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Original Research

Changes in oral health students' behaviors, attitudes, and oral status during academic training

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ABSTRACT

Objectives: To analyze the progression of oral health conditions, attitudes, and behaviors among oral health students throughout their academic training and to identify factors influencing these changes.

Methods: A longitudinal study was conducted with students from the Bachelor's Degree in Dental Hygiene (BDH), the Bachelor's Degree in Dental Laboratory Technology (BDLT), and the Integrated Master's Degree in Dental Medicine (IMDM) at the Faculty of Dental Medicine of the University of Lisbon. Data were collected at two or three moments: the 1st, 3rd, and 5th years (the latter only for IMDM). The quantitative analysis used a questionnaire that included the Hiroshima University Dental Behavioral Inventory. (HUDBI) and intraoral examinations assessing oral hygiene index (DI-S), gingival bleeding (CPI), and dental caries (DMFT). The statistical tests used were Kruskal-Wallis, Wilcoxon, and Friedman (α=0.05). A qualitative analysis, conducted through focus-group discussions with IMDM final-year students, was also included.

Results: HUDBI scores significantly improved in IMDM (p=0.004) and BDH (p=0.007) students. DI-S improved significantly in BDH students (p=0.016). Gingival bleeding (CPI) improved in all groups, with the greatest reduction among BDH students (p<0.001). Qualitative data revealed that increased knowledge, clinical exposure, and patient responsibility were key motivators for behavior change.

Conclusions: Academic training positively impacts oral health behaviors, with greater improvements in students with early clinical exposure. However, challenges such as flossing adherence and sugar consumption persist. Curricular enhancements should integrate earlier preventive strategies and emphasize self-care as a foundation for professional practice. (Rev Port Estomatol Med Dent Cir Maxilofac. 2025;66(x):1-xxx)

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Introduction

At the end of their academic training, oral health students are expected to be responsible for the education, promotion, and implementation of preventive measures among their future patients. The self-care of healthcare professionals reflects their understanding of the importance of preventing oral problems,[1,2] and can consequently influence their ability to educate and motivate patients regarding oral health care.[3,4]

While directed at distinct healthcare professionals, both *The Graduating European Dentist: A New Undergraduate Curriculum Framework*,[5] and *the Common European Curriculum for Dental Hygiene*,[6] converge in highlighting that dentistry and dental hygiene graduates should be prepared to promote general and oral health, design and implement effective preventive programs, and develop strategies that assess, reinforce, and improve patients' oral hygiene practices, ultimately fostering the adoption and maintenance of behaviors that minimize the risk of oral disease.

Therefore, during their training, dental and oral hygiene students should acquire progressively greater knowledge and better skills in oral hygiene care and oral disease prevention. They are expected to apply this knowledge and these skills to their daily oral self-care and clinical practice. The dental and oral hygiene curricula should encourage the improvement of students' attitudes and behaviors so they can positively influence their patients' oral health in daily clinical practice and the community's oral health in general. The curricula should integrate specific subjects on oral public health, health promotion and education, and prevention of oral diseases, as well as develop transversal skills in communication and motivation for oral health self-care, with practical application in clinical and community settings.[5,6]

Kawamura developed the *Hiroshima University Dental Behavioral Inventory* (HUDBI)[7] to assess individuals' attitudes and behaviors, and it was translated and adapted into Portuguese.[8] The assessment of oral health status and its relationship with HUDBI has been widely studied.[9-14] As a result, a relationship between HUDBI and dental caries,[15,16] oral hygiene level,[17] and periodontal disease[18] has been shown, indicating an association between a person's positive attitudes and behaviors and their oral health status. In Portugal, some studies have analyzed the relationship between HUDBI and oral health status in university students,[19-24] but they are primarily cross-sectional. Therefore, it was considered relevant to develop a longitudinal study aimed to: 1) analyze the progression of attitudes, behaviors, and oral health status of oral health students during their academic training; 2) identify the reasons that lead to the change in oral health behaviors and attitudes.

Material and methods

The present study was approved by the Health Ethics Committee of the Faculty of Dental Medicine of the University of Lisbon (FMDUL). All participants volunteered and signed an informed consent, and the data were processed confidentially.

