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Extract Formulation and Effectiveness of *Beta vulgaris* L. as dental plaque solution disclosing

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Abstract
This study aims to determine the effect of bit tuber effectiveness in controlling the plaque compared to the commercially branded product. This review is an experimental design with randomized pretest and posttest control group design. Beet extract obtained by maceration with water containing 0.2% citric acid and 0.1% ascorbic acid. The extract is then formulated into a dosage of dental plaque solution disclosing in the content of 5% 6% 7%, 8%, 9%, and 10%. The most stable is dental plaque solution disclosing beet extracts containing 9% and 10%, but the respondent is tested with the 9% content. The average difference in the plaque index after the prior treatment of the group preparations containing beet extract was 0.7673 ± 0.61954, and a group of commercial trademarks is 0.5913 ± 0.41361. Independent T-test ($p < 0.05$) showed no significant difference between the two groups. It can be concluded that dental plaque solution disclosing beet extracts containing 9% has the same effect with the well known commercial product in controlling the plaque.

Keywords: tuber bit extract, dental plaque, disclosing solution, plaque index

1. Introduction
Plaque is a soft deposit which is firmly attached to the tooth surface, made up of microorganisms that proliferate in an intercellular matrix if someone neglects oral hygiene. Plaque cannot be cleaned by merely rinsing the mouth with water but must be actively brushed mechanically using a toothbrush. If plaque is let to accumulate around the mouth tissue, it will cause calculus or tartar that will damage the hard and soft tissues in the oral cavity. Dental hard tissue damage is called dental caries or cavities.

To avoid the occurrence of dental caries, each should be able to do it his/her self or use the services of dentists to detect dental plaque. Dental plaque is usually transparent and colorless, so it is not readily visible causing the person is unaware of the presence of plaque on the teeth. It required a specific dosage to identify the presence of plaque called dental plaque disclosing preparation to form a solution, gel or chewable tablets.

Dental plaque disclosing preparation is a dosage form of a solution, gel or chewable tablets containing dyes and used to observe the dental plaque. The dye used is usually an organic dye material as a single colored Erythrosin with red or green which produces a blue color. Both of these preparations is easily cleaned with water, but the most effective is in the form of a gel. The weakness of this preparation is less delicious taste.

For alternative dye that can be used in the preparation of identification plaque is the root crop beet (*Beta Vulgaris* L). *Beta vulgaris* L. can be used as a colorant in disclosing solution the plaque identification. The solution is made of beetroot proving more efficient than the plaque disclosing solution on the market [1].

Beet (*Beta vulgaris*) is an annual plant in the form of grasses. The bit is much favored because it feels good, slightly sweet, and soft. The main content of this beet crop is betalain consisting of betacyanin which is a colored pigment betaxanthin of violet and yellow. From 12 weak acid solvent used for extracting betanin root beet plant, it is obtained two types of enzymes most suitable for producing the highest amount of extract: a solution containing 0.2% of citric acid and ascorbic acid 0, 1% and a solution containing 20% ethanol and 0.5% citric acid [2].

Based on research [1, 2], it has been formulated preparations for plaque identification of these bits plant root extract containing betanin and will be made in the form of a solution which was tested for physical stability for 28 days and tested for effectiveness on 30 respondents.

2. Materials and Methods
This study was an experimental study with randomized pretest and posttest Control Group Design. The object of research is beet (*Beta Vulgaris* L.) which is still fresh and bright red in color. The subjects were students from the Department of Dental Nursing voluntarily willing to accept treatment during the study by filling out forms and sign a statement as a volunteer. Before the first treatment to volunteers explained the purpose of research and other information related to the use of dental plaque disclosing solution. To assess the state of dental plaque, dental plaque index was examined before and after the treatment. In this study, there were 2 treatment groups consisting of two groups of 30 volunteers.

The results will be presented in the form of tables and histograms analyzed with the theory of pharmaceutical and ANOVA of the independent t-test.

3. Results & Discussion
Extracts obtained is stored for 28 days and examined the physical stability on days 0, 7, 14, 21 and 28 including pH, viscosity, homogeneity and color intensity. It also discussed the changes in smell and taste as well as irritation to the oral

mucosa. Preparations were stable then tested to phantom teeth and will be observed by five dentists. Preparations with the same color intensity with dental plaque disclosing solution under brand of the commercial product were tested. The execution of maceration up to evaporation is done within 12 hours to prevent damage to the extract containing betanin and betacyanin.

