

Assessing Oral Health Attitudes among Preclinical and Clinical Dental Students: A Cross-sectional Study at Cordoba Private University, Syria

Rafah Kassem¹, Mahmoud Toama², Mostafa Z Alyousif Aldaiea³, Alya Jaraho⁴, Marwa Abd AlRahman⁵, Mohammad HK Lalo⁶, Esraa Alabdullah⁷, Yasser Alsayed Tolibah⁸

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ABSTRACT

Aim: This cross-sectional study aimed to assess and compare the oral health attitudes of preclinical and clinical dental students at Cordoba Private University in Syria using the Hiroshima University–Dental Behavior Inventory (HU–DBI) questionnaire, while also examining differences by gender and specific questionnaire items to identify behavioral patterns that could guide future educational improvements.

Materials and methods: A total of 331 students participated, with the first 3 academic years classified as preclinical (187 students) and the final 2 years as clinical (144 students). The 20-item HU–DBI questionnaire in a paper-based format (hard copy) assessed oral health attitudes and behaviors with agree/disagree responses. Scores range from 0 to 19, with higher scores reflecting better oral health behavior. One point was awarded based on specific agree/disagree responses. Data were analyzed using the Kolmogorov–Smirnov test, Chi-square test, and Mann–Whitney *U* test. A *p*-value of < 0.05 was considered statistically significant.

Results: No significant difference in mean score between the two groups was analyzed; however, clinical (advanced years) students exhibit significantly better behaviors in certain key areas, such as frequent brushing (*p* = 0.001), brushing professionally (*p* = 0.001), and eating less sweets (*p* = 0.003), compared to preclinical students, indicating positive effects of dental education in those domains.

Conclusion: Clinical students exhibit significantly better behaviors in certain key areas, such as frequent brushing, brushing professionally, and eating fewer sweets, compared to preclinical students. However, many other aspects of oral health attitude did not differ notably between junior and senior students, and worrisome habits like increased heavy smoking in the clinical years were identified.

Clinical significance: Understanding the evolution of dental students' oral health attitudes is essential, as they serve as future role models. While education improves certain behaviors, the persistence of negative habits like smoking highlights the need for targeted interventions in the curriculum.

Keywords: Dental education, Dental students, Hiroshima University-Dental Behavior Inventory, Oral health behavior.

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INTRODUCTION

Good oral health is a fundamental component of overall health, significantly impacting general wellness. People's oral hygiene practices and attitudes reveal how they value their oral health.¹ Dental students, as future oral health professionals, are expected to serve as role models for proper oral hygiene.^{2,3} Their attitudes and behaviors not only affect their own oral well-being but also influence their ability to educate patients and the public.⁴ Evidence from international studies indicates that the level of clinical training received by dental students affects their approach to oral health, with variations observed by country, ethnicity, and program of study.^{5,6}

To evaluate these attitudes and behaviors, the Hiroshima University–Dental Behavioral Inventory (HU–DBI) is a commonly used tool. Developed by Kawamura et al. in Japan, it comprises 20 dichotomous (agree/disagree) items and has been widely translated and applied to assess dental students' self-reported oral health behaviors across cultures.^{7,8} The HU–DBI has been used in Britain and China, Turkey, Malaysia, the United States, Korea, and Arab countries such as Egypt, Jordan, and Saudi Arabia, but not previously in Aleppo, Syria.^{4,9–14}

Many studies using the HU–DBI have examined whether students' oral health attitudes improve as they progress from

¹Department of Fixed Prosthodontics, Cordoba Private University, Aleppo, Syria

²Department of Surgery, Cordoba Private University, Aleppo, Syria

^{3–7}Cordoba Private University, Damascus, Syria

⁸Department of Pediatric Dentistry, Damascus University, Damascus, Syria

Corresponding Author: Yasser Alsayed Tolibah, Department of Pediatric Dentistry, Damascus University, Damascus, Syria, Phone: +963988812044, e-mail: yasseralsayedtolibah@gmail.com

