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THE EFFECT OF MAULI BANANA (*Musa acuminata*) STEMS AND BASIL LEAVES (*Ocimum basilicum*) EXTRACTS ON GIC DISCOLORATION

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ABSTRACT
Background: *The water settable GIC material is easily influenced by fluids and is hydrophilic which causes discoloration of the restoration. Chlorhexidine is the gold standard mouthwash and if used for a long period of time it can cause discoloration of the restoration because it contains chemicals, so an alternative mouthwash made from natural ingredients is needed. A mixture of mauli banana stem and basil leaves extract has a more optimal antibacterial ability.* ***Objective:*** *In general, this study aimed to analyze the effect of a mixture of Mauli banana stem (Musa acuminata) and basil leaves (Ocimum basilicum) extracts on discoloration of the water settable GIC.* ***Methods:*** *This research is a true experimental research with pre test and post test designs with control group design. This study was divided into three treatments, namely water settable GIC soaked in a mixture of extracts of banana stems and basil leaves at concentrations of 75%, 100%, and 0.2% chlorhexidine gluconate (positive control). Color measurement was carried out using a series of digital analysis tools consisting of a Samsung A1 macro camera, Peyond series PD-480 SL and the MATLAB application.* ***Results:*** *The results of the Kruskal-Wallis statistical test showed p value = 0.282 (> 0.05), meaning that there was no significant difference in color change between the three treatments.* ***Conclusion:*** *There is an effect of a mixture banana mauli stems (Musa acuminata) and basil leaves (Ocimum basilicum) extracts at concentrations of 75%, 100%, and 0.2% chlorhexidine gluconate on the discoloration of the water settable GIC.*

Keywords: *Basil leaves (Ocimum basilicum), CIELAB system, discoloration, mauli banana stem (Musa acuminata), water settable GIC*
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INTRODUCTION

Dental caries is the most common problem experienced by the community related to dental and oral health.[1] Based on the Basic Health Research data in 2018, the incidences of dental caries in Indonesia were 88.8% in all age groups, with the level of dental and oral health problems in South Kalimantan reached 60%.[2] The high caries rate causes an increase in the need for dental care. The most dominant treatment undergone by dentists to treat caries is restoration. Restoration is the action of taking carious tissue and filling it with restorative materials. One of the materials used by dentists is Glass Ionomer Cement (GIC).[3] Along with the development of technology, GIC experiences modifications. Water settable GIC is a modification of GIC with a freeze-dried and polyacid design combined in powder form. The liquid used is only distilled water and will experience an acid-base reaction when combined with powder.[4] Water settable GIC materials have an unlimited shelf life and can overcome the problems of high molecular weight in GIC, as well as has a shorter setting time. Water settable GIC can balance the proportion between powder and liquid and overcome polyacids in volatile

liquids.[5,6] Lack of water settable GIC materials is easily influenced by fluids due to their hydrophilic properties, which causes the liquid to be absorbed into the restoration.[7,8]

The ability to absorb liquids can affect the color. The discoloration of the restoration is caused by intrinsic and extrinsic factors. Materials that experienced degradation, solubility, and are easily influenced by liquids are intrinsic factors. Extrinsic factors are factors whose causes come from outside, such as the use of mouthwash in daily life. 9,10 Mouthwash is a liquid to clean the oral cavity from disease-causing organisms. One of the mouthwashes used by the community and is the gold standard is chlorhexidine.[11] The use of chlorhexidine mouthwash for the long term can cause discoloration because it contains chemicals, so that an alternative mouthwash made from natural ingredients is required.[10,12] Cavendish banana (*Musa acuminata*) has the largest content of tannin by 67.59%, which can be used as antiseptic, antibacterial, antioxidant, and antifungal.[13] The 25% concentration of Cavendish banana stem extracts has antibacterial ability on *Streptococcus mutans* bacteria and is non-toxic to cells so that it has the potential to be used as an alternative mouthwash made from natural ingredients.[14]

Basil leaves (Ocimum basilicum) have the largest content of essential oil of 96.7% and can provide freshness and reduce the bitter taste of Cavendish banana stems containing high levels of tannins.[13] The concentration of 20% basil leaf extracts is equivalent to chlorhexidine in reducing plaque and can be used as an antibacterial against *Streptococcus mutans* bacteria.[15] A mixture of Cavendish banana stem extracts and basil leaves has a more optimal antibacterial ability, and at a concentration of 75%, has been able to represent antibacterial at the concentrations of 50% and 25% with a moderate antibacterial category and has been proven not toxic to cells.[13,16] Based on the explanation above, a study regarding the effect of a mixture of Mauli banana stem (*Musa acuminata*) extracts and basil leaves (*Ocimum basilicum*) on the discoloration of water settable GIC restorations is required.

