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Knowledge, Practices and Attitude among Sudanese Dental Students Towards Oral Health

Sudanlı Diş Hekimliği Öğrencilerinin Ağız Sağlığına Yönelik Bilgi, Uygulamalar ve Tutumları

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ÖZ

Amaç: Bu çalışmanın amacı, Hartum Üniversitesi'ndeki diş hekimliği öğrencilerinin ağız sağlığına yönelik bilgi, tutum ve uygulamalarını ve diş hekimliği eğitiminin akademik aşamalar boyunca ağız sağlığı davranışları üzerindeki etkisini değerlendirmektir.

Gereç ve Yöntemler: Tanımlayıcı prospektif bir çalışma, 664 kişilik bir popülasyondan rastgele seçilen 172 öğrenciden oluşan bir örneklem ile yürütülmüştür. Veriler, sosyo-demografik bilgileri ve ağız sağlığı konularını kapsayan, önceden test edilmiş yapılandırılmış bir anket aracılığıyla toplanmıştır. İstatistiksel analiz, tanımlayıcı istatistikler kullanılarak ve %95 güven aralığında ilişkiler değerlendirilerek SPSS sürüm 25 kullanılarak gerçekleştirilmiştir. Katılımcılardan etik onay ve bilgilendirilmiş onam alınmıştır.

Bulgular: Katılımcıların çoğunluğu kadındı (%75) ve ikinci sınıf öğrencileri en büyük grubu oluşturuyordu (%25). Bilgi değerlendirmesi, %74,8'inin iyi ağız sağlığı bilgisi sergilediğini, sadece %0,6'sının kötü puan aldığını ortaya koymuştur. Katılımcıların çoğu şeker (%18,6) ve bakteri kolonizasyonunu (%23,2) diş sorunlarına önemli katkıda bulunan faktörler olarak tanımlarken, %95,9'u düzenli diş muayenelerinin önemini kabul etmiştir. Uygulamada, %69,7'si diş sağlığı davranışlarının orta düzeyde olduğunu bildirmiş, ancak sadece %4,1'i iyi uygulamalar sergilemiştir. 96,2'si diş temizliğini kontrol etmek için boya kullanmasına rağmen, sadece %29,6'sı ağrı için diş hekimine başvurmuştur; bu da profesyonel hizmetlere erişimin önündeki engelleri göstermektedir. Diş sağlığına yönelik olumlu tutumlar gözlenmiş olup, %78,9'u diş sağlığını iyi olarak sınıflandırmıştır.

Sonuç: Bu çalışma, Hartum Üniversitesi'ndeki diş hekimliği öğrencileri arasında bilgi ve olumlu tutumları vurgulamakta, ancak özellikle diş ipi kullanımı ve proaktif diş hekimi ziyaretleri olmak üzere uygulamalardaki eksiklikleri ortaya koymaktadır. Bilgi ve uygulama arasındaki uçurumu kapatmak için önleyici bakım ve düzenli diş muayenelerine vurgu yapan hedefli eğitim müdahalelerine ihtiyaç vardır. Ek olarak, akademik ilerlemeyle birlikte ağız sağlığına yönelik bilgi, tutum ve uygulamalarındaki iyileşme, ağız sağlığı davranışlarının geliştirilmesinde sürekli öğrenmenin ve klinik maruziyetin öneminin altını çizmektedir.

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ABSTRACT

Objectives: This study aimed to assess the knowledge, attitudes, and practices (KAP) toward oral health among dental students at the University of Khartoum and to evaluate the influence of dental education on their oral health behaviors across academic stages.

Materials and Methods: A descriptive prospective study was conducted with a randomly selected sample of 172 students from a population of 664. Data were collected through a pre-tested structured questionnaire covering socio-demographics and oral health topics. Statistical analysis was performed using SPSS version 25, employing descriptive statistics and assessing associations at a 95% confidence interval. Ethical approval and informed consent were secured from participants.