The target population was FMDUL's students enrolled in the Bachelor's Degree in Dental Hygiene (BDH), the Bachelor's Degree in Dental Laboratory Technology (BDLT), and the Integrated Master's Degree in Dental Medicine (IMDM). Students who had previously attended any other higher education course were excluded.

The present study included both quantitative and qualitative analyses. The data were collected between 2015 and 2020, in two or three moments of the student's educational training: 1) in the 1st year of the three courses;[21] 2) in the 3rd year of the three courses (the final year for the BDH and BDLT courses);[22] and 3) in the 5th year, and final, of the IMDM course.[23] The data from these two or three moments, according to the student's course, were paired for each participating student. Data collection included a questionnaire and an intraoral examination, both conducted at the specified moments.

The questionnaire included the Portuguese version of the HUDBI[8] to assess students' attitudes and behaviors, as well as questions about oral health behaviors (toothbrushing, intake of cariogenic foods, and dental appointments). The HUDBI is an instrument consisting of 21 dichotomous questions (agree/disagree), 9 of which are considered "dummies" because they are not used to calculate the questionnaire's overall score. A correct answer to each of the 12 "non-dummy" items received one point. The higher the score, the better the attitudes and behaviors related to oral health.

The intraoral examination collected data on the oral hygiene level, gingival inflammation (bleeding), and caries diagnosis. The Simplified Oral Hygiene Index (OHI-S)[25] was used to study the oral hygiene level, using only the debris component index (DI-S). Bleeding was recorded through the Community Periodontal Index (CPI).[26] The International Caries Classification and Management System criteria were used for caries diagnosis,[27] by DMFT index calculation. Although initial caries lesions were recorded, only caries codes 3 to 6 (D_{3-6}MFT) were used for calculating the DMFT index to allow comparison with the WHO criteria.[26]

Not all examiners collected data at the three moments. Still, all of them were trained and calibrated by the same researcher with experience in oral health epidemiological studies and the indices used. All examinations were conducted in a classroom using an intraoral mirror, a WHO periodontal probe,[26] and an LED artificial frontal light.

The descriptive analysis included determining absolute and relative frequencies, as well as the mean, standard deviation (SD), maximum, and minimum values for the numerical variables. The inferential analysis used the Kruskal-Wallis, Wilcoxon, and Friedman tests, with a statistical significance of 5%.

The qualitative analysis was intended to investigate the reasons that can contribute to behavior changes during academic training. This analysis used a focus-group approach with students from the final year of the IMDM course, a subgroup of the study population. A total of twelve 5th-year students of the IMDM were specifically selected, based on their oral health behaviors and HUDBI scores obtained in the quantitative analysis at the end of their academic training, already published.[23] These students were divided into three groups of four: Group 1 included students with the least positive oral health behaviors; Group 2 included students with the highest HUDBI scores; and Group 3 included students with the lowest HUDBI scores. The objective of including students with differ-

ent HUDBI scores and behaviors in the focus group was to bring a wider range of perspectives and ensure more inclusive and accurate insights.

A trained facilitator conducted the focus-group interviews separately for each group. A script was prepared to guide and encourage students' participation in the group discussion. The script was designed to identify factors that led students to change their oral health attitudes and behaviors during their academic training.[28] The interview script encompassed three major perceptual dimensions: 1) students' perspective on oral health knowledge acquired in the course; 2) factors that led students to change and improve their oral health behaviors; 3) factors that facilitated or hindered the implementation of dental hygiene behaviors. In each group, participants were encouraged to talk freely, respond to one another's views, and generate new ideas from similar or divergent perspectives.

The focus-group interviews were conducted via videoconference because data collection occurred during the COVID-19 pandemic. They were recorded with consent and transcribed verbatim. The transcriptions were subjected to qualitative content analysis. The discussion in the various focus groups was analyzed for patterns and differences in perception.[29]

Results

Quantitative analysis

After pairing the data across the two or three collection moments, a sample of 55 students was obtained (Table 1), corresponding to 30%–40% of the target population, depending on the course.