RESEARCH METHODS

This study has obtained a permit and passed the ethical feasibility test conducted by the Faculty of Dentistry, Universitas Lambung Mangkurat, Banjarmasin No. 033/KEPKG-FKGULM/EC/III/2021. The method used was a true experiment with pre-test and post-test with control group design. The samples used were water settable GICs with a diameter of 5mm and a thickness of 2mm based on the provisions of the International Organization for Standardization (ISO) 9917-1: 2003. 8 samples were obtained by simple random sampling technique with 3 treatments. The first treatment was soaked using a mixture of Cavendish banana stem extracts and basil leaves at a concentration of 75%, the second treatment with a concentration of 100%, and the third treatment using 0.2% chlorhexidine gluconate (positive control).

The study was conducted at the Biochemistry Laboratory, Faculty of Medicine, Universitas Lambung Mangkurat Banjarbaru. First, the samples were made by making an acrylic mold first. The finished mold was placed on a glass lab in the form of the celluloid strip and smeared with vaseline. GIC water settable materials were manipulated with a ratio of powder and liquid of 1:1 or according to the manufacturer's rules. The liquids used distilled water stirred using an agate spatula for 40 seconds and put into a mold covered using a celluloid strip so that the surface was even. The celluloid strip was removed after 10 minutes. Finally, the samples were removed from the mold.

Making a mixture of banana stem extracts and basil leaves used a maceration method. First, the Cavendish banana stems and clean basil leaves were dried in an oven at 40-50◦C. Dried cavendish banana stems and basil leaves were mashed into powder and stored in a dry and closed place. The powder was mixed with 70% ethanol solvent, which was soaked for five days. The next step was evaporation using a rotary evaporator at 40◦C, followed in the waterbath until concentrated extracts with a concentration of 100% were obtained. An ethanol-free test was carried out by adding potassium dichromate. The concentration of 25% Cavendish banana stem extracts and 20% pure basil leaves was obtained by mixing 25 g of Cavendish banana stem extracts and 20 g of basil leaves using 100 ml of distilled water. The 25% concentration of Cavendish banana stem extracts and 20% concentration of basil leaves were mixed in a ratio of 1:1 to obtain a mixture of Cavendish banana stem extracts and 100% basil leaf extracts. A concentration of 75% was obtained by adding distilled water to dilute the concentration of 100%.

After making extracts, the samples were immersed in 2 ml of saline solution for each sample and placed in an incubator at 37◦C for 24 hours before being given treatment. The soaked samples were put into a container containing a

mixture of Cavendish banana stem extracts and basil leaves at concentrations of 75%, 100%, and 0.2% chlorhexidine gluconate with a total solution of 2 ml for one sample. Samples that have been submerged with the solution were placed in a beaker glass and stored in an incubator at 37◦C for 17 hours.

Measurement of discoloration was performed before and after immersion with a series of digital analysis tools consisting of a Samsung A1 macro camera, Beyond series PD-480 SL, and MATLAB application. The distance of the camera lens to the sample was 4cm, and the distance of the LED light to the sample was 5cm. Samples captured were inserted into the computer in JPG format. The color assessment was conduction using the MATLAB application and analyzed according to the standards of Commission Internationale de L'Eclairage (CIELAB).

RESULTS

The results of the study conducted can be seen in Figure 1.

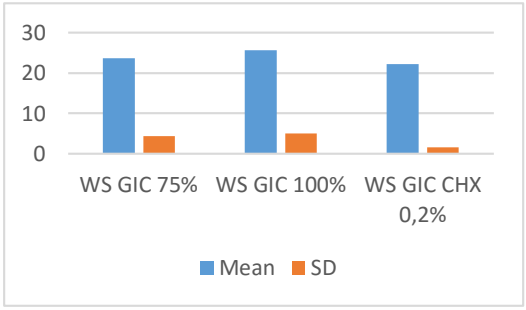

Figure 1. Diagram *Mean* and Standart Deviation Effect of Mauli Banana (*Musa acuminata*) Stems and Basil Leaves (*Ocimum basilicum*) Extracts on GIC Discoloration

The results of the measurement of discoloration after immersion showed that the mean value of the highest to the lowest was in the water settable GIC treatment soaked in a mixture of Cavendish banana stem extracts and basil leaves with a concentration of 100% with a value of 25.64, treatment with a concentration of 75% with a value of 23.67, and the lowest was in the treatment of 0.2% chlorhexidine gluconate solution with a value of 22.15.

All data obtained were performed normality test by the Shapiro-Wilk Test. The results of the discoloration test showed a p-value = 0.018 (<0.05) in the first treatment, which means the data was normally distributed. In the second treatment, the p-value = 0.063 (>0.05), which means the data was not normally distributed. Furthermore, in the third treatment, the p-value = 0.021 (<0.05) in the third treatment, which means the data was not normally distributed. After that, it was followed by the Kruskal-Wallis test, which can be seen in table 1.