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preclinical to clinical training. Reports from several countries suggest that clinical-level students tend to score higher, indicating better oral health attitudes and behaviors.^{1,4,15} This improvement is attributed to increased professional knowledge and patient contact in later years. For example, surveys in Malaysia found significantly higher HU–DBI mean scores among clinical students compared

to preclinical ones.⁴ Similarly, a recent systematic review covering 22 studies in 18 countries reported overall improvement in students' attitudes as they advanced through their programs.¹⁵

However, some studies have found little or no difference between preclinical and clinical students. A survey in German dental schools observed slightly higher HU-DBI scores among preclinical students, with no significant differences for most items, suggesting a limited impact of dental education.¹⁶ Likewise, an Indian study reported significantly higher HU-DBI scores among first- and second-year students compared to senior clinical students.¹⁷ Such findings may relate to increased academic stress and workload during clinical years, leading students to neglect their own oral care. Cultural and curricular differences likely contribute to these variations.

Gender differences have also been consistently noted. Female dental students often demonstrate significantly higher HU-DBI scores, reflecting greater concern for oral hygiene and preventive practices.^{18,19} This gender gap may reflect broader health behavior trends and highlights the importance of considering gender in oral health research.

In light of these findings, the current investigation aimed to evaluate and compare the oral health attitudes of preclinical versus clinical dental students at Cordoba Private University in Syria using the HU-DBI questionnaire. We also examined gender differences and responses to individual items to identify strengths and deficiencies. Understanding these patterns may guide educational strategies to ensure graduating dentists adopt optimal oral health practices and serve as positive role models for their patients.

MATERIALS AND METHODS

Study Design, Settings, and Ethical Approval

A cross-sectional survey was conducted at the Faculty of Dentistry, Cordoba Private University, Aleppo, Syria. Ethical approval for conducting the study was obtained from the Human Research Committee at Córdoba University (No. 24/26/3/2025). The study was conducted from April 1 to April 12, 2025.

Sample Size Calculation

Based on the total student population at Cordoba University ($n = 750$), the sample size was calculated using Raosoft Software with a 95% confidence interval, a 5% margin of error, and an assumed 50% response distribution. The minimum required sample size was 255 participants; however, the number was increased to 331 to compensate for potential dropouts that could affect the study's power and reliability.

Study Population

A total of 331 undergraduate students from Cordoba Private University in the academic year 2024 participated in the study. At the end of each lecture, a questionnaire was voluntarily distributed to all students present in the class. Students who agreed to complete the questionnaire remained in the classroom, and the expected time to fill it out was approximately 10 minutes. Out of 331 students, 187 were in the preclinical (first, second, and third years) program and 144 were in the clinical (fourth and fifth years) program.

Study Tool

In this study, the HU-DBI Questionnaire (a modified English version of the Hiroshima University-Dental Behavioral Inventory) in a paper-based format (hard copy) was employed to measure the oral health attitudes and behaviors of preclinical and clinical undergraduate

Table 1: The table shows the demographic distribution of the students included in this study

Students	Female	Male	Total
Clinical	74 (51.3%)	70 (48.7%)	144
Preclinical	71 (37.9%)	116 (62.1%)	187
Total	145 (43.8%)	186 (56.2%)	331

dental students. An explanation in Arabic was provided beneath every question to ensure that the students understood the exact meaning of the question.

The HU-DBI questionnaire is a 20-item tool that assesses dental students' oral health attitudes and behaviors. It covers areas such as toothbrushing frequency and technique, use of preventive measures, awareness of oral health problems (e.g., plaque, gingival bleeding), frequency of dental visits, and adherence to professional advice. Responses are scored dichotomously (agree/disagree), with higher scores reflecting better self-reported oral health behaviors.

When calculating the HU-DBI scores, one point was given for each of the agree responses to the questions 2, 4, 5, 7, 9, 11, 12, 13, and one point was given for each of the disagree responses to the questions 3, 6, 8, 10, 14, 15, 16, 17, 18, 19, and 20. The maximum HU-DBI score was 19, since the first question only labeled sociodemographic data. Higher scores indicate better oral behavior.

Data Analysis

Using the Kolmogorov-Smirnov test, the distribution of total HU-DBI scores was assessed for normality. The normality test indicated that the score distribution deviated from a standard curve ($p < 0.05$); thus, non-parametric statistical tests were chosen for comparisons.

