

Jurnal Info Kesehatan

Vol. 20, No. 2, December 2022, pp. 296-303

P-ISSN 0216-504X, E-ISSN 2620-536X

DOI: [10.31965/infokes.Vol20Iss2.997](https://doi.org/10.31965/infokes.Vol20Iss2.997)Journal homepage: <http://jurnal.poltekkeskupang.ac.id/index.php/infokes>**RESEARCH****Open Access****Effectiveness of Purple Sweet Potato Extract and Disclosing Substance for Plaque Identification****Aflinda Yenti^{1a*}, Eka Sukanti^{1b}, Damhuji^{2c}, M. Ibraar Ayatullah^{3d}**¹ Department of Dental Health, Politeknik Kesehatan Kemenkes Padang, Padang City, West Sumatera, Indonesia² Department of Dental Health, Politeknik Kesehatan Kementerian Kesehatan Pontianak, Pontianak City, West Kalimantan, Indonesia³ Department of Dental Health, Politeknik Kesehatan Kementerian Kesehatan Kupang, Kupang City, East Nusa Tenggara, Indonesia^a Email address: yenti.aflin@gmail.com^b Email address: ekasukanti@gmail.com^c Email address: damhuji.ahmad@yahoo.com^d Email address: mibraarayattullah21@gmail.com

Received: 15 December 2022

Revised: 31 December 2022

Accepted: 31 December 2022

Abstract

Oral hygiene is an indicator of oral and dental health which can be assessed based on the presence or absence of organic deposits, such as pellicle, materia alba (dental deposit), food residue, calculus, and dental plaque. Plaque is the cause of tooth decay among the world's population. Plaque on the tooth surface can be used as an indicator of oral hygiene. Poor cleaning can lead to stickier plaque and tartar after calcification. The thin plaque is almost the same as the color of the teeth, so that plaque cannot be seen with the naked eye. The presence of plaque that is formed from contact with oral fluids can be detected by using certain dye. This study aims to determine the Effectiveness of Purple Sweet Potato Extract and Disclosing substance for Plaque Identification among the children in Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District. This was a quasi-experimental study with a post-test-only design. The samples of this study were 30 children at Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District, with the inclusion criteria of children with permanent teeth and index teeth. The samples were selected through total sampling technique. The results showed that after applying purple sweet potato extract to the children at Aisyah Orphanage in Bukittinggi City, most of them had the Patient Hygiene Performance index (PHP) in the moderate criteria (50%). Furthermore, after applying disclosing substances to the children at Aisyah Orphanage in Bukittinggi City, most of them had the PHP index in the poor criteria (56.7%). The t-test independent statistical test results obtained a p-value of 0.000 ($p < 0.005$), indicating a significant difference between sweet potato extract and disclosing substance. Disclosing substance was more effective than purple sweet potato extract in identifying plaque on the tooth surface. Further study is recommended to apply purple sweet potato extract with different concentrations as an alternative ingredient to identify plaque on the tooth surface.

Keywords: Purple Sweet Potato, Disclosing Substance.***Corresponding Author:**

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1. INTRODUCTION

According to the World Health Organization, health is a state of perfect balance of physical, mental and social aspects, not only free from disease and weakness (World Health Organization, 2022). Health is the most important aspect of human life, where human should be physically and spiritually healthy (Britani, Ranimpi, & Nusawakan, 2017). Dental and oral health needs optimum care since it can affect overall body health (Lestari, Wowor, & Tambunan, 2016), (Sherlyta, Wardani, & Susilawati, 2017), (Nurhidayat, 2012). Dental and oral health is an integral part of overall body health which inseparable aspect of general body health (Harahap, & Masnawati, 2022). Oral hygiene is an indicator of oral and dental health which can be assessed based on the presence or absence of organic deposits, such as pellicle, *materia alba* (dental deposit), food residue, calculus, and dental plaque (Arifian, Chairanna, & Prasetyowati, 2022).

Plaque is a cause of caries with the incidence level of 75% to 90% in the world's population (Asura, & Danan, 2021). Plaque is formed from soft deposits that further forms a layer called "biofilm" and adheres tightly to the surface of the teeth, gums and other hard surfaces in the oral cavity. Plaque is made up of dead cells, small food fragments, bacteria, kidney remnants, and a sticky part of saliva called mucin (a substance found in saliva). The main species found in human dental plaque is *Streptococcus mutans* (Winarni, 2014).

Plaque on the tooth surface can be used as an indicator of oral hygiene. Poor cleaning can lead to stickier plaque and tartar after calcification (Ekoningtyas, Wiyatini & Nisa, 2016). Thin plaque has a color that is almost the same as the color of the teeth so that plaque cannot be seen with the naked eye. The presence of plaque that is formed from contact with oral fluids can be detected by using certain dye. (Murni, & Listrianah, 2020), (Waty, 2022). Plaque will look more gray, yellowish in color when it has matured and accumulated which is a usually found on one-third of the gingival surface and on deformed and rough tooth surfaces (Ekoningtyas, Wiyatini & Nisa, 2016).

