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SYSTEMATIC REVIEW

Oral health attitude and behavior among dental students

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ABSTRACT

Dental students will play an important role in educating and promoting oral health. The oral health behavior of dental providers and their attitudes toward their oral health could depict the oral health of their patients. The aim of this study was to review the current studies available on the oral health attitudes and behavior of dental students. A systematic search of original articles was carried out in two databases to write this systematic review. MEDLINE (pubMed) and GOOGLE SCHOLAR. Studies published in the English, Arabic and Indonesian languages up to 31/6/2023 was carried out. Search results were managed through EndNote. The search strategy identified 180 articles (133 from Google Scholar and 47 from PubMed databases), of which 22 articles were included in the analysis after the systematic review process. Study of oral health attitude and behavior based on the Hiroshima University Dental Behavioral Inventory (HU-DBI). As a result of variation in the subjects age, measure of outcomes quantitative analysis is not showed. A total of 22 studies met the inclusion criteria. The studies included a total of 7,562 undergraduate dental students and were conducted in 18 countries. The review found that clinical students have good oral health attitudes and behavior compared with preclinical students, showing improvements in oral health attitude and behavior of dental students through the students' educational progress. The improvement in oral health care has been shown to be linked to experience, especially for clinical students that have been in clinical settings.

Keywords: attitudes and behaviour; dental students; hiroshima university dental behavioural inventory (hu-dbi); human and health; oral health

INTRODUCTION

Oral health is a fundamental aspect of overall health, significantly influencing individual well-being and quality of life.[1,2] Dental students, as future practitioners, are crucial in promoting oral health awareness and practices.[3,4] Understanding their attitudes and behaviors towards oral health is essential for improving educational outcomes and patient care.[5,6] Thus, teaching in dental schools become ineffective unless it leads to a profound change in the student's behavior and attitude towards improvement of his own personal oral health.[7]

This systematic review focuses on evaluating these attitudes and behaviors among dental students using the Hiroshima University Dental Behavior Inventory (HU-DBI), which has been a standardized tool for assessing oral health perceptions and practices across various cultural contexts.[8] A total of 22 studies from 18 different countries have employed a cross-sectional design to investigate the oral health attitudes and behaviors of dental students, utilizing a modified HU-DBI questionnaire. The findings reveal that clinical dental students generally exhibit higher HU-DBI scores compared to their preclinical counterparts, indicating greater awareness and better practices related to oral health. However, some studies reported contrary results, particularly in India and Nepal, where preclinical students demonstrated equal or superior attitudes compared to clinical students.[9,10] Research has shown that, There is

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an importance of considering gender differences in oral health practices, as female students often demonstrate better self-care due to psychosocial factors.[11] This inconsistency highlights a significant gap in understanding how educational stages influence oral health behaviors.

The main objective of this systematic review was to investigate the impact of teaching in dental schools on changing in the undergraduate student's behavior and attitude towards improvement of his own personal oral health.

MATERIALS AND METHODS

This type of research is a systematic review using secondary data from published articles in the English, Arabic and Indonesian languages up to 31/6/2023. To provide an appropriate search protocol, the methods and inclusion criteria of this systematic review were selected following the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) statement. This review was not registered in PROSPERO.

Research strategy incorporated examinations of electronic databases. A search of two electronic databases, including PUBMED and GOOGLE SCHOLAR studies published in the English, Arabic and Indonesian languages up to 31/6/2023.

Literatures published was systematically searched using search strategy as follow; PUBMED**:** ((((Hiroshima University-Dental Behavioral Inventory) OR (HU-DBI)) and ((attitude) OR behavior))) and (dent* and student*)), GOOGLE SCHOLAR: "Hiroshima University-Dental Behavioral Inventory" AND students. Search results were managed through EndNote.

Study Selection the selection process of the papers was conducted using four steps: identification, selection, eligibility, and inclusion, following the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines.

The inclusion criteria include studies conducted on undergraduate dental students, original research, published in the scientific journals in English, Arabic or Indonesian language, study of oral health attitude and behavior based on the Hiroshima University Dental Behavioral Inventory (HU-DBI), studies evaluated the effectiveness of dental education program on oral health attitude and behavior and studies include both of the genders. The exclusion criteria were review articles (narrative, systematic, meta-analysis), letters-to-the editor, qualitative articles, and those presented in congresses, animal studies or in vitro studies, studies with fewer than 30 respondents, articles that the full-text were not available, there were not enough information to be extracted, incomplete data reporting, articles that do not concentrate on oral health attitude and behavior, as well as articles that were not based on HU-DBI.

