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**RESEARCH**

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## The Use of Turmeric (Extracts and Squeeze) to Detect Plaque on Teeth

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### Abstract

Turmeric is one of the original spices and medicinal plants from the Asian region. The benefits of the turmeric plant are good as a complement to cooking spices, herbs/medicines, or to maintain health and beauty. Turmeric can also be used as a coloring agent, such as food coloring agents and dyes for woven fabric crafts. Turmeric plants are easy to find, so turmeric can be used as a substitute for disclosing solution (plaque detection liquid). This turmeric plant is very easy to obtain and does not incur high costs in its management. This study aimed to determine the effectiveness of using turmeric (extract and juice) to detect plaque in teeth in 2019. This type of research uses a quasi-experimental type. The population in this study, namely level 1 military service, amounted to 76 people. The sample used is by using a purposive sampling technique totaling 20 respondents. The results showed an average difference between disclosing solution, 100% turmeric extract, 75% turmeric extract, and 100% turmeric juice. The average disclosing solution was 36.34, 100% turmeric extract 64.50, 75% turmeric extract 79.95, and 100% turmeric juice 90.00. The results of the one-way ANOVA test were sig 0.000 < 0.05, meaning that there was an average difference between these variants, from the research results of turmeric extract and turmeric juice could detect plaque but were less effective as a substitute for disclosing solution in plaque detection.

**Keywords:** Plaque index, turmeric, disclosing

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## 1. INTRODUCTION

The prevalence of dental and oral health problems in Indonesia is 57.6% with daily brushing behavior of 94.7% and only 2.8% behave in tooth brushing according to the results of the 2018 Basic Health Research. West Kalimantan Province has a prevalence dental and mouth health problems around 60.5% of the population from 21 provinces in Indonesia (Kementerian Kesehatan R. I., 2018).

The process of dental caries begins with the presence of plaque on the surface of the teeth, sucrose (sugar) from food scraps and bacteria that attach to a certain time then turn into lactic acid which will reduce the pH of the mouth to be critical (5.5), thus, it causes enamel demineralization to continue to dentin and pulp (Rahmawati et al., 2015; Lemos, 2005). The oral cavity is never free of plaque (Ghosh et al., 2014). Plaque plays an important role in the formation of debris and calculus (Alhamda, 2011)(Rezki, 2014). The attachment of calculus begins with the formation of dental plaque and the surface of the calculus itself is always plagued by plaque (O'Sullivan, 2000) (Fathmawati, 2015).

Plaque can be identified in many ways such as screening directly on the tooth surface, using disclosing solutions (Cahyati, 2013), or by using the natural ability of teeth to fluoresce under blue light. These methods are conducted because plaque cannot be identified directly even for dental health workers or patients. It is because the color of the plaque is the same as the surface of the teeth. Disclosing solution will change the color of dental plaque to contrast with the white tooth surface. Dental plaque has the ability to hold a large amount of the substance of the solution used as a disclosing solution.

Disclosing solution material which is currently commonly used is erythrocin. Erythrocin is one of the red coloring agents for food and can also be used for bacterial dyes (Mangiri et al., 2018). The glycoprotein contained in the plaque can be absorbed by this coloring agent so that the plaque can be seen (Datta et al., 2007). The choice of color is because red is easier to see in teeth when compared to other colors. However, because erythrocin is a triiodine derivative from fluorescein, high iodine content can cause thyroid cancer if ingested in large amounts (Chowdhary et al., 2015).

Another disadvantage of disclosing solution is that it is made from chemicals, bad taste and less preferred, can dye the mucosa for several hours so that it can cause embarrassment for patients who will do activities immediately after using it, and coloring materials that have potential as carcinogenic substances (Putri et al., 2009).

The use of natural dyes can reduce the risk of body damage. Natural dyes are pigments that are formed from living cells or dead cells that come from plants, animals, fungi or micro organisms that are isolated from cells, and their composition is modified to change the solubility stability and intensity of the color (Budiyono & Kaseno., 2004). Dyes derived from plants are naturally caused by organic compounds called pigments, for example yellow pigments from turmeric, green pigments from suji leaves or pandan leaves (Permata et al, 2015).

Turmeric is a regional plant that thrives and is widely available in Indonesia. Utilization of natural dyes such as curcumin from turmeric is one alternative that can be used, because in addition to low prices, the amount is also abundant, and safe for health. It becomes my basis in conducting research using turmeric to detect dental plaque.