The substance used to determine plaque usually has a contrast color with the color of the teeth (Fione, 2020), (Mega, et al., 2019), (Sukendro, Sutomo, & Sariyem, 2016). The dye in question is disclosing substance which can work to change the color of dental plaque so that it becomes contrast with the white color of the tooth surface (Chetruş, & Ion, 2013), (Haryani, Mahmiyah, & Ayatullah, 2019). Disclosing substance can be found in various preparations in the form of solutions, capsules, and tablets. The disclosure material that is currently commonly used is erythrosine (Oktapraja, Murniwati, & Suprianto, 2021). Erythrosine is a coloring agent for food and can also be used to dye bacteria (Utami, Amperawati, & Rizaki, 2022), (Laela, Mulyanti, & Nurnaningsih, 2021). The glycoprotein contained in the plaque can be absorbed by this dye so that the plaque can be seen (Siregar, 2019). This coloring agent is easier to see on the teeth when compared to other colors. However, since erythrosine is a triodin derivative of fluorescein with a high iodine content, it may cause thyroid cancer if ingested in large quantities.

The effectiveness of various kinds of cake plugs as a substitute for disclosing substance for detecting plaque in the mouth cavity found that rose-red, rose pink, and red powder plugs had the same effectiveness as disclosing solutions. Furthermore, a study conducted by Fatmasari et al., (2014) regarding the effectiveness of beetroot (*Beta vulgaris*) as a disclosing substance (plaque identification material) found that beetroot was more effective as a substitute for disclosing substance to see plaque. The comparison between erythrosine and anthocyanin extract of red dragon fruit peel (*Hylocereus costaricensis*) as an alternative material for plaque detection solution concluded that red dragon fruit peel as a natural food coloring agent with anthocyanin content concentration of 100% could be applied as an alternative material for

plaque detection, same as the color quality of commonly used disclosing substance and significantly different from the anthocyanin content concentration of 50%.

Sweet potato is a vine that lives in all weather conditions, in mountainous areas as well as on beaches (Winarti, 2008). Sweet potatoes are rich in carbohydrates, vitamins, minerals and dietary fiber. In addition, it has the potential as a functional food in the presence of beta carotene pigments in yellow sweet potatoes and anthocyanins in purple sweet potatoes (Hambali, & Noermansyah, 2015). The purple color in sweet potatoes is caused by the presence of natural anthocyanin dyes which are a group of reddish pigments located in water-soluble cell fluids. The anthocyanin components of purple sweet potato are mono or diacetyl derivatives of 3-(2-glucosyl) glucosyl-5-glucosyl peonidine and cyanidine (El Husna, Novita & Rohaya, 2013).

Anthocyanins are subtype of organic compounds from the flavonoid group. Some of the most commonly found anthocyanin compounds are pelargonidin, peonidin, cyanidin, malvidin, petunidin and delphinidin (Ngete, 2020). The high anthocyanin content in purple sweet potato has high stability compared to anthocyanins from other sources (Ekoningtyas, Wiyatini, & Nisa, 2016). That is why this plant is a healthier choice and in accordance with natural dye alternatives. This study was conducted at the Aisiyah Orphanage located in Bukittinggi City III. After examining the PHP index on 10 randomly selected children, it was found a mean plaque score in the poor criteria. This was also an alternative study which made disclosing media from natural ingredient of Purple Sweet Potato. This study aims to determine the Effectiveness of Purple Sweet Potato Extract and Disclosing Substance for Plaque Identification among Children at Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District.

2. RESEARCH METHOD

This was a quasi-experimental study with post-test only design. In this study, treatment or intervention was performed, which was followed by measurement (observation) or post-test. The population in this study were all children at Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District. The samples for this study were 30 children at Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District with the inclusion criteria of children with permanent teeth and index teeth. The samples were selected through total sampling technique. Data were collected by visiting the Aisiyah Orphanage, Tilatang Kamang Sub-District, Agam District to apply for permission to conduct an investigation. Furthermore, the researchers invited respondents according to the date and time that had been determined and approved by the Aisyah Orphanage, Tilatang Kamang Sub-District, Agam District.

Data were analysed using univariate and bivariate analysis. Univariate data analysis was conducted explain the characteristics of each study variable that were presented in the form of a frequency distribution table. In addition, bivariate analysis was conducted to determine the effectiveness of purple sweet potato extract and disclosing substance in identifying plaque which could be assessed using a computer program, namely the Independent t test with a p value <0.05.

3. RESULTS AND DISCUSSION

Table 1. PHP Index after Applying Purple Sweet Potato Extract among the Children at Aisiyah Orphanage, Bukittinggi City.

PHP Index Criteria	Purple Sweet Potato Application	
	F	%
Good (0 – 1.7)	13	43.3
Moderate (1.8 – 3.4)	15	50
Poor (3.5 – 5)	2	6.7

Sum	30	100
Mean		2

Table 1 showed that after applying purple sweet potato extract, most of respondents had the PHP index in the moderate criteria (50%) and only 2 respondents had the PHP index in the poor criteria (6.7%) with a mean plaque index of 2.1.