To compare categorical data between preclinical and clinical students, Chi-square tests were used. The Mann-Whitney test was applied to compare the two independent groups (preclinical vs clinical).

Gender-based comparisons were made using a *t*-test for score differences between male and female students.

All statistical tests were two-tailed, with a significance set at $p \leq 0.05$. Data were analyzed using SPSS version 25.0.

RESULTS

A total of 331 students completed the questionnaire. The preclinical group (years 1-3, $n = 187$) and clinical group (years 4-5, $n = 144$) were compared.

Number of students who volunteered in the study from the first year were 60, 58 students from the second year, 69 students from the third year, 68 students from the fourth year, 76 students from the fifth (final) year, the students filled the questionnaire by themselves and none of them left empty questions so none of them were excluded from the study.

Of the students, 145 were female, and 186 were male, and **Table 1** shows the distribution of participating students by preclinical or clinical study.

The mean age of participants was approximately 20.4 ± 1.3 years for preclinical and 23.1 ± 0.9 years for clinical students. Females comprised 43.8% of the sample, and **Table 1** showed the distribution of students (male/female) in the studied groups (clinical/preclinical).

Table 2 presents the results of the Chi-square test for each item of the HU-DBI questionnaire between preclinical and clinical students.

Table 2: The table shows the results of the Chi-square test for each item of the HU–DBI questionnaire between preclinical and clinical students

S. No.	Questions	Clinical		Preclinical		p-value*
		Percentage	Students number	Percentage	Students number	
1	I live with my family	67%	97	63%	118	0.421
2	I had been to a dentist office before	88%	128	88%	166	0.973
3	I do not go to the dentist unless I feel pain	64%	93	63%	119	0.859
4	I brush my teeth at least twice a day	80%	116	63%	119	0.001 [†]
5	I brush my teeth after every meal	34%	50	44%	153	0.061
6	My gum bleeds when I brush my teeth	78%	113	60%	113	<0.001 [†]
7	I have been taught the professional brushing technique and I use it	93%	135	81%	153	0.001 [†]
8	I use a toothbrush with hard bristles	89%	192	88%	166	0.814
9	I brush my teeth carefully	90%	130	83%	157	0.093
10	I think my teeth are getting worse despite my daily brushing	88%	128	98%	167	0.904
11	I use dental floss regularly	43%	63	53%	100	0.079
12	I use a mouthwash regularly	40%	58	34%	64	0.258
13	I worry about having bad breath	72%	104	50%	94	<0.001 [†]
14	I think I can brush my teeth without toothpaste	79%	114	79%	149	0.909
15	I am bothered with the color of my gums	75%	108	83%	156	0.059
16	I worry about the color of my teeth	65%	93	51%	95	0.012 [†]
17	I am a smoker	67%	97	63%	118	0.421
18	I smoke 10 or more cigarettes a day	61%	88	81%	152	<0.001 [†]
19	I have been smoking for a year or more	70%	101	79%	148	0.060
20	I like snacking on sweets during the day	38%	56	55%	103	0.003 [†]

*Chi-square test, [†]Significant differences

Out of 19 possible points, the mean score among clinical students was 13.04 (± 3.1), and among preclinical students, it was 12.9 (± 2.8). This difference in total scores was slight and not statistically significant on the Mann–Whitney *U* test ($p > 0.05$). In other words, clinical students scored only marginally higher, on average, than preclinical students on overall oral health attitudes, and this advantage did not reach statistical significance. When examining scores by gender, female students showed a tendency toward higher HU–DBI totals than male students.

Question-by-question comparisons were applied, and seven questions showed statistically significant differences between preclinical and clinical students. The questions were: I brush my teeth twice a day (question 4) in this question 80% of clinical students agree with the statement. This indicates a marked improvement in brushing frequency in the clinical years, and complies with the results in question 6 that 78% of clinical students' gum do not bleed when brushing, while the ratio is significantly less in preclinical students ($p < 0.05$).

In question number 7, the results of clinical students were significantly better than those of preclinical students, as most clinical students were taught the professional way of brushing (93%), in contrast to preclinical students, who were taught much less.

In question number 13, clinical students were significantly more concerned about having bad breath (72%) than preclinical students (50%).