Results showed a significant increase in HUDBI values for IMDM (p=0.004) and BDH (p=0.007) students during their academic training, indicating improved attitudes and behaviors. Only BDH students significantly improved their oral hygiene level (DI-S) (p=0.016). BDLT and IMDM students also showed a trend toward improvement, nearly significant (p=0.056 and 0.055, respectively). Regarding CPI, gingival bleeding significantly improved in all students, but the improvement was more pronounced in BDH students. Finally, the D_{3-6}MFT increased significantly during academic training among students in the BDLT and IMDM courses (p<0.001) (Table 2).

Table 1. Study sample of the quantitative analysis.

Course	Sex	Data collection moments		
		1st year	3rd year	5th year
BDH	Female	11	11	
	Male	1	1	
BDLT	Female	17	17	
	Male	7	7	
IMDM	Female	19	19	14
	Male	0	0	0
Total		55	55	14

Table 2. Evolution of HUDBI, DI-S, CPI, and D3-6MFT in the students of the three courses.

		BDH mean (SD)	BDLT mean (SD)	IMDM mean (SD)	*p-value*
HUDBI	1st year	7.00 (1.35)	7.54 (0.83)	7.95 (0.91)	0.08*
	3rd year	9.75 (1.05)	7.42 (1.32)	8.84 (1.46)	**<0.001***
	5th year	–	–	9.43 (1.16)	–
	p-value	**0.007****	0.62	**0.004*****	–
DI-S	1st year	0.75 (0.51)	1.01 (0.64)	0.73 (0.65)	0.24*
	3rd year	0.36 (0.25)	0.72 (0.46)	0.63 (0.34)	**0.035***
	5th year	–	–	0.32 (0.34)	–
	p-value	**0.016****	0.056**	0.055***	–
CPI	1st year	0.62 (0.49)	0.69 (0.22)	0.61 (0.25)	0.18*
	3rd year	0.06 (0.11)	0.26 (0.21)	0.15 (0.21)	**0.008***
	5th year	–	–	0.30 (0.20)	–
	p-value	**0.003****	**<0.001****	**<0.001*****	–
D_{3-6}MFT	1st year	2.08 (2.35)	3.00 (2.62)	1.53 (2.12)	0.07*
	3rd year	2.50 (2.35)	4.71 (3.13)	2.37 (2.67)	**0.012***
	5th year	–	–	3.07 (2.37)	–
	p-value	0.10**	**<0.001****	**<0.001*****	–

** Kruskal-Wallis; ** Wilcoxon; *** Friedman. CPI – Community Periodontal Index; DI-S – debris component index; D_{3-6}MFT – Decayed, missing, and filled permanent teeth index, using caries codes 3 to 6 of the International Caries Classification and Management System criteria; HUDBI – Hiroshima University Dental Behavioral Inventory; SD – standard deviation.*

At baseline (1st year), there were no statistically significant differences between the three student groups in any oral health indicator (p>0.05). When comparing the four indicators in the 3rd year of the course, there were statistically significant differences for all of them: HUDBI (p<0.001), S-ID (p=0.035), CPI (p=0.008), and D_{3-6}MFT (p=0.012) (Table 2).

Qualitative analysis – focus group

Table 3 presents the sample characterization, considering age, sex, HUDBI scores, and oral health behaviors. All participants, regardless of the group, reported greater awareness of appropriate oral health attitudes and behaviors following the academic training. Most students said that they had never received any explanation about oral health before entering university:

> *"Much of my oral hygiene, nowadays, is the result of the teaching I had in the university."*
>
> *"… the importance of brushing twice a day, the importance of the brushing technique… the importance of a less cariogenic diet… I did not know how to wash my teeth well. It's something I only discovered at university."*

The students reported that, during their training, they progressively acquired the knowledge and skills for oral self-care

Table 3. Characterization of the focus group sample.

