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Research Report

The effect of toothpaste containing Kayu Sugi extract on plaque formation

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ABSTRACT

Background*: Although many researches had revealed the beneficial effect of Kayu Sugi as a chewing stick, study on the effectiveness of its extract in toothpaste is still inadequate.* ***Purpose****: The objective of this study was to compare the effect of toothpaste, with and without Kayu Sugi extract on preventing plaque formation.* ***Methods****: The study consists of two sessions which was separated by three days washout period. The subjects were given two types of toothpaste, with and without Kayu Sugi extract to be used in the first and second session separately. The subjects were polished and plaque score were measured after one hour for the first quadrant, two hours later for the second quadrant and after four hours for the third/fourth quadrant. Subjects were not allowed to eat, drink or rinse during this four hours period. The procedures were repeated for the second session after three days washout period. The plaque score were recorded as absent (code 0) and present (code 1), and only labial and palatal/lingual surfaces of each tooth were used for plaque scoring.* ***Result****: The study showed that there was no significant difference of the amount of plaque formed after polishing using two different toothpastes, with and without Kayu Sugi extract.* ***Conclusion****: We concluded that toothpaste with or without Kayu Sugi extract give similar level in preventing plaque formation.*

Key words*: Kayu Sugi, plaque formation, toothpaste*

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INTRODUCTION

Kayu Sugi, known as Miswak or *chewing stick* is used as teeth cleaning tool in many regions in the world especially in Muslim predominant areas. It is made from the roots or twigs of *Salvadora persica* tree. The World Health Organization[1] has recommended and encourages the use of *Kayu Sugi* as an effective alternative tool for oral hygiene.

The use of *Kayu Sugi*, when preceded by professional instruction has been shown to be more effective than toothbrush in reducing plaque formation and gingivitis.[2] The observational study on Sudanese volunteers[3] showed that *Kayu Sugi* users demonstrated better periodontal status as compared to toothbrush user. Besides, the *Kayu Sugi* users were also found to present with lower salivary level of *Streptococci* species[4] and *Actinobacillus actinomycetemcomitans*[5] in comparison to the toothbrush user.

Due to its long history of usage as a natural tooth brush and many positive findings were reported on the *Kayu Sugi* users especially concerning its effects in reducing gingivitis and some oral pathogens,[2-5] many researches were carried out the extract of *Kayu Sugi*. A numbers of *in vitro* studies had reported on the antibacterial properties of the *Kayu Sugi* extract on some cariogenic bacteria and periodontal pathogens,[5-7] thus suggesting another potential antibacterial agent suitable to be added in the oral health products.

Based on its antibacterial properties, *Kayu Sugi* extract was included in many oral health products such as toothpaste and mouthwash in an attempt to inhibit bacterial growth and thus slowing down the process of plaque formation. Although in vitro studies had shown the antibacterial properties of the *Kayu Sugi* extract, there were very few studies, if any that look at the effectiveness of *Kayu Sugi* extract added in oral health products especially toothpaste in hindering plaque formation. Hence, the objective of the study was to compare the effect of the toothpaste,

with and without *Kayu Sugi* extract in preventing plaque formation

MATERIALS AND METHODS

This was a community trial study performed at School of Dental Sciences, Universiti Sains Malaysia (USM) to compare the efficiency of two different toothpastes, with and without *Kayu Sugi* extract in hindering plaque accumulation. The ethical clearance was obtained from the Research and Ethics Committee USM.

Thirdty six 36 subjects who were the students of School of Dental Sciences USM volunteered for the study. Their ages were ranged from 20- to 25-year-old and comprised of 31 ladies and 5 gentlemen. The inclusion criteria were as follows: a) subjects with intact periodontal tissues which means free from calculus, gingivitis and periodontal diseases; b) subjects without any prosthodontics or orthodontics appliance; and c) subjects were non smokers.

Two types of toothpastes, with and without *Kayu Sugi* extract were provided. Double blinding method was employed in the study where both operator and subjects did not know the type of toothpaste used in each visit.

Data collection procedures were carried out in two sessions where three days washout period applied in between the sessions. The washout period was where the subjects were instructed to use their normal oral hygiene method. In the first session, disclosing agent was applied to the entire teeth and the subjects were polished using the toothpaste until the disclosing agent was not visible. Plaque score measurement were carried out at the following scheduled periods: a) after one hour (measurement on first quadrant); b) after two hours (measurement on second quadrant); and c) after four hours (measurement on third or fourth quadrant). The subjects were not allowed to eat, drink or rinse during this four hours period. The procedures were repeated in the second session with the other provided toothpaste.

Plaque score measurements were carried out by single operator using mouth mirror and periodontal probe. Five teeth from each quadrant were selected which were central incisor, lateral incisor, canine, first premolar and second premolar. The plaque score measurements were carried out on facial and lingual/palatal surfaces of the tooth by running the probe on the cervical areas. The plaque score were recorded as absent (code 0) and present (code 1). The overall teeth surfaces evaluated in each variable were 360 surfaces.