Results: The majority of participants were female (75%), with second-year students comprising the largest group (25%). Knowledge assessment revealed that 74.8% exhibited good oral health knowledge, while only 0.6% scored poorly. Most respondents identified sugar (18.6%) and bacterial colonization (23.2%) as significant contributors to dental problems, with 95.9% acknowledging the importance of regular dental check-ups. In practice, 69.7% reported fair dental health behaviors, but only 4.1% demonstrated good practices. Despite 96.2% using dyes to check tooth cleaning, only 29.6% sought dental care for pain, indicating barriers to accessing professional services. Positive attitudes toward dental health were observed, with 78.9% classified as having a good attitude. Statistical analysis revealed significant relationships between knowledge and attitudes with study year, and female students generally exhibited higher knowledge and positive attitudes compared to males.

Conclusion: This study highlights strong knowledge and positive attitudes among dental students at the University of Khartoum, but reveals gaps in practices, particularly in flossing and proactive dental visits. Targeted educational interventions are needed to bridge the gap between knowledge and practice, with an emphasis on preventive care and regular dental check-ups. Additionally, the improvement in KAP with academic progression underscores the importance of continuous learning and clinical exposure in enhancing oral health behaviors.

Keywords: Knowledge, Attitudes, Practices, Oral Health, Dental Students

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INTRODUCTION

Oral health knowledge is a fundamental prerequisite for developing health-related behaviors, playing a pivotal role in preventing oral diseases and maintaining overall health (Al Kawas et al., 2010). Dental education aims to not only impart knowledge but also instill a lifelong commitment to oral health in both dental students and the patients they will serve (Rahman & Al Kawas, 2013). This makes educating dental students in oral health critical, as their personal attitudes and practices can significantly influence their patients' health outcomes (Moslemi et al., 2017, Mamai-Homata et al., 2016). The process of fostering positive oral health habits among dental students, however, is not without challenges. Effective education in this area requires sustained effort, time, and a curriculum that emphasizes the importance of preventive care (Yildiz & Dogan, 2011).

Dental students engage with patients from diverse age groups and backgrounds, and as future oral health professionals, their own attitudes toward oral hygiene become reflective of the care they provide (Al-Wahadni et al., 2004). Several studies suggest that dental students' oral health behaviors improve significantly as they advance in their education. In particular, those in their final years exhibit better hygiene practices and attitudes than their junior counterparts, highlighting the positive influence of prolonged exposure to clinical training (Yildiz & Dogan, 2011, Peker & Alkurt, 2009). This transformation underscores the link between academic experience and personal health behaviors, which in turn impacts the quality of care students deliver to their patients.

While oral diseases are not life-threatening, they have a profound impact on an individual's quality of life, affecting self-esteem, nutrition, and overall well-being (Al Kawas et al., 2010). Oral diseases, such as dental caries and periodontal issues, are associated with pain, anxiety, and social impairments, making their prevention a critical public health concern. Despite substantial data on oral health issues in children and adults, there is a notable gap in understanding how these issues evolve in young adults, particularly among dental students who are expected to champion oral hygiene practices both personally and professionally. Studies examining the progression of dental students' oral health behaviors consistently show that education plays a key role in improving their attitudes toward oral hygiene, especially during the later stages of their academic careers (Al-Wahadni et al., 2004).

However, while health promotion efforts have been shown to increase knowledge levels, translating this knowledge into sustained behavioral changes remains a challenge. Effective oral health education must result in a meaningful shift in behavior and attitudes, not just knowledge acquisition. Although chair-side health promotion has proven to be more effective in influencing behavior, the quality of educational programs in dental schools requires ongoing enhancement to ensure students become advocates for oral health. This is particularly relevant given that dental students are future role models who will influence the oral health behaviors of their patients, family, and friends (Al Kawas et al., 2010, Yildiz & Dogan, 2011).

Globally, numerous studies have examined the oral health attitudes and behaviors of dental students, revealing significant variations across different cultural and academic contexts. For instance, a cross-cultural study comparing British and Chinese dental students found striking differences in their attitudes toward oral hygiene practices, with 77% of Chinese students concerned about gum color compared to only 18% of their British counterparts (Komabayashi et al., 2005). In another study conducted across four Asian countries, approximately 70% of dental students rated their oral health positively, though 72.6% visited a dentist only when experiencing problems, highlighting a discrepancy between knowledge and preventive behavior (Halawany et al., 2015).