		Group 1	Group 2	Group 3	Total
Mean age (years)		*27.0 (SD=3.5)*	*25.0 (SD=1.6)*	*24.0 (SD=0.8)*	*25.3 (SD=2.4)*
Sex	Female	*100% (4)*	*100% (4)*	*75% (3)*	*91.7% (11)*
	Male	*0% (0)*	*0% (0)*	*25% (1)*	*8.3% (1)*
HUDBI score		*9.00 (SD=0.8)*	*11.25 (SD=0.5)*	*6.75 (SD=0.5)*	*9.00 (SD=2.0)*
Toothbrushing twice a day		*75% (3)*	*100% (4)*	*100% (4)*	*91.7% (11)*
Toothbrushing before sleep		*75% (3)*	*100% (4)*	*100% (4)*	*91.7% (11)*
Daily/Frequent flossing		*50% (2)*	*100% (4)*	*100% (4)*	*83.3% (10)*
Visited an oral health professional (in the last 12 months)		*75% (3)*	*100% (4)*	*75% (3)*	*83.3% (10)*
Oral health appointment without complaints		*50% (2)*	*100% (4)*	*50% (2)*	*66.7% (8)*
Frequent intake of sugary food		*25% (1)*	*75% (3)*	*50% (2)*	*50.0% (6)*

HUDBI – Hiroshima University Dental Behavioral Inventory; SD – standard deviation.

from Preventive and Community Dentistry and Periodontology disciplines, namely, recommended behaviors to avoid oral health problems and the consequences of poor oral hygiene:

> *"I would say it started more in the 2nd year with Preventive and Community Dentistry … when I suddenly realized that my brushing technique was wrong. I started by changing the brushing process, and slowly, I started trying to floss… The more I knew, later in the 3rd and 4th years, the more attention I started to pay."*

All students felt that, during the 1st year of their training, this knowledge was very scarce, and it would be important to introduce and transmit information about oral self-care at the beginning of their academic training:

> *"…in the 1st year …I still didn't know how to clean my teeth properly…we spent the whole first year not knowing, we only learned in Preventive and Community Dentistry in the 2nd year."*

Most of the students revealed that there were some gaps in the information transmitted, namely about food alternatives to carbohydrates and about the practical teaching of flossing:

> *"Everyone says that sugary foods cause cavities and everything else, but I have never heard any specific lecture […] there is no unit that teaches us the alternatives."*
>
> *"There is always much talk about what not to do, what not to eat, what to avoid. Perhaps it should refer a little more to what to do instead."*
>
> *"There isn't much attention to teaching the [flossing] technique. I often found myself in the position of having to teach a patient how to floss, and I was uncomfortable because I wasn't confident."*

Students felt that the academic environment and learning the reason behind the recommendation influenced their behavior. One of the main reasons mentioned for changing and improving oral health behaviors was knowing the consequences of poor oral hygiene (oral diseases, tooth loss) and, consequently, the fear of undergoing invasive dental treatments:

> *"… I started to pay a lot more attention because I started to understand all forms of dental pathology… some problems that could happen if I didn't pay attention to my oral hygiene."*
>
> *"… what makes many of us change our behavior is to be aware of what treatment is necessary…"*

Another factor referred to as contributing to changing and improving oral health behavior was clinical activity, mainly because, in clinical years, it is possible to observe first-hand the consequences of bad oral health:

> *"Working a little bit [in the clinic] and already seeing the consequences more closely… I have to start having more attention to self-care because I don't want this to happen to me."*
>
> *"Seeing [the patients and their diseases]… was what made me worry about my health, and I try my best not to get to that point…"*

Additionally, most participants reported that they felt a moral obligation toward their patients to present themselves as an example of good oral health:

> *"You feel the responsibility to take care of yourself as best as you can. And that it is a bit unethical not to do it and then transmit to others the best way to do it."*
>
> *"I wanted to do better in order to teach better, but I also know how difficult it was to adapt to things in the role of the patient."*
>
> *"… when you do it yourself, you know how to explain it better to the patient and even give tips that worked for you."*

However, some students with less positive behaviors did not consider this aspect as a factor for change:

"Regarding the flossing procedure, [...] I learned the techniques, and I know how to explain them to patients. So, I think that the fact that I didn't do it had no influence."

"It's easy for a person who does not have the habits to explain them."

The previous experience of oral disease was also a factor cited as a relevant reason for changing, and students who had experienced dental disease or treatment attributed more value to their oral hygiene:

"A cavity developed. [...] And since then, I valued it (oral health) even more."