The data analysis was carried out using SPSS version 12.0 (SPSS Inc., Chicago, IL), where Pearson's Chi-square test was used to assess the significant of an association between proportion of plaque accumulation after polishing using toothpaste, with and without *Kayu Sugi* extract.

RESULT

From the 36 selected subjects, the overall of 720 teeth surfaces were observed for plaque formation at each plaque evaluation time namely one hour, two hours and four hours. Details of the descriptive statistics of the study are shown in table 1, and the frequency of plaque for tooth paste are shown in table 2.

The proportions of plaque formation after polishing between toothpastes, with and without *Kayu Sugi* extract was not significantly different at one hour ($P = 0.110$), two hours ($P = 0.328$) and four hours ($P = 0.823$). Therefore, there was no significant association between polishing using toothpaste, with and without *Kayu Sugi* extract and plaque formation.

Table 1. Demographic data of 36 subjects with plaque evaluation on 720 surfaces in each time variable

Variable	Mean (SD)	Frequency (%)
Age (year)	22.75 (1.131)	
Gender		
Male		5 (14)
Female		31 (86)
Proportion of plaque formation on teeth surfaces (n = 720)		
One Hour		230 (31.9)
Extract *Kayu Sugi*		105 (45.7)
Without *Kayu Sugi*		125 (54.3)
Two hours		311 (43.2)
Extract *Kayu Sugi*		149 (47.9)
Without *Kayu Sugi*		162 (52.1)
Four hours		353 (49.0)
Extract *Kayu Sugi*		178 (50.4)
Without *Kayu Sugi*		175 (49.6)

Table 2. Proportion of plaque formations after polishing using toothpaste, with and without *Kayu Sugi* extract in four hours

Variable	n	With extract Freq (%)	Without extract Freq (%)	X^2 statistic[a] (*df*)	*P*-value
One hour					
Present	230	105 (45.7)	125 (54.3)	2.555	0.110
Absent	490	255 (52.0)	235 (48.0)		
Two hours					
Present	311	149 (47.9)	162 (52.1)	0.957	0.328
Absent	409	211 (51.6)	198 (48.4)		
Four hours					
Present	353	178 (50.4)	175 (49.6)	0.050	0.823
Absent	367	182 (49.6)	185 (50.4)		

[a] Chi-square test for independence; Significant level was set at p = 0.05

DISCUSSION

The use of toothpaste as a vehicle in carrying chemical adjunct is widely established.[8] A wide range of chemicals especially antibacterial agents[9] including *Kayu Sugi* extract have been added in toothpaste as an attempt to produce a direct inhibitory effect on oral pathogens and thus preventing plaque accumulation.

However, in the present study, when we compared the effect of polishing using toothpaste, with and without *Kayu Sugi* extract for their effect on plaque formation, we found that the difference was not significant.

Since there was no similar study regarding the effect of toothpaste containing *Kayu Sugi* extract on plaque formation, the comparison of the result cannot be made. However, many other studies were carried out regarding the effect of toothpaste containing other chemical adjunct on their effect on the plaque formation. The study on tooth paste and extract containing herbal,[10–13] amine fluorides,[14] sodium fluoride or stannous fluoride[15] and triclosan[16,17] were failed to prove the superiority of the tested toothpaste as compared to the control.

On the other hand, there were also studies indicated the toothpaste containing stannous fluoride,[18] salivary substitutes[19] and chlorhexidine mouth rinses[20] had better prevention in the plaque formation in comparison to the control materials.

Although many *in vitro* studies had proved the antibacterial capability of the *Kayu Sugi* extract[6,9] its capability, especially when carried in toothpaste for inhibiting oral pathogen is questionable/doubtful. As in our study, we found that the plaque formation was equal in the subjects who polish using toothpaste either with or without *Kayu Sugi* extract, where the plaque formation should be less in the subjects who used toothpaste with *Kayu Sugi* extract, since its has the antibacterial properties.

The possible reason for the ineffectiveness of the adjunct added in toothpaste in inhibiting bacterial or plaque formation is may be due to the clearance effect of the saliva. The Dawes model of oral clearance stated that the extraneous component of saliva such glucose can be cleared by half after 2.2 minutes if the unstimulated flow rate is 0.3 mL/minute.[21] With the high efficiency of the oral clearance of the saliva, the only possible way for chemical adjunct from toothpaste to stay in the mouth is by their ability to bind to oral tissues. However some chemical adjuncts such as stannous fluoride and chlorhexidine somehow had the ability to bind with oral tissue.[22] Hence, may be explained the reason why some study showed that certain toothpaste (containing fluoride or chlorhexidine) showed superiority in preventing plaque formation.

From the present study, we concluded that when polishing with toothpaste containing *Kayu Sugi* extract, the effect of preventing plaque formation of this material is not significantly better than the one without the extract.

The study of *Kayu Sugi* extract into the reduction of dental plaque have been studied from many point of views using modern scientific methods such as local and clinical,[2,3,10,12,23] microbial[4–7,23] and chemical effects.[8,9,22,23] However, so far, there is no study have been done in the mechanisms of the reduction of dental plaque by molecular point of view. Based on this fact we suggest to further study in the relation of the mechanism of plaque reduction from the point of molecular perceptions

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