Studies focused on specific regions, such as Iraq, Egypt, and Yemen, further emphasize the role of education in shaping dental students' oral health attitudes. In Iraq, for example, 75.3% of dental students reported regularly examining their teeth after brushing, while a significant proportion delayed dental visits until experiencing pain (Karem Hassan & Jabbar Ali, 2020). Egyptian dental students demonstrated significant improvements in oral health knowledge and behaviors as they progressed through their studies, underscoring the importance of incorporating comprehensive oral health education early in the curriculum (Al-Wesabi et al., 2019). Similarly, a comparative study in Yemen revealed that female students, particularly those attending public universities, exhibited better oral health behaviors compared to their male counterparts (Halboub et al., 2016).

Despite the extensive research conducted internationally, there is a paucity of data on the oral health attitudes and behaviors of dental students in Sudan. Only two recent studies have explored this topic, both concluding that Sudanese dental students, particularly those in clinical years, demonstrate better oral health practices compared to their regional and international peers (Al-Shiekh et al., 2014, Khalid et al., 2016). However, these studies also revealed that overall scores for oral health behavior and attitude were relatively low compared to students from other countries (Al-Wahadni et al., 2004, Yildiz & Dogan, 2011). Furthermore, it has been suggested that oral health promotion and prevention courses should be integrated earlier in dental curricula to reinforce positive behaviors from the outset (Halawany et al., 2015). By fostering positive attitudes and behaviors throughout their studies, dental students can better serve as advocates for oral health, benefiting both their personal health and the broader community they will ultimately serve (Al-Shiekh et al., 2014).

This study aimed to assess the knowledge, attitudes, and practices toward oral health among dental students at the University of Khartoum. It seeks to evaluate how dental education shapes their oral health behaviors, particularly in relation to their progression through different academic stages.

MATERIAL AND METHODS

A descriptive prospective study had been implemented, to assess knowledge, attitude and practice among University of Khartoum dental students towards oral health.

Study Area

Faculty of Dentistry, University of Khartoum, Khartoum, Sudan.

Study population

All dental students in the Dental College were selected as a case study; as they belong to the largest most ancient school of dentistry in Sudan.

Sample Size

The sample size for students was selected randomly using the following statistical formula: n=N/1+N(e)2

The sample was distributed using the simple random method where all participants of each level were chosen randomly using the students' names lists provided by the faculty of dentistry of Khartoum by the lottery method, where 172 from the Faculty of Dentistry from the population of 664 students.

Data management

Data was collected using a pre-prepared and pre-tested structured questionnaire directed to the students to collect data regarding their knowledge, attitude and practices regarding Oral Health. The structured questionnaire was constructed in two parts, the first addressing the socio-demographic data (age, gender and academic year). The second addressed the knowledge, attitude and practices of students regarding oral health. Questionnaires were distributed to students during their rest time, after classes were done, they were asked to participate and were questioned by the researcher and her assistants and filled by them.

Data was analyzed using Statistical Package for Social Sciences version 25, and the association between different variables is checked using descriptive data analysis of means and standard deviation at level 95% confidence interval.

Ethical approval

Ethical approval for the study was approved by Ethics Committee of SMSB, Noninvasive Clinic Ethics Committee (Approval date: 09/02/2022; NumberNA). All participants were informed about the objectives and purpose of the study before their participation. Written informed consent was obtained from each participant prior to data collection. Students were assured of the confidentiality and anonymity of their responses, and their participation was entirely voluntary, with the option to withdraw from the study at any time without any consequences. The data collected was used solely for the purposes of this research, and no identifying information was included in the analysis or reporting. Additionally, the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki, ensuring the rights, safety, and well-being of all participants.

RESULTS

This prospective cross-sectional study included 172 students from the Faculty of Dentistry at the University of Khartoum, accounting for 51.7% of the intended population. The majority of participants were female, with 129 students (75%), while males made up 43 students (25%). Regarding academic year distribution, second-year students formed the largest group, comprising 43 students (25%), followed by third-year students with 39 (22.7%). First-year students accounted for 36 participants (20.9%), fifth-year students totaled 30 (17.4%), and fourth-year students were the smallest group with 24 students (14%). The results indicated that female students predominated in all academic levels, and second-year students had the highest representation, while fourth-year students were the least represented. A scoring system was used to evaluate dental health knowledge, attitudes, and practices among the students. Variations in KAP scores were observed across different academic years, shedding light on the influence of dental education on students' skills and behaviors.

