental Caries," *Molecules*, vol. 27, no. 9, 2022, doi: 10.3390/molecules27092861.
- [12] U. Chowdhury and P. K. Baruah, "Betelvine (*Piper betle* L.): A potential source for oral care," *Curr. Bot.*, vol. 11, pp. 87–92, 2020, doi: 10.25081/cb.2020.v11.6130.
- [13] D. Georgieva and G. Valchev, "Specific Features of Interpersonal Communication in Deaf Children," *Proc. CBU Soc. Sci.*, vol. 1, pp. 81–87, 2020, doi: 10.12955/pss.v1.51.
- [14] U. Zulkaidah, B. Santoso, D. Fatmasari, L. Sunarjo, and M. Djamil, "Indonesian Sign Language Visualization Model (BISINDO) Website-Based Oral Health on Tooth Brushing Behavior in Deaf Children," *Int. J. Innov. Sci. Res. Technol.*, vol. 13, no. 11, pp. 378–383, 2022.
- [15] R. S. Kumar *et al.*, "Oral Hygiene Knowledge and Practices , Gingival Health , and A Randomized Controlled Trial," *Children*, vol. 9, pp. 1–11, 2022, doi: https://doi.org/10.3390/children9121905.
- [16] W. Haryani, H. Y. Pratiwi, and D. Suyatmi, "Knowledge of Dental and Oral Health in Deaf Students at SLB Negeri Purworejo," *Int. J. Multidiscip. Res. Anal.*, vol. 05, no. 08, pp. 2057–2061, 2022, doi: 10.47191/ijmra/v5-i8-21.
- [17] D. Kurniawati, S. F. Bernice, and F. R. A. Pasha, "The Effectiveness of Dental and Oral Health Promotion with Audivisual Media on Knowledge Level and Oral Hygiene Status of Deaf Children," *Rev. Latinoam. Hipertens.*, vol. 17, pp. 1–23, 2022, doi: 10.5281/zenodo.6481810.
- [18] A. Kristiani and H. I. Robbihi, "The Effect of Counseling Using Pocketbooks on Knowledge of Attitudes and Behavior of Parents of Deaf Children in SLB Happy Foundation , Tasikmalaya City," *Int. J. Med. Sci. Dent. Res.*, vol. 06, no. 01, pp. 43–48, 2023.
- [19] S. W. Peeran and Karthikeyan Ramalingam, *Essentials of Periodontics & Oral Implantologi*, 1st ed. Tamil Nadu, India: Saranraj JPS Publication, 2021.
- [20] H. Cai, J. Chen, N. K. Panagodage Perera, and X. Liang, "Effects of Herbal Mouthwashes on Plaque and Inflammation Control for Patients with Gingivitis: A Systematic Review and Meta-Analysis of Randomised Controlled Trials," *Evidence-based Complement. Altern. Med.*, vol. 2020, p. 16, 2020, doi: 10.1155/2020/2829854.
- [21] C. Janakiram, R. Venkitachalam, P. Fontelo, T. J. Iafolla, and B. A. Dye, "Effectiveness of herbal oral care products in reducing dental plaque & gingivitis - a systematic review and meta-analysis," *BMC Complement. Med. Ther.*, vol. 20, no. 1, p. 43, 2020, doi: 10.1186/s12906-020-2812-1.
- [22] R. V. D. L. Homans and D. R. Nahusona, "Effect of binahong leaf extract on the growth of *Candida albicans* in patients using removable orthodontic appliances," *Makassar Dent. J.*, vol. 9, no. 2, pp. 73–77, 2020, doi: 10.35856/mdj.v9i2.321.
- [23] M. Z. Ali *et al.*, "Effect of a Novel Betel Leaf Dentifrice on Commonly Seen Oral Hygiene Parameters—A Randomized Clinical Crossover Study," *Dent. J.*, vol. 10, no. 9, pp. 1–9, 2022, doi: 10.3390/dj10090166.
- [24] P. Surjowardojo, E. Setyowati, and I. Ambarwati, "Antibacterial effects of green betel (*Piper betle* linn.) leaf against streptococcus agalactiae and escherichia coli," *J. Agric. Sci.*, vol. 41, no. 3, pp. 569–574, 2019, doi: 10.17503/agrivita.v41i3.2437.
- [25] F. I. Muhaimin and S. E. Cahyaningrum, "Characterization and Antibacterial Activity Assessment of Hydroxyapatite-Betel Leaf Extract Formulation against *Streptococcus mutans* In Vitro and In Vivo," *Indones. J. Chem.*, vol. 23, pp. 1–6, 2023, doi: 10.22146/ijc.77853.
- [26] M. H. Putri, E. Julacha, E. Herijulianti, and N. Nurjanah, "Formulation of Mouthwash for Gingivitis from Combination Infusion of Salam leaves (*Eugenia Polyantha* Wight) and Betel leaf (*Piper betle* L.)," *Padjadjaran J. Dent.*, vol. 34, no. 3, p. 239, 2022, doi: 10.24198/pjd.vol34no3.41509.