"I had to do a root canal treatment on another tooth, and I thought: No, I really have to pay more attention to this."

In contrast, students with inappropriate oral health behaviors who acknowledged not having improved their behaviors reported that they did not feel the need to change because they never had oral health problems despite their negative habits:

"I don't think I have meticulous oral hygiene … I always did the basics, but I never had cavities."

One student also mentioned the increased responsibility with aging as an explanation for improving oral health behaviors.

For most students, the main changes in oral health self-care during university were starting to floss, improving their brushing technique, and increasing the frequency of dental appointments. Flossing was the least positively implemented behavior, and despite an improvement, most students did not floss daily as recommended. Students discussed that some behaviors were already present and just needed to be corrected, so they felt it was easy to improve and adapt the behavior (such as the brushing technique). Regarding behaviors that were not implemented, such as flossing, students considered it more difficult to start doing them:

"The brushing, [...] it was just a technique adaptation… The flossing, it's easy to give up at the first try, and I think it's the hardest thing to get used to".

According to the students, the problem with implementing daily flossing may be that it was introduced later in life and that it is a complex procedure that requires dedication, time, and patience. Consequently, "sleepiness," "laziness," and "lack of time" were mentioned as obstacles:

"As it [flossing] was a knowledge that was added when I was already a young adult, it was much more difficult to implement."

"It [flossing] is one thing that requires a person to devote the time and attention to doing it."

"Sometimes I'm able to do that [flossing] every day, and other times I might pass, depending on whether I'm busy with exams and tests or not."

"It's really because it [flossing] takes time to be done properly, and I don't have the patience."

Students who flossed more frequently considered that not flossing gave them the feeling that their oral hygiene was incomplete:

"When I don't do it [flossing], I feel like I don't have clean teeth… When you get used to it, it is tough not to do it. It seems like it is not complete."

"Sometimes that weight remains that I didn't floss, and I brushed in vain."

However, participants who did not floss frequently further explained that, because they did not notice an immediate result, they did not feel the need to floss. Some participants also indicated that after toothbrushing, they do not have the feeling of "dirty teeth," and that makes it more challenging to implement flossing:

"As it [flossing] is something that you don't feel the result at the moment, it's a little easier to neglect a little. I think that's the reason for not flossing."

Some participants stated that leaving their family home to study negatively influenced their oral healthcare, as it led to many more responsibilities and consequently more laziness and lack of time:

"You do everything, and you don't have anyone to wake you up, and you don't have anyone to confirm if you're awake, so sometimes there are things that are made in a hurry."

Although the students were aware of the harmful effects of carbohydrate intake, all identified that they did not change the amount or frequency of carbohydrate intake during university. The reasons given for this behavior were the feeling of dependence on sugary foods, the low cost and accessibility of processed food compared to healthy food, the perception of greater control over the harmful effects through oral hygiene care, and the more frequent stressful situations, particularly during exam periods:

"I think it is like a drug. From the moment you start consuming, it increases, and you can't stop."

"There is still the economic factor. [...] eating well is more expensive than eating poorly."

"And the dental school itself does not encourage this [the change to healthy food] to happen because there are all these snacks... at the bar offers sugary foods."

"These foods (sugary foods) are fast and easy to consume… it is practical, you can eat them anywhere."

"… You feel that you have more control over your habits… you know that you can eat that chocolate because you have the tools to eliminate the damage those chocolates can do."

"When a person is very stressed studying, they want to eat more energetic things. And more energetic things usually have more sugar. It's an encouragement for study."