Knowledge

The table 1 provides insights into respondents' knowledge about dental health. A notable portion of participants identifies **sugar consumption** (32, 18.6%) and **bacterial colonization** (40, 23.2%) as key factors contributing to dental problems, with 56 respondents (32.6%) acknowledging both as causes. The **Mixed Method** is the most commonly used brushing technique, favored by 106 individuals (61.6%), indicating a trend toward using various approaches. Regarding the best time to brush, the majority (118, 68.6%) recommend brushing both before bed and after meals, demonstrating a solid grasp of effective oral hygiene practices. Additionally, a remarkable 165 participants (95.9%) understand the importance of regular dental check-ups, which suggests effective public health messaging in this area. When considering reasons for dental visits, pain is the primary concern for 31 respondents (18.0%), but a significant majority (126, 73.3%) recognize the importance of multiple factors for seeking dental care. In terms of caries, **bacterial colonization** is acknowledged by 93 respondents (54.1%) as a leading cause, and 133 participants (77.3%) correctly state that toothbrushes should be replaced every 2-3 months. Lastly, most respondents (125, 72.7%) believe that gingival bleeding can be prevented, although 42 individuals (24.4%) are uncertain about this matter. Overall, the results indicate a high level of knowledge among the respondents, though additional education could further enhance their understanding of preventive oral health measures.

Table 1. Overview of respondents' knowledge regarding dental health

Category	Knowledge	N (%)
Knowledge about Reasons for Dental Issues	Sugar Consumption	32 (18.6)
	Bacterial Colonization	40 (23.2)
	Sugar and Bacteria	56 (32.6)
	Lack of Brushing	16 (9.3)
	All Reasons	28 (16.3)
	Total	172 (100)
Brushing Techniques	Horizontal Movement	6 (3.5)
	Vertical Movement	30 (17.4)
	Circular Movement	24 (14)
	Mixed Method	106 (61.6)
	Other Methods	6 (3.5)
	Total	172 (100)
Best Time to Brush	Before Bed	40 (23.2)
	After Meals	13 (7.6)
	Before Bed and After Meals	118 (68.6)
	Don't Know	1 (0.6)
	Total	172 (100)
Knowledge About Regular Dental Check-Ups	Know	165 (95.9)
	Don't Know	7 (4.1)
	Total	172 (100)
Main Reasons for Dentist Visits	Pain	31 (18)
	Gingival Bleeding	5 (2.9)
	All Reasons	126 (73.3)
	Others	5 (2.9)
	Don't Know	5 (2.9)
	Total	172 (100)
Knowledge About Caries Causes	Sugar Consumption	40 (23.3)
	Bacterial Colonization	93 (54.1)
	Lack of Brushing	12 (6.9)
	All Causes	6 (3.5)
	Others	9 (5.3)
	Don't Know	12 (6.9)
	Total	172 (100)
Knowledge About Changing Toothbrush	If Becomes Weak	12 (7)
	Every 6-12 Months	24 (14)
	Every 2-3 Months	133 (77.3)
	Don't Know	3 (1.7)
	Total	172 (100)
Knowledge About Avoidance of Gingival Bleeding	Yes, Can Be Avoided	125 (72.7)
	No, It Can't Be Avoided	5 (2.9)
	Don't Know	42 (24.4)
	Total	172 (100)

A scoring assessment of dental students' knowledge reveals that a significant majority exhibit a strong understanding of oral health. Specifically, 129 students (74.8%) demonstrate good knowledge, while only one student (0.6%) scores poorly. This distribution underscores anotable level of competence in oral health knowledge among the students, as illustrated in Table 2.