The risk of bias assessment within this systematic review underscores key considerations. While meticulous adherence to PRISMA guidelines enhances the robustness of the search protocol, there is a potential for publication bias due to limitations in database selection. Clear and well-defined inclusion criteria contribute to a rigorous study selection process, although the exclusion of non-HU-DBI studies introduces a potential source of bias. The systematic approach to study selection, complemented by the involvement of three independent reviewers, ensures transparency in the review process. A carefully devised strategy for handling duplicates adds precision to data synthesis.

Three reviewers separately screened the articles identified by the search strategy by abstract and title. In order to be selected, abstracts had to clearly identify the impact of teaching in dental schools on changing in the undergraduate student's behavior and attitude towards improvement of his own personal oral health, measured using HU-DBI. After the exclusion due to duplicate, language and unrelated title and abstracts, the full-text reports of all remaining articles were obtained and assessed independently for eligibility by these three reviewers, based on the defined inclusion criteria. Any disagreements were resolved through discussion between the three investigators and, if needed, consultation with the fourth author. Data extraction was undertaken and checked by the three reviewers. The search strategy identified

180 articles (133 from Google Scholar and 47 from PubMed databases), of which 22 articles were included in the analysis after the systematic review process (Figure 1).

RESULTS

All studies (n = 22, Table 1) used a cross-sectional design to capture the information on the oral health attitudes and behaviors among dental students, based on a modified version of the Hiroshima University Dental Behavior Inventory (HU-DBI) questionnaire. The studies originated from 18 countries namely India (n=5), Egypt (n=3), Japan (n=2), Greece (n=2), Nepal (n=1), Iraq (n=1), Jordan (n=1), China (n=1), Britain (n=1), Croatia(n=1),), United Arab Emirates (n = 1), Sudan (n=1), Germany (n=1), Turkey (n=1), Peru (n=1), Australia (n=1), New Zealand (n=1), and Finland (n=1). The sample size of the studies ranged from 90 to 896 participants with a total of 7,562 undergraduate dental students. Five studies included a comparison of countries and universities for the health attitudes and behaviors among the academic year of the dental students,[12-16] and the remaining included studies of students of each university separately.