As for previous studies that conducted experiments on other plants to detect dental plaque such as dragon fruit in the study of Mangiri et al., (2018) about super red dragon fruit juice (*hylocereus costaricensis*) as a natural dye for dental plaque in addition to research by Fatmasari et al., (2014) about the effectiveness of beets (*beta vulganis*) as

disclosing solution (Plaque Identification Material), there are no researchers in this study who use turmeric as a dental plaque detection. Attention to the use of natural dyes is increasing due to the possibility of carcinogenic compounds in synthetic dyes.

## 2. RESEARCH METHOD

This research used quasi-experiment. The population in this study was 76 students majoring in dental health at the Health Polytechnic of Health Ministry, Pontianak consisting of 2 classes. The number of samples in this study was 20 respondents using purposive sampling technique.

Researchers conducted a calibration to equalize perceptions and assist in conducting the application of turmeric extract, turmeric juice, disclosing solution and documentation. Data collection was obtained by examining the Hygiene Index (HI), with the treatment of disclosing solution, 100% turmeric extract, 75% turmeric extract, 100% turmeric juice on the Students of dental health department of batch. 1 of 2019.

The first treatment for 20 respondents was the smear of disclosing solution by taking a cotton pellet using tweezers and applying the entire surface of the tooth awaited for 2 minutes, then, gargling with clean water and examining the plaque index using the Hygiene Index (HI) method and recording the results of the examination on examination sheet.

The second treatment was to apply 100% turmeric extract and take cotton pellets using tweezers and then apply turmeric extract with a concentration of 100% on the entire surface of the tooth awaited for 2 minutes, after that gargle with clean water, then check the plaque index with the Hygiene Index (HI) method as well as record the results of the inspection on the inspection sheet.

Third Treatment was smear of 75% turmeric extract and take cotton pellets using tweezers, and then apply turmeric extract with a concentration of 75% on the entire surface of the tooth awaited for 2 minutes, after that gargle with clean water, then check the plaque index with the Hygiene Index (HI) method and record examination results.

Fourth Treatments was smear of 100% turmeric juice and take cotton pellets using tweezers and then apply 100% turmeric juice on all surfaces of the teeth awaited for 2 minutes after that gargle with clean water then check the plaque index with the Hygiene Index (HI) method and record the examination results on thr examination sheet. This study was approved by the ethical research commission of the Health Polytechnic of Health Ministry, Pontianak Number: 143/KEPK-PK.PKP/V/2019.

## 3. RESULTS AND DISCUSSION

Table 1. Frequency distribution of plaque categories detected by the Hygiene Index

Hygiene Index	(0%-033%)	(34%-67%)	(68%-100%)	Total
Disclosing solution	11	8	1	20
Turmeric Extract 100%	-	12	8	20
Turmeric Extract 75%	-	1	19	20
Turmeric Juice 100%	-	2	18	20

In table 1 above, it can be seen that 20 respondents in the Hygiene Index (0% - 33%) only in the treatment of 11 people disclosing solution, in other treatments none, but 12 respondents who were smeared with turmeric extract 100% were in the Hygiene Index (34% -67%).

Table 2. Plaque Score Frequency Distribution with Hygiene Index Using Disclosing Solution Coloring, 100% Turmeric Extract, 75% Turmeric Extract and 100% Turmeric Juice.

Treatment	Number of Respondent	Lowest HI Score (%)	Highest HI Score (%)	Average (%)
Disclosing solution	20	.80	75.00	36.3400
Turmeric Extract 100%	20	46.00	92.00	64.5000
Turmeric Extract 75%	20	67.00	96.00	79.9500
Turmeric Juice 100%	20	63.00	90.00	78.9500

Table 2 shows that out of 20 respondents, disclosing solution and 100% turmeric extract can detect plaque with an average score of 36.34 and 64.50 compared with 75% turmeric extract and 100% turmeric juice. HI scores obtained from the HI formula by dividing the number of plaque-free surfaces by the number of surfaces examined, expressed in the percentage of clean surfaces (Putri et al., 2009).

Table 3. Test of Homogeneity of Variance and Shapiro-Wilk Normality Test Results

Levene Statistic	df <sup>1</sup>	df <sup>2</sup>	Sig.
.872	2	57	.424
Shapiro-Wilk			
	Statistic	df	Sig.
Disclosing Solution	.914	20	.075
Turmeric Extract 100%	.945	20	.296
Turmeric Extract 75%	.944	20	.285
Turmeric Juice 100%	.911	20	.066

Table 3 shows that disclosing solution, 100% turmeric extract, 75% turmeric extract, and turmeric juice have the same variant seen from the significance value of 0.000 which is greater than 0.05. It shows that the data groups come from the same variant (homogeneous). In addition, the results of the Shapiro-Wilk normality test indicate that a sig value > 0.05 which can be concluded that the data are normally distributed.