Table 2. PHP Index after Applying Disclosing substance among the Children at Aisyiyah Orphanage, Bukittinggi City

PHP Index Criteria	Disclosing Substance Application	
	F	%
Good (0 – 1.7)	3	10
Moderate (1.8 – 3.4)	10	33.3
Poor (3.5 – 5)	17	56.7
Sum	30	100
Mean		3.3

Table 2 showed that after applying disclosing substance, most of respondents had the PHP index in the poor criteria (56.7%) and only 3 respondents had the PHP index in the good criteria (10%) with a mean plaque index of 3.3.

Table 3. The t-test Results regarding the Effectiveness of Purple Sweet Potato Extract and Disclosing substance on the PHP index among the Children at Aisyah Orphanage, Bukittinggi City

T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
4.316	58	.000	1.1600	.6221	.1.6979

The independent t-test obtained a p-value of 0.000 ($p < 0.005$), which indicated that there was a significant difference between purple sweet potato extract and disclosing in identifying the PHP index among the children at Aisyah Orphanage Children, Bukittinggi City.

The plaque has the ability to retain large amounts of coloring matter. The difference in dye depends on the thickness of the plaque and is not related to bacterial or biochemical factors. The mechanism is that plaque metachromasia will bind to the dye through a diffusion process (Fatmasari, Supriyana, & Sukmawati, 2017).

Based on table 2 and table 3, it can be observed that the dyes used in identifying plaque, both chemical-based dye (disclosing substance) and natural coloring components from plants (purple sweet potato) could indicate the presence of plaque on the tooth surface. Purple sweet potato contains anthocyanin pigment with various amount of content in each plant which ranges from 20mg/100gr to 600 mg/100gr based on base weight. Some of the most commonly found anthocyanin compounds are pelargonidin, peonidin, cyanidin, malvidin, petunidin, and delphinidin (Anggriani et al., 2017), (Ifadah, Wiratara, & Afgani, 2022), (Khatimah, Hasanuddin, & Amirullah, 2022).

To determine the effectiveness of the two ingredients, namely purple sweet potato and disclosing substance as dental plaque identification materials, an independent t-test was performed. It was obtained a p-value of 0.000 ($p < 0.005$) which indicated that there was a significant difference in the use of purple sweet potato extract and disclosing substance as ingredients in identifying plaque on the tooth surface.

Anthocyanin pigment in purple sweet potato has a low stability under certain conditions. Anthocyanin stability is influenced by several factors, including pH, temperature, light and oxygen (Irawati, & Mardiana, 2018), (Ismed, Sayuti, & Andini, 2018). Temperature can shift the anthocyanin balance to tend to be a colorless form. Absorption value of anthocyanin color is also affected by pH. The lower the pH value, the higher the absorption value. A pH level of 5 and above may cause damage to the anthocyanin pigment which turns colorless. The color instability of the anthocyanins in purple sweet potato causes the color of the purple sweet potato extract to stick slightly to the plaque (Winarti, et al, 2008).

In addition, purple sweet potato contains anthocyanin dye. Such anthocyanin coloring pigment has water-soluble property, and it has already known that there is oral fluid (saliva) in the environment of the oral cavity. Such condition will surely affect the bond formed between the purple sweet potato and the plaque. Purple sweet potato has the ability to bind fluids around plaque in the oral cavity so that it does not strongly bind glycoprotein as the main component for plaque impact (El Husna, Novita & Rohaya, 2013).

Disclosing substance was better in identifying plaque on the tooth surface compared to purple sweet potato since disclosing substance is a chemical that has been processed in such a way intended to color plaque on the tooth surface. One of the contents of the solution disclosure is iodine which has high electronegativity, which indicates the ability to bind.

The results of this study are in line with the study conducted by Ekoningtyas, et al., (2017) regarding the chemical potential of purple sweet potato (*ipomoea batatas L*) as an identification material for the presence of plaque on the tooth surface. Such study found a p value of 0.000, which indicated that there was a significant difference in the use of purple sweet potato and disclosing substance ingredient as an identification material for plaque on the tooth surface. The mean plaque index value of disclosure solution was higher than the mean plaque index value of purple sweet potato. The results of this study are also in line with a study conducted by Fatmasari et al., (2014) regarding purple sweet potato and beet solutions as identification materials for the presence of dental plaque, which revealed that the mean value of sweet potato in identifying plaque was lower than beets.

4. CONCLUSION

It was found that after purple sweet potato extract, most of respondents had the PHP index in the moderate criteria (50%) and after applying disclosing, most of respondents had the PHP index in the poor criteria (56.7%). Disclosing was more effective than purple sweet potato extract in identifying plaque on the tooth surface. Further study is recommended to apply purple sweet potato extract with different concentrations as an alternative ingredient to identify plaque on the tooth surface.

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