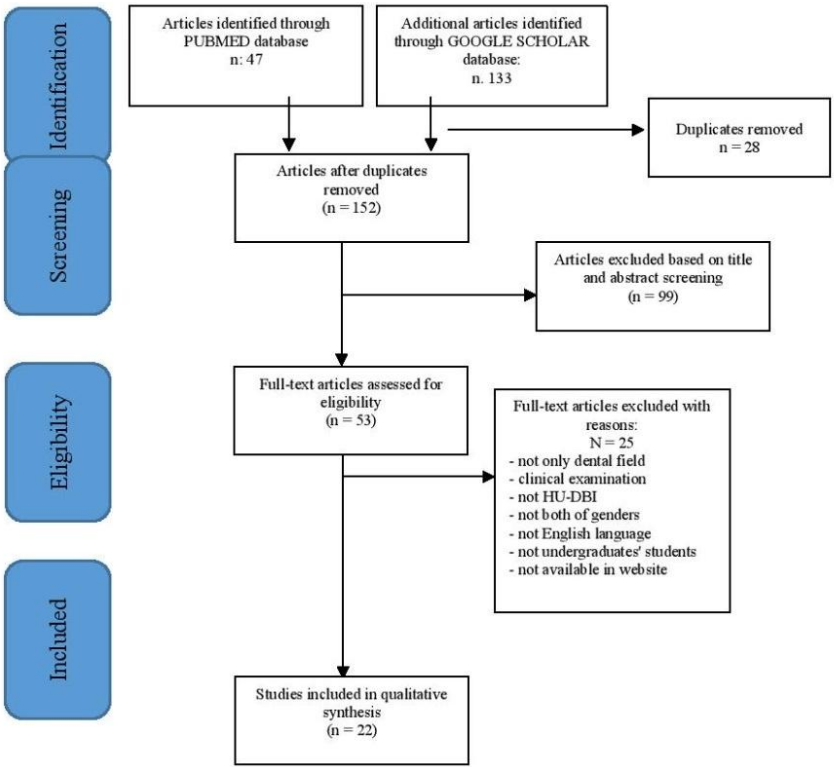

Figure 1. PRISMA Flowchart of study selection process

The questionnaires included in the studies composed of 20 items associated with features of oral health attitudes and behavior. Each item involved a dichotomous (close-ended) selection for its response (agree/disagree). The questionnaire was designed to record the oral health attitude, oral hygiene behavior, and self-reported oral health and dental visits (knowledge). The relevant attitude items include (I think that I cannot help having false teeth when I am old, I think I can clean my teeth well without using toothpaste, it is impossible to prevent gum disease with tooth brushing alone) based on the attitude of the students for the maintenance of the oral health. However, the oral health behaviors include four items on the basic behavior of the oral health

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Table 1. Overview of studies with Hiroshima University Dental Behavioral Inventory (HU-DBI)

No	Author name and publication year	Population and Sample size	study comparison	Outcome / Result	Summary
1	Komabayashi et al, 2005[12]	372 students from Britain and China. 1. Britain (192) 133 preclinical / 59 clinical 2. China (180) 124 preclinical / 56 clinical	between 2 universal countries of undergraduate student. Clinical and preclinical not specify in result	The mean HU-DBI scores of British students was 7.33, which was significantly higher than that of Chinese students (5.07; P < 0.001)	The present study identified an increased HU-DBI score as British and Chinese students progress in their dental programs.
2	Mekhemar et al, 2021[13]	149 students. 71 preclinical and 78 clinical students.	Pilot study/ Between clinical and preclinical	The general HU-DBI mean score of the answers favouring good oral hygiene was slightly higher in the clinical (11.50 ± 3.25) than preclinical (10.63 ± 2.64) students. Comparing the students' responses by gender, we found that females demonstrated a significantly higher HU-DBI mean than male	The study exhibited weak differences in the improvement of oral hygiene behaviour and attitudes between participating preclinical and clinical students, as well as overall poor oral health behaviour in both groups.
3	Polychronopoulou and Kawamura, 2005[14]	877 students (338 Japanese, 539 Greece)	dental school students from both countries	Regarding gender differentiation, both in Japan and in Greece, females show a slightly higher mean score than males, but this is not statistically significant.1 However, the comparison between the two countries indicates that the Japanese males, as well as the Japanese females have significantly higher mean scores than the respective Greek subgroups. The Japanese curriculum has six study levels, whilst the Greek dental university program includes five levels. Overall mean HU-DBI score of Japanese students (7.40 +- 2.55) is significantly higher than that of Greek students (6.86 +- 1.83).	The results of the present study show that the oral health attitudes/ behavior improves by educational level The different school curriculum and training programs may explain the variation in the improvement patterns observed between the countries.
4	Tanny et al, 2016[15]	97 students (22 students from year 1 and 14 students from year 3 Australian school; 30 year 1 and 31 students from year 3 New Zealand school)	dental school students from both countries	The results of this study suggest that education for oral health students has significant effects. Results obtained in this study recognized that despite the limited 3-year curriculum, some aspects of modification of oral health attitudes and behaviors of oral health students are consistent with those for dental students in other countries.	Oral health students who had been educated with a 3-year curriculum had more positive oral health attitudes and behaviorus than students who were at the beginning of their course.

No	Author name and publication year	Population and Sample size	study comparison	Outcome / Result	Summary
5	Kawamura et sl, 2000[16]	450 students (337 in Japan, 113 in Finland)	dental school students from both countries.	The overall mean HU-DBI score of Finnish dental students was significantly higher than that of the Japanese students. The mean scores of Finnish students were significantly higher than those of the Japanese until Year 3. The Japanese final year dental students appeared to have better oral health behaviour than that of their Finnish peers.	In general, the oral health attitudes and behavior increased with the level of study. Dental students as future health professionals should have a comprehensive programme, including their own self-care regimens.
6	Al-wesabi et al, 2019[17]	780 students preclinical (485) clinical (298)	Between clinical and preclinical	Clinical students' scores were significantly higher than preclinical ones for, attitude and behaviour with P = 0.000, P = 0.026, respectively.	The oral health knowledge, attitude and behaviour of preclinical dental students were lower than that of clinical ones.
7	Badovinac et al, 2013[18]	included 503 255 preclinical 248 clinical 139 male 365 female	between academic year and gender	Comparison of HU-DBI scores by academic year; the fourth year was significantly higher than the score of students in the first, second, and third years. The sixth-year students had a significantly higher score than the first-year students. Gender did not have an influence. There was a relatively small progress in the HU-DBI score between first-year and last-year students.	Oral health behavior and attitudes of the Croatian dental students were significantly better in year six then in year one
8	Muthu et al, 2015[19]	282 dental students 63 male and 219 females	academic year and gender preclinical and clinical	No significant differences were observed among male and female dental students. Highly significant results were observed with regards to questions: #5, #12, and #13. The dental attitude and behavior among dental students significantly improved with the level of education. not specifies for whole questionnaire, no mean or SD	Dental students in India had poorer oral hygiene awareness compared to several other countries
9	Sato et al, 2013 [20]	273 students (153 year 1 students, 120 year 5 students)	academic year	Students from year 5 show more agreement towards positive oral health behavior than year 1. The increased knowledge of and clinical experience with oral health practices are significant products of dental education and contribute to more positive dental students' attitude in their final year.	Students who had been educated with a three-phase curriculum in didactic and clinical training had more positive oral healh-realted attitudes and behaviors than students at the beginning of their educational experience in this program.