Table 4. Test results for One Way Anova analysis

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2990.033	2	1495.017	15.236	.000
Within Groups	5592.900	57	98.121		
Total	8582.933	59			

Table 4 shows that the significance is  $0.000 < 0.05$  which means that the plaque values of the three groups are different.

Table 5. Test Result of Post-Hoc Bonferroni analysis

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Sig.
Disclosing solution	Turmeric extract 100%	-28.16000*	.000
	Turmeric extract 75%	-43.61000*	.000
	Turmeric juice 100%	-42.61000*	.000
Turmeric Extract 100%	Disclosing solution	28.16000*	.000
	Turmeric extract 75%	-15.45000*	.006
	Turmeric juice 100%	-14.45000*	.011

Turmeric Extract 75%	Disclosing solution	43.61000*	.000
	Turmeric extract 100%	15.45000*	.006
	Turmeric juice 100%	1.00000	1.000
Turmeric Juice 100%	Disclosing solution	42.61000*	.000
	Turmeric extract 100%	14.45000*	.011
	Turmeric juice 75%	-1.00000	1.000

Table 5 shows the average value of 75% turmeric extract and 100% turmeric juice proved to be not significantly different.

The test results show that the 4 variants have a significance value of 0.000. It shows that the variants are the same (homogeneous), and from the Shapiro Wilk test, it shows that the data are normally distributed. From the One Way Annova test the significance value of 0.000 indicates the average plaque value of the four different groups. The Bonferroni Post-Hoc Test above shows that the dental plaque index after disclosing solution ( $p=0.000$ ) is significantly different from 100% extraction ( $p=0.000$ ), 75% ( $p=0.000$ ) and turmeric juice 100% ( $p = 0,000$ ). Meanwhile, the 75% ( $p=1.000$ ) extract plaque index did not differ significantly from 100% turmeric juice ( $p=1.000$ ) The difference was due to the curcumin content in the extract and the turmeric juice did not give a striking color when applied to the surface of the teeth (Sari & Maulidya, 2016). Turmeric extract when applied to the surface of the teeth looks staining on the teeth but when the respondent rinsed with water, the coloring of the teeth also dissolves in the mouth rinse.

This research contradicts with Wahyuni, (2016) study which states that turmeric contains 624 histologists which can be used as natural coloring agents in coloring cows' brushing teeth. The color results obtained from anthocyanin curcumin dyes so that the coloring of turmeric 624 scientists combined with  $\text{Ca(OH)}_2$  can cause a brownish color contrast between the dental tissue so that its parts can be distinguished, so this dye has fulfilled the purpose of coloring. In addition, Sadiyah's research, (2015) explained that curcumin turmeric filtrate (*Curcuma Domestica* Val.) as a coloring agent by simply mixing 624 turmeric scientists with lime water will turn brown.

This research on turmeric extract and juice has not yet succeeded in replacing disclosing solution because only a small amount of turmeric extract is attached to the plaque. Therefore, that further research needs to be conducted so that the extract and the juice of turmeric can be obtained so that it can be a substitute for the disclosing agent by adding variations/other ingredients. Research has also been conducted using natural dyes by Mangiri, (2018) about super red dragon fruit juice (*hylocereus costaricensis*) as a natural dye for dental plaque. Super red dragon fruit juice (*hylocereus costaricensis*) has a staining effect on dental plaque, but it is still lacking in the duration of color intensity in the oral cavity compared with disclosing solution, whereas in the research of Fatmasari et al., (2014) about the effectiveness of beets (*beta vulgaris*) as disclosing solution (Plaque Identification Material) the result is that it can be seen that beets are more effectively used to replace disclosing solutions to see plaque.

#### 4. CONCLUSION

Based on the results of research and discussion about the effectiveness of the use of turmeric plants (extracts and juice) to detect plaque on teeth in dental health students batch 1 of 2019, it can be concluded that turmeric extract and turmeric juice can detect plaque but are less effective to be used as a substitute for disclosing solution. Further



research is recommended for the manufacture of turmeric extract or turmeric juice that is more concentrated color such as synthetic dyes or disclosing solution.

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