Table 1. Table *Kruskal-Wallis* Results Effect of Mauli Banana (*Musa acuminata*) Stems and Basil Leaves (*Ocimum basilicum*) Extracts on GIC Discoloration

	Water Settable GIC Discoloration
Kruskal-Wallis H	2.535
Df	2
Asymp. Sig	0,282

The Kruskal-Wallis test showed a p-value =0.282 (p>0.05), which means that there was no significant difference in the discoloration of the water settable GIC restoration in the water settable GIC treatment soaked in a mixture of Cavendish banana stem extracts and basil leaves at a concentration of 75%, a mixture of Cavendish banana stem extracts and basil leaves with a concentration of 100%, and 0.2% chlorhexidine gluconate solution.

DISCUSSION

In the treatment of water settable GIC restorative materials soaked in a mixture of banana stem extracts and basil leaves at concentrations of 75% and 100% for 17 hours showed that all samples experienced a decrease in L value and a value and increased in b value. These results indicate discoloration of restoration to be darker, yellowish, and greenish. This is in line with the study by Mangiwa and Maryuni (2019), which stated that tannins cause greenish and blackish coloring.[17] Study by Latanza et al. (2020) stated that the tannin content in a mixture of Cavendish banana stem extracts and basil leaves resulted in a yellowish coloration.[16] Based on a study by Holle et al. (2018) stated that tannins are natural staining agents found in all parts of plants and produce brownish and yellowish colors.[18] Tannins help in accelerating water absorption in restorations because they contain acidic polyphenolic compounds..[19] Acid content can cause erosion and increase roughness so that the restoration structure becomes uneven, which causes the dye to settle easily, resulting in discoloration.[8]

Other contents besides tannins are essential oils. In basil leaves, essential oils are very high, and there are alkaloid compounds and

tannins that can cause discoloration. This is supported by a study by Kumalasari and Andiarna (2020), which stated that basil leaves could give yellowish, greenish, and brownish coloring. [20] The essential oil content in basil leaves contains phenolic compounds, which are acidic and release H+ ions and have a small molecular weight which causes water to be easily absorbed so that it helps in the deposition of dyes.[21] Another content of basil leaves besides essential oil is polyphenol compounds. Polyphenols have a role in accelerating discoloration. Polyphenols can be acidic and accelerate the absorption of fluids, thereby damaging the bonding of the particles of the restoration structure.[19] Discoloration of the restorative materials is also caused by the hydrophilic properties and vulnerability to fluids, thereby causing the liquid to be easily absorbed and affecting the microstructure, causing discoloration. GIC water settable restoration has properties that are very easily influenced by liquids and are not resistant to acid solutions so that liquids are easily absorbed and cause discoloration.[8]

In the treatment of water settable GIC restorative materials that had been soaked in 0.2% chlorhexidine gluconate solution for 17 hours, all samples experienced a decrease in the value of L, a value, and increased in b value. These results indicate that the discoloration on immersion in 0.2% chlorhexidine gluconate solution becomes darker, greenish, and yellowish. This is in line with the study by Puspitasari and Apriasari (2018), which showed discoloration of restorations soaked with 0.2% chlorhexidine gluconate.[19] Based on a study by Armiati (2020), it was explained that 0.2% chlorhexidine gluconate mouthwash has a clear color but contains PEG-40 hydrogenated castor oil dye, which can stick to dental restorations so that it causes staining. Chlorhexidine gluconate 0.2% is soluble in water and can cause the dye to be easily absorbed because the bond in the restoration is degraded through a hydrolysis reaction so that it causes the dye to be easily absorbed and the occurrence of discoloration.[22] Another content of 0.2% chlorhexidine gluconate is an anti-plaque that can interact on the restoration surface and produce a brownish stain called the Maillard reaction.[19] Discoloration can also be caused by an acidic pH; 0.2% chlorhexidine gluconate has a pH ranging from 5.5 to 6 and including in the acid category.[23]

In this study, it can be seen that the difference of discoloration in the treatment of water settable GIC restorative materials soaked in a mixture of Cavendish banana stem extracts and basil leaves at concentrations of 75% and 100%, and 0.2% chlorhexidine gluconate solution did not have a significant difference. The difference of discoloration was not significant because the concentration range of the mixture of Cavendish banana stem extracts and basil leaves with a concentration of 75% was not too far from a concentration of 100%, and the number of extracts and 0.2% chlorhexidine gluconate solutions soaked with the samples had the same volume, 2 ml with the same duration of immersion, temperature, and measuring instruments used to measure discoloration.[24] It can be concluded that there is an effect for the mixture of Cavendish banana stem (*Musa acuminata*) and basil leaves (*Ocimum basilicum*) at concentrations of 75%, 100%, and 0.2% chlorhexidine gluconate on the discoloration of the water settable GIC.

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