



Prevalence and Associated Factors of Tongue-Cleaning Practices Among Health and Non-Health Undergraduate Students at Diponegoro University

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KEYWORDS

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ABSTRACT

The tongue is one of the soft tissues in the oral cavity with a large surface area that can serve as a reservoir for pathogenic microorganisms associated with various oral diseases. Despite its important role in maintaining oral health, tongue cleaning is often neglected as part of daily oral hygiene practices. This study aimed to compare the prevalence of tongue-cleaning behavior between health and non-health students and to identify factors associated with this behavior. This analytical observational study employed a cross-sectional design involving 360 students from Diponegoro University, consisting of 180 health students and 180 non-health students, in their 6th–8th semesters who were actively participating in selected academic activities, using a consecutive sampling method. Data were collected using a validated online questionnaire. Statistical analysis was performed using the Chi-square test to assess differences in tongue-cleaning behavior between groups and associated influencing factors. The results showed that the prevalence of tongue-cleaning behavior was significantly higher among health students (72.2%) than among non-health students (52.8%) ($p < 0.001$). The main factors associated with not performing tongue cleaning were discomfort during tongue cleaning and lack of knowledge regarding the importance of tongue cleaning. Among non-health students, lack of knowledge was identified as the predominant factor, whereas discomfort during tongue cleaning was more frequently reported among health students. In conclusion, health students demonstrated significantly better tongue-cleaning behavior than non-health students. Knowledge and comfort-related factors were found to influence tongue-cleaning practices among university students. Improving awareness regarding the importance of tongue cleaning may help promote better oral hygiene behavior.

1. INTRODUCTION

Tongue hygiene is an important part of oral hygiene. Previous studies have demonstrated that tooth brushing alone is insufficient to optimally reduce oral bacterial load. Therefore, additional oral hygiene measures, such as routine tongue cleaning, are needed to improve oral hygiene and oral health status [1-3].

The dorsum of the tongue possesses a large mucosal surface covered by numerous papillae, making it an ideal site for microbial colonization and recolonization. If the tongue dorsum is not cleaned regularly, plaque and debris may accumulate on its surface, eventually leading to the formation of tongue coating. Tongue cleaning is considered an essential component of oral hygiene maintenance because it contributes to reducing microbial accumulation on the tongue surface, minimizing tongue coating, and preventing oral malodor [2-10]. Despite its benefits, tongue-cleaning habits remain relatively low in many populations. Matsuda et al. reported that only 18.4% of participants cleaned their tongue daily, whereas 34.1% performed tongue cleaning only occasionally. Similarly, Long et al. found that only 65.76% of medical students regularly practiced tongue cleaning, with less than half performing it daily [11,12].

Oral hygiene behavior is influenced by multiple factors, including educational attainment, oral health literacy, and academic background. Information regarding tongue-cleaning practices may be acquired through various sources, such as healthcare services (dental clinics, community health centers, and hospitals), formal education in higher institutions, mass media (television, social media, and books), as well as interpersonal communication with family members or peers [13,14]. Differences in educational background may contribute to variations in individual health-related behaviors, including tongue-cleaning practices. Previous studies have reported that students enrolled in health-related disciplines generally demonstrate superior oral health knowledge, attitudes, and practices compared with students from non-health-related disciplines [13-18].

In addition, discomfort and behavioral neglect have been identified as factors influencing tongue-cleaning habits. Individuals may experience discomfort during tongue brushing, including a stinging sensation, gag reflex, nausea, or vomiting, which may reduce adherence to the practice [19,20]. Furthermore, poor time management and lack of self-discipline may contribute to negligent oral hygiene behavior. Although some individuals possess adequate knowledge regarding tongue-cleaning techniques, insufficient motivation and lack of reinforcement may hinder the regular implementation of this practice. Limited free time has also been reported as a contributing factor to the neglect of routine tongue cleaning [21,22].

Although tongue-cleaning behavior has been investigated in several populations, evidence comparing oral hygiene behavior between health and non-health university students in Indonesia remains limited. Understanding behavioral differences and associated factors may help develop targeted oral health promotion strategies among young adults. Therefore, this study aimed to determine the prevalence of tongue-brushing behavior among students from health and non-health disciplines and to analyze the factors influencing this behavior.

2. METHODOLOGY

This study was an analytical observational study with a cross-sectional design. The study was conducted at Diponegoro University and involved faculties from the health sciences cluster, namely the Faculty of Medicine and the Faculty of Public Health, as well as the non-health sciences cluster consisting of nine faculties. A Consecutive sampling was selected due to feasibility and accessibility considerations during data collection. The inclusion criteria included students in semesters 6–8 who were actively enrolled in academic activities.