In question number 16, clinical students were more concerned about the color of their teeth (65%) than preclinical students (51%), and the difference was statistically significant.

In question number 18, a significant difference was found: 81% of preclinical students disagreed, which indicated the vast majority

were not heavy smokers, whereas only 61% of clinical students disagreed. It may reflect stress or other factors associated with the clinical phase of training.

In all cases except question 18, the clinical students exhibited more favorable behavior or attitudes than the preclinical students. Clinical students were more likely to care about their oral health maintenance (brushing twice daily, brushing professionally, caring about their breath)—all these positive behaviors indicate improvements consistent with their advanced training. However, clinical students were also more likely to be heavy smokers, a negative behavior that was significantly lower in the preclinical group. The remaining questions showed no statistically significant differences, indicating that the aspects of oral health attitudes among preclinical and clinical students in our study were quite similar. Many questions had high favorable response rates in both groups (careful brushing, not using hard toothbrushes, and brushing teeth carefully), which is a good behavior.

In question number 20, a majority of preclinical students preferred sweet, snacks the difference between preclinical and clinical was significant. This suggests dietary sugar exposure might be a common issue among preclinical students.

In comparison between male and female, a gender analysis was conducted to examine attitudes related to gender and oral health score using Welch's test [the variances were not assumed, and Levene's test was 0.011 ($p < 0.05$)]. The results showed that female students had better oral health attitudes than males, with significance ($p < 0.001$), and that females scored 3.05 points higher than males.

Although differences were noted between male and female students on several items, female participants were significantly

more likely to floss regularly (85% of flossing students were female) and to pay closer attention to oral hygiene details such as tooth color (72%) and concerns about bad breath (75%). In contrast, smoking was more prevalent among male students, with 80% of smokers being male. These differences align with the general trend that female dental students tend to have higher HU–DBI scores than their male counterparts.

Overall, the findings indicate that while clinical students demonstrated slightly more favorable oral health attitudes and behaviors than preclinical students, this difference in total HU–DBI scores was not statistically significant. However, significant improvements were noted in specific behaviors, such as brushing frequency and technique, among clinical students, whereas negative behaviors like smoking were more prevalent in this group. In addition, female students consistently exhibited better oral health attitudes and practices than males, suggesting the influence of gender on self-reported oral health behaviors.

DISCUSSION

Results suggest that both preclinical and clinical students demonstrated high levels of favorable behavior in careful toothbrushing, brushing in professional technique, and avoiding hard-bristled toothbrushes. These high rates likely reflect the effectiveness of early dental education in instilling basic oral hygiene principles.

One of the more striking findings in the current study was the issue of smoking habits; heavy smoking (≥ 10 cigarettes a day) was significantly more prevalent among clinical students than preclinical students, with similar overall smoking rates in both groups. Dental students are among the most vulnerable to long-term stress compared with their counterparts in other medical fields. This finding might be attributed to their tendency toward perfectionism, fear of failure, exam stress, the teaching curriculum, workload, and lack of leisure time. Heavy smoking could be related to the high stress in the clinical year that students have to work hard to finish clinical cases, and the fear of failure, lack of leisure.²⁰

Comparing our results with results from other countries, most studies using HU–DBI have reported improvements in oral health attitudes with advancing education, like Egypt, and Malaysia.^{4,12} However, in a similar study in Germany, no statistically significant differences were found between preclinical and clinical students on HU–DBI questions. The study concluded that dental education in its current form has a weak effect on improving students' oral health attitudes in Germany.¹⁶ Moreover, a study by Vangipuram et al. conducted among Indian dental students reported opposite findings, with preclinical students demonstrating significantly better HU–DBI scores compared to their clinical counterparts.²¹

This study assessed self-reported oral health attitudes and behaviors among dental students at different stages of training in a Syrian private university, using the HU–DBI questionnaire. Overall, our findings suggest that there are some positive changes in oral health behavior as students progress to clinical training; however, these improvements are selective rather than universal. Clinical students outperformed preclinical students in several critical behaviors, suggesting that the dental curriculum and clinical exposure have a beneficial impact on these aspects.