Table 2. Level of Knowledge Scores

Knowledge Level	Frequency	Percent
Poor (0-10)	1	0.6%
Fair (11-17)	42	24.4%
Good (18+)	129	74.8%
Total	172	100.0%

Statistical analysis revealed varied associations between demographic factors and knowledge levels among dental students. The p-value of 0.824 indicates no significant association between gender and knowledge levels. In contrast, a significant difference was found in knowledge scores based on gender (p=0.005). This suggests that female students possess higher knowledge scores compared to their male counterparts. Furthermore, a p-value of 0.025 indicates a statistically significant association between the year of study and knowledge levels, suggesting that knowledge may increase with advancing years of study. Moreover, ($p < 0.001$), indicating significant associations between knowledge levels and both attitudes and practices concerning dental health.

Practice

The results presented in Table 3 highlight various aspects of dental health practices among respondents, revealing both commendable behaviors and areas requiring improvement. A notable 96.2% of participants reported using dyes to check the effectiveness of their tooth cleaning, indicating a strong engagement in personal oral hygiene assessments. However, only 29.6% indicated they would seek dental care when experiencing pain, suggesting significant barriers to accessing professional dental services. While a commendable 64.3% reported brushing their teeth before bed, the 35.7% who do not could benefit from education on the importance of nighttime brushing. The majority (62.2%) brush twice daily, but the 34.3% who brush only once highlight a need for increased awareness regarding optimal brushing frequency. Additionally, the data revealed that only 33.3% of respondents regularly use dental floss, emphasizing a critical gap in effective oral hygiene practices. Alarmingly, only 7.7% brush after meals, suggesting a lack of understanding of its importance in preventing decay. On a positive note, 87.2% of respondents have visited a dentist previously, indicating general recognition of the importance of professional dental care.

Table 3. Summary of Dental Health Practices

Category	Practices	Frequency N (%)
Use of Dye to Check Cleaning of Teeth	Have Used Dyes	165 (96.2)
	Have Not Used Dyes	7 (3.8)
	Total	172 (100)
Seeking Dental Visits When Feeling Dental Pain	Yes	51 (29.6)
	No	121 (70.4)
	Total	172 (100)
Brushing Before Bed	Yes	111 (64.3)
	No	61 (35.7)
	Total	172 (100)
Number of Times Brushing	Brushing Once	59 (34.3)
	Brushing Twice	107 (62.2)
	Brushing 3 Times and More	6 (3.5)
	Total	172 (100)
Use of Dental Floss	Using Floss	57 (33.3)
	Not Using Floss	115 (66.7)
	Total	172 (100)
Brushing After Meals	Brushing	13 (7.7)
	Not Brushing	159 (92.3)
	Total	172 (100)
Previous Dental Visits	Have Visited a Dentist	150 (87.2)
	Have Not Visited a Dentist	22 (12.8)
	Total	172 (100)

The data presented indicates the distribution of practice levels among respondents concerning their dental health habits. A significant majority, 69.7%, reported a fair level of practice, suggesting that while they engage in some positive behaviors, there is considerable room for improvement in their dental health practices. In contrast, only 4.1% of participants achieved a good practice level, highlighting a lack of optimal adherence to recommended dental hygiene guidelines. Meanwhile, 26.2% of respondents were classified as having a poor level of practice, indicating a concerning number of individuals potentially neglecting essential oral health behaviors. This distribution underscores the need for targeted educational interventions to enhance overall dental hygiene practices and promote healthier oral health behaviors among the students. (Table 4.)

Table 4. Levels of Practice Distribution

Practice Level	Frequency	Percent
Poor	45	26.2%
Fair	120	69.7%
Good	7	4.1%
Total	172	100.0%

The analysis indicates that a very small p-value (e.g., $p < 0.001$) would suggest a significant relationship between practice levels and attitudes. However, the current p-value of 0.503 is above the conventional significance threshold of 0.05, leading us to fail to reject the null hypothesis. Therefore, we conclude that there is no statistically significant correlation between gender and practice levels in this sample. Similarly, the p-value of 0.1497 also exceeds the typical significance level of 0.05, further supporting our decision to fail to reject the null hypothesis. Thus, we find no significant association between the year of study and practice scores among the participants.