No	Author name and publication year	Population and Sample size	study comparison	Outcome / Result	Summary
10	Abu Alregal, 2018[21]	896 undergraduate students 308 were male and 583 were female. Preclinical (547) clinical (344)	academic year and gender	The attitude and knowledge of clinical students are higher than that of preclinical, while behavior showed no statistically significant difference. Furthermore, oral health attitude of males was better than females, while oral health behavior of female dental students was better than males,	The oral health attitude and knowledge of clinical students are higher than that of preclinical; however, oral health behavior was the same for all levels. The oral health attitude for males was higher than that of females, and in contrast, the oral health behavior for females was higher than males.
11	Joshi and Sagtani, 2016[10]	218 students (98 preclinical and 120 clinical)	academic year (clinical and preclinical)	The mean values of the summary estimate among the clinical students was significantly ($p<0.001$) higher compared to pre-clinical students. The mean values of oral health behavior estimate did not show significant difference among the students on the basis of sex.	clinical year students had significantly better oral health attitudes and behavior compared to preclinical students.
12	Vangipuram et al, 2015[22]	270 students 165 preclinical. clinical 105	academic year and gender	On the comparison of the mean HU-DBI scores among various years of dental education, the 1st year B.D.S students had a highest mean followed by interns. Preclinical students had a high mean which was statistically significant compared to clinical students and female students having high mean when compared to males.	Gender had a significant relationship with HU-DBI scores. Females had better attitude and behavior regarding visiting the dentist and oral hygiene and health. It was found that the overall mean HU-DBI score of the preclinical students was significantly higher than that of clinical students.
13	Peker and Alkurt, 2009[4]	267 dental students (153 female, 114 male) 141 preclinical 126 clinical students	academic year (clinical and preclinical) , gender	Statistically significant differences were found between years of study for having had their dentist tell that they brush very well. There were statistically significant differences between females and males for using a toothbrush which has hard bristles and using tooth floss regularly. No specific result comparison by pre and clinical	Oral and dental health behavior and attitudes and also their knowledge about oral and dental health care of a group of Turkish dental students improved with increasing level of education. While, oral and dental health care of female
14	Neeraja, Kayalvizhi and Sangeetha, 2011[23]	250 students, (each 50 students from 1st, 2nd, 3rd, 4th, and 5th years of school)	academic year	Oral health attitudes and behavior improved with increasing levels of education. Oral health attitudes and behavior seem to increase significantly in the fourth and fifth years of dental education.	Overall the knowledge among the dental students in this study was good although they had deficits in knowledge in a few areas.
15	Barrieshi-Nusair, Alomari and Said, 2006[24]	314 students from all five academic years	academic year	Preclinical students had low dental awareness and poor oral health attitudes, while the higher year of study showed improvement.	Dental student in Jordan had low dental health awareness when started dental education, but improved with advancement in dental school.