The sample size was calculated based on a population of approximately 15,000 students using the Isaac and Michael formula, resulting in a total of 360 samples divided into two groups: health sciences and non-health sciences [18]. Prior to the commencement of the study, ethical approval was obtained from the Health Research Ethics Committee (HREC) Faculty of Medicine Diponegoro University. Written informed consent was also obtained from all study participants.

The questionnaire consisted of two main sections. The first section consisted of one question regarding the participants' tongue-brushing habits. All questionnaire items demonstrated acceptable validity ($r > 0.30$) and reliability (Cronbach's alpha = 0.82). Participants were categorized as having tongue-brushing behavior if they reported cleaning their tongue at least once daily. The second section consisted of three questions related to factors influencing this behavior. All participants completed the questionnaire online.

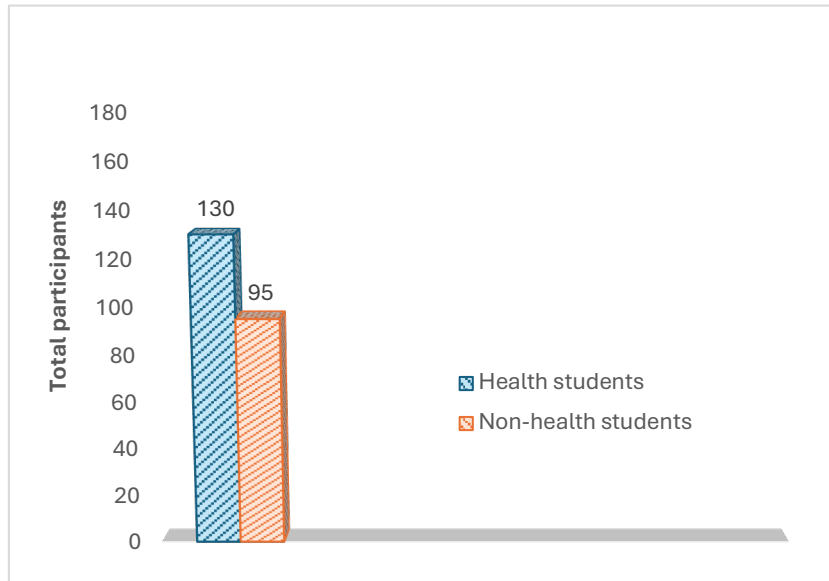
Data were processed and analyzed using SPSS software. The Chi-square test was used to analyze the prevalence and level of knowledge regarding tongue cleaning. Statistical significance was set at 0.05. Descriptive statistical analysis was performed to describe the distribution of variables related to factors influencing tongue-brushing behavior. Differences in the prevalence and distribution of factors influencing tongue-cleaning behavior between health and non-health students were analyzed using Pearson's chi-square test. The strength of association between variables was assessed using Cramér's V effect size coefficient, interpreted according to Cohen's criteria, where values of 0.1, 0.3, and 0.5 indicate small, medium, and large effect sizes, respectively [21-23].

As an additional analysis, odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for each response category by comparing one category against the combined remaining categories. Non-health students were used as the reference group. Confidence intervals were estimated using the normal approximation method based on the logarithmic transformation of the OR. A two-tailed p-value of < 0.05 was considered statistically significant [21-23].

3. RESULTS

The prevalence of tongue brushing among health and non-health students is presented in Figure 1. Among health students, 130 participants (72.2%) reported practicing tongue brushing, whereas only 95 participants (52.8%) among non-health students reported similar behavior. Chi-square analysis demonstrated a statistically significant difference in tongue-brushing prevalence between the two groups ($p < 0.001$) (Table 1).

Figure 1. The prevalence of tongue brushing among health and non-health students



	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	14.519 ^a	1	.000		
Continuity Correction ^b	13.701	1	.000		
Likelihood Ratio	14.645	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	14.478	1	.000		
N of Valid Cases	360				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 67.50

b. Computed only for a 2x2 table

Table 1. Chi-Square Test Results for Differences in the Prevalence of Tongue Brushing Between Health and Non-Health Students at Diponegoro University

A total of 50 health students and 85 non-health students reported not having a tongue-brushing habit. These participants were subsequently given a questionnaire regarding factors or reasons influencing this behavior. The results are presented in Table 2.

Reason for not brushing the Tongue	The total n = 135	Non-Health n = 85	Health n = 50	p-value
Neglected	22	13	9	< 0.01
Discomfort/ nauseous	60	25	35	
Lack of knowledge	53	47	6	

Table 2. Distribution and Chi-Square Analysis of Factors Influencing the Lack of Tongue-Brushing Behavior Among Health and Non-Health Students

The distribution of factors influencing the absence of tongue-brushing behavior differed significantly between the two academic groups ($p < 0.001$), with a large effect size (Cramer's $V = 0.451$). Among health students, the most dominant response was "discomfort" (70.0%), whereas among non-health students, the most dominant response was "not knowing that the tongue should be brushed daily" (55.4%), followed by "discomfort" (28.9%) (Table 2).