Attitude

Table 5 summarizes participants' attitudes toward various facets of dental health. A significant portion, 64.5%, view chewing gum positively. Conversely, only 14.5% have a negative perception, which may stem from worries about sugar levels or associated health risks, while 21% remain indifferent. In terms of toothbrush preference, 78.5% choose fine toothbrushes, reflecting a tendency towards gentler oral care, while only 7% prefer medium and 14.5% select hard toothbrushes. When considering smoking and nicotine use, only 14.5% of respondents maintain a positive outlook, whereas a striking 84.9% express disapproval, indicating a robust public health message regarding the dangers of tobacco. Additionally, 71.5% of participants hold a favorable view of dental visits, recognizing their importance for maintaining oral health; only 7% have negative feelings. Support for teeth replacement as individuals age is considerable, with 87.8% endorsing the practice, while just 4.1% disagree. Furthermore, 87.2% advocate for teeth replacement when they are lost, indicating a proactive stance on dental care. Overall, these results demonstrate a largely positive attitude toward dental health practices among respondents, underscoring the need for ongoing education and awareness to promote good oral hygiene.

Table 5. Summary of Attitudes

Attitude Category	Attitude	Frequency (N) (%)
Attitude Towards Chewing Gum	Positive	111 (64.5)
	Negative	25 (14.5)
	Neutral	36 (21)
	Total	172 (100.0)
Attitude Towards Choice of Toothbrush Type	Fine Toothbrush	135 (78.5)
	Medium Toothbrush	12 (7.0)
	Hard Toothbrush	25 (14.5)
	Total	172 (100.0)
Attitude Towards Smoking and Nicotine Consumption	Positive	25 (14.5)
	Negative	146 (84.9)
	Neutral	1 (0.6)
	Total	172 (100.0)
Attitude Towards Dental Visits	Positive	123 (71.5)
	Negative	12 (7.0)
	Neutral	37 (21.5)
	Total	172 (100.0)
Attitude Towards Teeth Replacement When Getting Old	Positive	151 (87.8)
	Negative	7 (4.1)
	Neutral	14 (8.1)
	Total	172 (100.0)
Attitude Towards Teeth Replacement When Losing Them	Positive	150 (87.2)
	Negative	10 (5.8)
	Neutral	12 (7.0)
	Total	172 (100.0)

The data reveals the distribution of respondents' attitudes towards dental health practices. A significant majority, 78.9%, are categorized as having a "Good" attitude, indicating a strong understanding and appreciation for the importance of oral hygiene. This suggests a high level of awareness about maintaining dental health. Conversely, 20.5% fall into the "Fair" category, which implies that while their attitudes are generally positive, there is potential for enhancement through further education on dental care. Only one individual (0.6%) was classified with a "Poor" attitude, demonstrating that most respondents possess a commendable positive outlook towards their dental health practices. In summary, the results indicate that the majority of participants not only recognize the significance of good dental health but also actively endorse effective oral care practices, as shown in table 6.

Table 6. Levels of Attitude Distribution

Attitude Level	Frequency	Percent
Poor (<4)	1	0.6%
Fair (5-9)	35	20.5%
Good (10+)	136	78.9%
Total	172	100.0%

Furthermore, the p-value of 0.011 indicates a statistically significant association between the year of study and attitude levels among students in this study. In contrast, the p-value of 0.212 suggests an absence of a statistically

significant relationship between sex and attitude levels. Notably, the analysis reveals that female students exhibit a more favorable attitude compared to their male counterparts, with no females categorized within the "Poor" attitude level. This finding underscores a potential need for targeted engagement strategies specifically aimed at male students to enhance their overall attitude levels, despite the lack of significant differences in attitudes between male and female students.

DISCUSSION

The findings from this study at the University of Khartoum offer important insights and align with existing research on dental students' knowledge, attitudes, and practices (KAP) in oral health. While the results are generally positive, they also highlight specific areas that need improvement, especially when compared to similar studies conducted in other regions.