No	Author name and publication year	Population and Sample size	study comparison	Outcome / Result	Summary
16	Hashim and Ibrahim, 2013[25]	279 students (141 male and 138 female) preclinical (180), clinical (99)	academic year	The percentage of the final year students was significantly higher than first year dental students. The study showed that the level of dental education was related to oral health attitudes and behavior. Statistically significant differences were found between first and senior years of study	Dental students in Ajman University of Science and Technology had rather low oral health awareness in the beginning of their dental education. However, oral health behavior and attitude improved significantly in the fourth- and fifth-year's dental education.
17	Polychronopoulou, Kawamura and Athanasouli, 2002[26]	(n = 539) total dental student preclinical (315) clinical (224). Male (228) female (311)	academic year and gender	Females present statistically significant higher scores even after adjustment for year of education. The scores present a statistically significant increase in the fourth year and fifth year of dental studies	The quantitative summary estimate of oral health attitudes/ behavior, increases from first to fifth level, increments are observed in the fourth and fifth level compared to the entry level score. females tend to gain overall higher scores compared to males.
18	Dagli et al., 2008 [27]	282 students 142 preclinical 144 clinical. 124 male 158 female	dental education, age, and gender.	The total mean score of clinical years was almost equal to the score of in pre-clinical years. The level of dental education did not show a significant correlation with higher total mean score of dental awareness among years 3 and 4 compared to years 1 and 2. No statistically significant differences in gender and academic year.	The findings of the study highlight the relatively poor oral health behavior of Indian dental students,
19	Mekhemar et al, 2020[28]	172 dental students 56 preclinical and 116 clinical students	Between clinical and preclinical & between German universities	The overall HU-DBI mean score of answers favouring a good oral hygiene was marginally higher in preclinical (14.62 ± 0.42) than clinical students (14.31 ± 0.43) with no statistical significance (p = 0.170) Preclinical dental students showed better oral health attitudes than the clinical group in most of the items related to oral health attitudes.	Preclinical dental students of German universities showed a marginally higher HU-DBI score of oral health attitudes and behaviour than clinical students with statistically insignificant differences.
20	Hashim N, Al-Shiekh L, et al[29]	223 students male (64) and female (159) preclinical students (141) clinical (82)	academic year and gender	Females showed a significantly higher score than males. There was no statistically significant difference between preclinical (1st, 2nd and 3rd year) and clinical (4th and 5th year) dental students.	The survey revealed that their awareness did not increase even in relation to higher education levels. The awareness of oral hygiene was low amongst dental students in Sudan with no direct relationship to level of education.
21	Mohammed A.N.[30]	200 dental students, 80 male and 120 females	academic year (clinical and preclinical), gender	Significant differences between male and female dental students were found for all academic years with significant and highly significant differences	The study showed that the female dental students had in general more positive oral health and practices than male students.

No	Author name and publication year	Population and Sample size	study comparison	Outcome / Result	Summary
				between the first three years when compared with the final year. Female dental students had more positive oral health attitudes and practices than male student,	
22	Kumar S.M., et al.[31]	400 students from first year to internship of the undergraduate dental course (not specified)	academic year and gender	This result was highly significant for most questions. Dental hygiene and dental hygiene practices among dental students in this South Indian population show an improvement among dental students from year to year. No significant differences were seen between male and female dental students.	Dental hygiene and dental hygiene practices among dental students in this South Indian population show an improvement among dental students from year to year. No significant differences were seen between male and female dental student

Reporting guidelines:
This study has been reported as per the PRISMA reporting guidelines

practices taken by the students toward the maintenance of the oral health (I have noticed some white sticky deposits on my teeth, I brush each of my teeth carefully, I often check my teeth in a mirror after brushing alone, I have used a dye to show how clean my teeth are). The remaining eight questions were used as mock questions and not included in the final scoring system.[12]

Studies reported that the majority scores of oral health attitude and behavior between preclinical and clinical dental students were found to have statistically significant differences of which the clinical student have higher attitude in awareness and behavior than preclinical students.[10,17-21] Other studies revealed opposite result on the comparison of the mean HU-DBI scores among various years of dental education, where preclinical dental students in India showed better oral health attitudes than the clinical group with a highest mean score of[5,8,22] moreover, the preclinical dental students of German universities showed a marginally higher HU-DBI score of oral health attitudes and behavior than clinical students with statistically insignificant differences.[13]

Of the 22 publications, half of the studies reported the oral health attitudes and behavior increased and progressed with the level of study in their dental program.[4,12,14-16,18,19,23-26] Another study exhibited weak differences in the improvement of oral hygiene behavior and attitudes between participating preclinical and clinical students, as well as overall poor oral health behavior in both groups.[13]

A small number of studies finding highlight the relatively poor oral health behavior, this may be due to the effect of socio-economic status which is a factor affecting the HU-DBI score, as the mean HU-DBI score was low.[19,27] All studies included in this systematic literature review agreed that preclinical students need properly designed oral health educational programs to increase their attitude and behavior towards oral health. In addition, preventive dental science curricula need to be changed to incorporate oral self-care regimens, not only in clinical practices but also in academic and public policy.