In lectures and especially during clinical rotations, students receive repeated messaging about the importance of thorough plaque control. By the time students reach the clinical phase (treating patients and perhaps seeing the consequences of

poor oral hygiene in others), a greater proportion adopt these recommended habits themselves. Similarly, a study from Malaysia has documented that dental students generally improve their oral hygiene practices throughout their education.⁴ The implication is that the dental curriculum, including preventive dentistry courses and periodontology rotations, has a positive influence on personal oral care routines for many students, albeit not enough for all. A considerable fraction of students, even in clinical years, remains uninterested in their oral hygiene. For hygiene, for instance, only 43% of clinical students use floss regularly, which is a gap that educators should address by emphasizing flossing technique and compliance more frequently and earlier.

Some dental schools have introduced wellness programs and antitobacco campaigns aimed at students and staff; our results suggest that such interventions would also be beneficial in this setting.

This study showed no difference in score mean between clinical and preclinical groups (13.04 vs 12.9), which contradicts the survey in Egypt, Mekhemar et al.¹² found that clinical students had a significantly higher mean HU–DBI score than preclinical students (11.5 vs 10.6, $p = 0.03$), reflecting broadly better attitudes in the clinical group. They attributed this to the increased clinical exposure and responsibility that students undergo as they prepare to become practicing dentists. Our study did find evidence of this educational effect, but only in targeted behaviors (like flossing and dental visits). On the other hand, an Indian study by Vangipuram et al. found that preclinical students had a higher mean score than clinical students, and they reported that oral health attitudes did not improve with increasing levels of education. The authors speculated that the insufficient emphasis on personal oral health in the later years of the curriculum, combined with mounting academic stress, could explain why senior students did not maintain the same level of self-care. Interestingly, our Syrian cohort does show some improved self-care (like better brushing habits) in the later years, implying that our curriculum does impart some positive reinforcement. Yet, the fact that many behaviors leveled off suggests that there is room to strengthen the focus on personal preventive practices throughout the dental program.

The current findings on gender differences align with a broad consensus in the literature: Female dental students tend to exhibit better oral health attitudes and behaviors than their male counterparts. This finding is consistent with many studies reviewed in the literature, which have shown significantly higher positive attitudes about dental visits and demonstrate better oral health behaviors than men. Men tend to go to the dentist mainly when they have an acute problem.^{22,23} A study in Saudi Arabia showed that brushing and flossing are significantly higher in women compared to men.²⁴

Regardless, the implication is that male students might benefit from additional encouragement or targeted interventions to match the oral health practices of their female peers.

The clinical translational value of the present study lies in its ability to identify specific gaps in oral health attitudes and behaviors among dental students. These findings can inform targeted educational interventions within the dental curriculum, particularly focusing on improving negative behaviors such as smoking and dietary habits while reinforcing positive practices. Addressing these gaps can help ensure that graduating dentists embody optimal oral health behaviors, ultimately serving as effective role models for their patients.

Key strengths of this study are the substantial sample size of healthcare students and the thorough survey methodology, which explored diverse dimensions of oral health attitudes and behaviors. Nevertheless, some limitations should be noted. Since dental students possess specialized knowledge of optimal oral health practices, social desirability bias may lead to inaccurate questionnaire responses that do not align with their actual behaviors. However, similar studies have shown that this limitation of cross-sectional surveys has a weak effect on evaluation, as misdiagnoses of gathered data tend to be equally distributed.²⁵

Future research should aim to include larger and more diverse student populations from multiple dental schools to enhance the generalizability of the findings. Longitudinal studies are also recommended to track changes in oral health attitudes and behaviors throughout the entire dental curriculum. In addition, incorporating qualitative approaches, such as interviews or focus groups, could provide deeper insight into the underlying reasons for negative habits, including smoking, and help in developing more effective educational interventions.

CONCLUSION

In summary, this study offers insight into the oral health attitudes and behaviors of Syrian dental students at various stages of their training. We observed that clinical (advanced year) students exhibit significantly better behaviors in certain key areas, such as frequent brushing, brushing professionally, and eating fewer sweets, compared to preclinical students, indicating the positive effects of dental education in those domains. However, many other aspects of oral health attitude did not differ notably between junior and senior students, and worrisome habits like increased heavy smoking in the clinical years were identified.

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