Odds ratio analysis confirmed this pattern (Table 3). Compared with non-health students, health students had 5.74 times greater odds of reporting "discomfort" ($p < 0.001$) and 9.1 times lower odds of reporting "not knowing that the tongue should be brushed daily" (OR = 0.11; $p < 0.001$). No significant difference was found between the two groups for the response "forgetfulness" ($p = 0.725$).

Response Category	OR (95% CI)	p-value
Discomfort	5,74 (2,66–12,40)	< 0,001
Lack of knowledge	0,11 (0,04–0,29)	< 0,001
Neglected	1,18 (0,47–3,01)	0,725

Table 3. Odds Ratios for Each Response Category Among Health Students Compared with Non-Health Students

4. DISCUSSION

The findings of this study demonstrated a significant difference in the prevalence of tongue-brushing habits between students from health-related and non-health-related disciplines. The higher prevalence among health students may reflect greater exposure to preventive oral health education, which potentially improves health literacy and self-care awareness. These findings are consistent with previous studies conducted by Ying et al. (2015), Matsuda et al. (2019), and Long et al. (2024) which reported that students from health-related disciplines tend to possess higher levels of oral health knowledge and better oral hygiene behaviors than students from non-health-related disciplines [11,12,24].

The predominant factor contributing to the absence of tongue-brushing habits among students from non-health-related disciplines was a lack of awareness that the tongue should also be cleaned daily. In contrast, only a small proportion of students from health-related disciplines reported insufficient knowledge regarding tongue cleaning. This finding suggests that students from health-related disciplines possess better knowledge regarding oral hygiene practices, including tongue cleaning. This difference may be attributed to the educational exposure received by health-related students during their academic training, whereas students from non-health-related disciplines generally do not receive formal education related to oral and dental health. Consequently, information regarding tongue cleaning among non-health students is often obtained independently through mass media or social media platforms. A study conducted by Kishi et al. (2012) reported that most information regarding tongue cleaning among non-health students originated from general information sources and social media (33.3%) [13,14,25,26].

Another commonly reported reason for not performing tongue brushing was discomfort or nausea during the procedure. Nausea associated with tongue brushing is generally related to an exaggerated gag reflex triggered by the insertion of a foreign object into the oral cavity or contact with sensitive areas near the posterior region of the tongue. Inappropriate brushing techniques, excessive brushing pressure, or the use of hard tongue-cleaning instruments may also contribute to discomfort during tongue cleaning. Furthermore, the strong odor or taste of toothpaste, as well as certain medical conditions such as gastroesophageal reflux disease (GERD), may trigger nausea during oral hygiene procedures. These findings are in agreement with studies conducted by Rhyn et al. (2020) and Timmesfeld et al. (2020), which reported complaints of gag reflex during mechanical tongue cleaning using toothbrushes or tongue scrapers [19,20,27].

Interestingly, some students were aware of the importance of daily tongue cleaning but still neglected the practice, both among students from health-related and non-health-related disciplines. This finding may reflect a gap between oral health knowledge and actual oral hygiene behavior. Inadequate awareness regarding the clinical importance of tongue hygiene and insufficient understanding of the consequences of neglecting tongue cleaning may contribute to this behavior [14,25]. Previous studies have demonstrated that tongue cleaning plays an important role in reducing debris accumulation, decreasing microbial load, eliminating plaque-associated microorganisms, and preventing tongue coating formation, which is strongly associated with halitosis and impaired taste perception. Furthermore, tongue coating has been recognized as a major reservoir of oral microorganisms involved in oral malodor and other oral health problems [6,28]. Behavioral factors such as poor time management, low motivation, and insufficient self-discipline may also contribute to inadequate tongue-cleaning practices among university students [12,25,26].

This study had several limitations. First, the use of self-reported questionnaires may have introduced response bias. Second, the cross-sectional design did not allow causal relationships to be established between knowledge and tongue-brushing behavior. Third, the study population was limited to students from a single university, which may limit the generalizability of the findings.

5. CONCLUSION

The prevalence of tongue-brushing behavior was significantly higher among health students than among non-health students at Diponegoro University. Lack of knowledge regarding the importance of tongue cleaning was the predominant factor influencing the absence of tongue-brushing behavior among non-health students, whereas discomfort during tongue cleaning was more commonly reported among health students. These findings suggest that oral health education plays an important role in improving tongue-cleaning behavior among university students. Educational interventions and promotion programs emphasizing the importance of tongue cleaning and proper tongue-brushing techniques are recommended to improve oral hygiene practices in the student population.

Conflict of Interest

The authors declare no conflicts of interest in this study.

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Authors Contribution

Conceptualization: SN; Methodology and Formal Analysis: SN, ES, OS; Funding Acquisition: ES, SN; Data Curation: SN; Initial Draft Writing: ES, Supervision and Editing: SN; Administration: ES

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