DISCUSSION

The aim of this study is to collect and review the oral health attitude and behavior among dental students using the Hiroshima University – Dental Behavioral Inventory (HU-DBI). This questionnaire was developed by Kawamura to

examine oral health attitudes and behavior. It is not only used to understand patients, but also predicting clinical outcome.[12] Overall, eleven out of the twenty-two studies showed that HU-DBI score of the clinical students is higher than those from preclinical phase. This result shows that level of education has a significant effect to the oral health attitude and behavior.[15] The increasing knowledge and experience of the clinical students can be due to their frequent contact with patients in clinical environment, so the students become more conscious of their overall health and more attentive to oral health related issues.[32] In contrast, studies conducted in India and Germany showed a higher score, yet insignificant, in preclinical students.[22,28] This can be due to the increased stress and pressure during clinical years so the students put off their oral health.[28]

Regarding the gender-specified studies, there are ten articles that compared between female and male dental students' HU-DBI scores. Six studies showed that female students have significant higher HU-DBI scores compared to the male students.[4,13,22,26,29,33] This can be contributed to female students commonly being care more about their appearance, thus tend to be more educated about their oral health.[4] This psychosocial reasons linked to their positive self-care[29] and engage in better oral health behavior.[33] However, studies conducted in India in 2008 and 2018 showed that there is no significant differences among male and female students,[27,31] while study in Egypt resulted in oral health attitude for males was higher, and in contrast, the oral health behavior for females was higher.[21]

Oral health and behavior of dental students also differ between countries. The study conducted in Britain and China showed that British dental students have significant higher HU-DBI score than their Chinese peers,[12] while the comparison between Japanese and Greek dental students indicated that the HU-DBI scores in Japanese dental students is significantly higher.[14] Other study conducted between Japanese and Finnish dental students showed overall mean of HU-DBI scores of Finnish students is significantly higher than Japanese students, even though Japanese students in their final year have better oral health behavior than that of their Finnish peers.[34] Although the translation used for the questionnaire can alter the meaning,[14,34] varying results can be attributed to the overlaps between dental health knowledge and cultural influences.[12] For example, there is a difference between Asian and Western in term of dealing with health and disease, in which the most of the health behavior is learned and practiced at home, and professional help is only sought when home remedies fail.[35] Furthermore, there might be error in measuring the self-care report instead of observed behaviors.

This review has limitations in terms of the lack of specifying results. Some of the studies do not include the table of HU-DBI scores. Studies included were from both advanced and developing countries, hence it is not known whether the health care systems and quality of life in general could have affected the oral health attitudes and behaviors. This review also does not look for articles published in languages other than English, Indonesian and Arabic as well as the unpublished articles. Future studies in this topic need to take these limitations into consideration. It can be concluded in this review that the education level has s significant effect in increasing oral health attitudes and behaviors for dental students. This improvement in oral health care has been shown to be linked to their experience, especially for clinical students that have been in clinical settings. However, it should be noted that all of studies are cross-sectional, hence it doesn't show improvement of students from preclinical to clinical phase. It also suggested that female students have better oral health care because of their attention to body and appearance. Other factor that also has significant effect to the oral health attitudes and behavior is cultural influence and dental health belief. Future research must take into account cultural variety, broaden cross-national comparisons, investigate qualitative aspects, and use longitudinal designs to monitor educational effects. Innovative methods for improving oral health habits among dentistry students will emerge from research into dental education interventions and multidisciplinary

approaches. Insightful information may also be gained through study on the interactions among oral health behaviors, general health, and quality of life.

CONCLUSION

Dental students' oral health attitudes and behaviors are influenced by their level of education, with clinical students showing higher scores. Female students also tend to have higher scores compared to male students, possibly due to their focus on appearance. Additionally, there are differences in oral health attitudes and behaviors between countries, which can be attributed to cultural influences and variations in healthcare systems. However, the study has limitations and future research should consider these factors and explore interventions to improve oral health habits among dental students.

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CONFLICT OF INTEREST

The author(s) declare that they have no Conflict of Interests.

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