After four times the extraction of a total of 1546 grams of beet concentrated extract obtained in succession 43.12 g, 29.42 g, 31.04 g and 26.15 g for a total of 129.73 grams. So that the yield of the extraction process beet is 8.39%. Previous studies [3,4] have extracted as much as 9.89 ± 0.48 g of 120 g beet meaning the yield in the study was 8.24%. It can be concluded both returns is not much different.

Acidity level (pH) used for the preparation refers to the pH stability of betanin and betacyanin as the main content of the extract that gives the red color in the range of 4-8 and the pH of the commercial dental plaque disclosing solution is found at 5.3. After storage for 28 days, the pH of the preparation was checked every seven days. It was found that there was a tendency to decrease the pH of each formula but remained in the pH range of stability at 4-8. This decline is expected due to the chemical content of betanin and betalain found in beet extract undergoing a reaction after being mixed with other ingredients. This response has been anticipated by the addition of sodium metabisulfite antioxidant.

ANOVA test ($p < 0.05$) obtains the significance of 0.072 greater than 0.05, which means there is no difference in the average of the pH profile on days 0, 7th, 14th, 21st and 28th indicating there was no change in the pH of the preparation after 28 days of storage.

Homogeneity examination was conducted by rubbing the preparation on the slide and examined under a microscope at 100x magnification. It is seen that during the 28 days of storage preparations remain homogeneous in particle growth. If there is a growth of particles or their aggregates, there is a tendency increasing in the viscosity of the preparation. It was found that the viscosity of the dosage ranges from 2.040 to 2.830 centipoise. The higher the levels of beet extract in the preparation, the more viscous the preparations, and the longer the storage, the higher the visible increase in viscosity. The viscosity of the preparation is associated with dispersive power solution when applied to the tooth surface. If too thick, it will give low dispersive power, but if too watery, it will stick hard on the teeth.

To test whether the changes in viscosity significantly after 28 days of storage, ANOVA ($p < 0.05$) was used to compare the viscosity profile preparation on days 0, 7th, 14th, 21st and to-28. The significance of 0.163 ($p > 0.05$) indicated that no significant immutability on the viscosity profile in the days of storage. Further, color intensity preparation is relatively stable in storage at room temperature. In this evaluation of the respondents stated that there was no change in the smell and taste of preparations containing extracts of beet from day 0 until the 28th. This suggests that a decrease in pH and viscosity increase after storage of not affect the smell and taste of the preparation. In the evaluation of changes in odor and taste, the respondents stated that there was no change in the smell and taste of preparations containing extracts of beet from day 0 until the 28th. This suggests that a decrease in pH and viscosity increase after storage do not affect the smell and taste of the preparation.

In the evaluation of oral mucosa irritation, none of the 30 respondents feel the soreness, burning or itching in the mouth. They all said good taste and not leave the irritation. Thus, it is concluded that up to 10% dosage levels plaque dental disclosing solution containing beet extract is not irritating the mucosa of the mouth.

The statistic shows that the significance of the plaque index comparison group using dental plaque disclosing solution containing fruit extracts bits and the one available commercially in the market was 0.371 ($p > 0.05$). It means there is no difference between the two preparations in the effectiveness as the dental plaque solution. However, the previous study [1] the juice of bit tuber could display plaque apparently compared to the commercial products.

Extract bits as preparation dental plaque disclosing solution can be used more practical and last longer. The preparation of this research has been adapted from a patented product [5] where the modifications made have been changed to the nature of the active substance content tuber beet extract betacyanin and betanin which is stable at pH 4-8. In this research, these preparations were made at pH 5.3 similar to pH of dental plaque solution produced for commercial purposes. Preparations with the levels of 9% and 10% are relatively the most stable dosage that can be compared to the preparations of the commercial product. Preparations with levels of statistically was not significant to the preparation of the business solutions in determining the plaque index indicating that there is no difference in effectiveness between the formula containing 9% bit tuber extract to the commercial product in solving the plaque problems.

4. Conclusions

The research has proven that from the dental plaque solution disclosing in the content of 5% 6% 7%, 8%, 9%, and 10%, the most stable is dental plaque solution disclosing beet extracts containing 9% and 10%. Though the dental plaque solution disclosing beet extracts containing 9% has the same effect with the well known commercial product in controlling the plaque, further research is necessary to determine the durability of the preparation as it was tested until 28th day only. The outcome if would like to be commercialized must be able to stay in keeping for might be more than one year as the current existing commercial product.

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