The high level of knowledge demonstrated by the students, with 74.8% scoring "good," reflects a solid foundation in oral health education. This is consistent with studies from Palestine (Kateeb, 2010) and Jordan (Al-Batayneh et al., 2014), where dental students also showed a strong understanding of key dental health issues, such as the role of bacterial colonization and sugar in dental problems. In the Khartoum study, 54.1% of students identified bacterial colonization as a major cause of dental issues, and 32.6% recognized both bacteria and sugar as contributing factors, reflecting similar comprehension.

However, while most students (95.9%) understood the importance of regular dental check-ups, only 73.3% acknowledged multiple reasons for visiting the dentist, indicating that some students might not fully grasp the broader benefits of routine dental care. This contrasts with research from Lay et al., (2023), where a higher percentage of dental students viewed regular dental visits as essential for maintaining overall oral health. This presents an opportunity to further enhance students' understanding of preventive dental care in Khartoum.

The discrepancy between knowledge and practices is evident, as only 4.1% of students displayed "good" oral health practices, with 26.2% showing "poor" practices. While 62.2% of students brushed twice daily—comparable to other global studies, like that of Peltzer and Pengpid, (2017) other essential practices, such as flossing and brushing after meals, were less common. Only 33.3% of students in Khartoum used dental floss regularly, and just 7.7% brushed after meals. This pattern of inadequate oral hygiene behaviors despite sound theoretical knowledge is seen worldwide. Mekhemar et al,. (2021) noted that more advanced students in Germany showed better adherence to practices like flossing, suggesting that experience plays a role in improving hygiene behaviors over time.

Additionally, the reluctance to visit the dentist unless in pain (29.6%) reflects a common issue globally, as seen in ASEAN countries, where many students delay dental care until necessary (Peltzer & Pengpid, 2017). This reliance on reactive rather than preventive care indicates a need for more education on the long-term benefits of regular dental check-ups in maintaining oral health.

The generally positive attitudes toward dental health in this study, with 78.9% of students exhibiting a "good" attitude, are consistent with findings from other regions. For example, Riad et al., (2022) reported similarly positive attitudes among German dental students regarding the importance of preventive care and routine dental visits. These attitudes in Khartoum suggest a strong understanding of oral health, but they don't always translate into optimal practices.

An interesting finding in this study is the difference in attitudes between male and female students. Female students showed higher knowledge and more positive attitudes, with no females falling into the "poor" category. While this gender difference wasn't statistically significant, it mirrors similar findings from who observed significant gender gaps in dental health attitudes, particularly regarding preventive behaviors. This suggests that gender-specific strategies may be needed to engage male students more effectively and improve their oral health attitudes and practices.

One of the key findings in this study is the significant increase in knowledge and positive attitudes with advancing academic years. This trend is also observed in other studies, where senior dental students tend to have better knowledge and practices than their junior counterparts. For instance, Mekhemar et al., (2021) found that German students in clinical stages were more likely to follow recommended oral hygiene practices than those in preclinical years. In this study, the significant association between year of study and knowledge scores ($p = 0.025$) underscores the importance of continuous education and clinical experience in improving students' oral health behaviors.

CONCLUSION

This study focused on KAP of dental students at the University of Khartoum. While the students generally demonstrated strong knowledge and positive attitudes, there were notable gaps in their practices, particularly with regard to flossing, brushing after meals, and proactive dental visits. These results are consistent with international trends, highlighting the need to close the gap between knowledge and practice through targeted education and interventions.

A key focus should be on preventive care, encouraging students to adopt more consistent oral hygiene routines and to visit the dentist regularly, even when there are no symptoms of dental problems. Furthermore, the gender differences in KAP scores suggest the potential benefit of targeted strategies to improve male students' engagement with oral health practices. Finally, the finding that knowledge and practices improve with academic progression emphasizes the importance of continuous

learning and clinical exposure in fostering better oral health behaviors.

Conflicts of Interest
The authors declare that they have no conflict of interest.

Author Contributions
Research idea: WHIM, HAAM;Design of the study: WHIM,HAAM; Acquisition of data for the study: WHIM; Analysis of data for the study: WHIM; Interpretation of data for the study: WHIM, HAAM; Drafting the manuscript: WHIM, HAAM; Revising it critically for important intellectual content: WHIM, HAAM; Final approval of the version to be published: WHIM, HAAM.

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