Despite considering the importance of routine oral health appointments and trying to instill this behavior in their patients, some students explained that they hadn't gone to an

appointment in the previous year due to the high cost, because they did not have a toothache, or did not know a dentist they trusted:

> *"I didn't go [to an appointment] for the two reasons that the Portuguese don't go: I don't have pain, and I don't have money."*
>
> *"You don't know if the dentist is good; it's also a concern of mine."*

Participants who acknowledged going to oral health appointments only in situations of pain or complaint explained that they did not have a preventive mentality regarding their health. An aspect that emerged during the discussion was that it was not usual in the students' families to do routine and preventive oral health appointments:

> *"I go only when I feel that something is not right. I go to the dentist and pay to see if everything is ok, and everything is ok."*
>
> *"I still think that the country's mentality on oral health is still too much treatment and not prevention as compared to other countries. But I think it is getting better."*

Regarding access to dental treatment, most students reported having it provided by their colleagues during practical classes. Most believed that working in the oral health field would give them greater opportunities to conduct preventive appointments. However, for a minority of the students, there was a belief that dentists do not regularly perform routine appointments to take care of their own oral health:

> *"...we're going to work in a clinic, just ask someone to look and see if everything's ok.'*
>
> *"I had colleagues [oral health professionals] who thought it was ridiculous to ask to leave sooner or take one afternoon off to go to the dentist."*

Discussion

Studying changes in attitudes and behaviors during the academic training of oral health students is essential as an auxiliary tool to assess how that training influences the acquisition of positive oral health knowledge and attitudes, as well as the development of oral health self-care habits. The academic curricula of oral health professionals should help students improve their own health and gain essential skills to promote oral health among their patients and communities.

Although the present study's sample is small, it represents a very considerable percentage of its target population, so it can be considered a good representative sample. The characteristics of the population, namely the high number of females, are in line with the distribution of health courses in Portugal and, more specifically, at the institution in question, where the percentage of male students is relatively low, especially in the IMDM and BDH courses.

Throughout their academic course, the students in this study learned about the etiology, treatment, and prevention of oral diseases. However, this exposure is much more differentiated and detailed in the courses that deal directly with patients in the clinic, namely, IMDM and BDH. BDLT students do not deal directly with patients, and their practice is in a laboratory rather than a clinical environment.

At the beginning of their academic training (1st year), there were no significant differences in attitudes and behaviors between students from the three FMDUL courses. These results are in line with several studies,[8,30-32] which show that at the beginning of their academic training, there are no differences in oral health attitudes and behaviors among young people from different courses and the same community, probably because there are no differences in specific knowledge about oral diseases. It is reported that students often underestimate their susceptibility to developing caries lesions or periodontal diseases, probably because these diseases progress and accumulate, often with medium to long-term consequences.[33]

At the end of the 3rd year, which corresponds to BDLT and BDH graduation, statistically significant differences already exist among students in the three courses. Namely, the mean HUDBI scores of the BDH students were higher than those of the IMDM students, indicating more positive attitudes and behaviors toward oral health. These results are similar to those of a study in Jordan.[33] The difference between the courses could be explained by the different curricula and, consequently, the differences in the acquisition of knowledge and skills related to oral diseases. In fact, early contact with the patient and closer integration of theoretical and practical teaching help students become aware of the consequences of incorrect oral health behavior and promote a shift toward more positive attitudes. BDH and IMDM students have significantly more disciplines linked to the prevention and etiology of oral diseases, and the increased knowledge of oral diseases throughout the course leads to improved oral health attitudes and behaviors.[32] On the other hand, the fact that the BDH students showed better results in most of the indicators can be explained by the course having much earlier and more relevant contact with the clinic and patients by the end of the 3rd year, resulting in more common observation of oral pathologies, their severity, and their consequences for the oral and general health. IMDM students have this contact only in the 4th and 5th years, which may explain why they reach oral health indicator values similar to those of the 3rd-year BDH students only at the end of this period.

Similar studies have demonstrated significant improvement in mean HUDBI scores during academic training.[8,32] This improvement can be more evident from the pre-clinical to the clinical years,[10,13,30] showing that clinical training and contact with patients are essential factors for changing behavior. Behavior change can be facilitated by witnessing the seriousness of the disease and its consequences.[28]

As with the HUDBI, there were no significant differences in the other oral health indicators at the beginning of the academic training. However, in general, FMDUL students have good oral health indicators in the 1st year of the courses. Only the BDLT students had a mean $D_{3-6}MFT$ value slightly above that reported in the 3rd National Study on the Prevalence of Oral Diseases for the 18-year-old population.[34]

At the end of the 3rd year, there were statistically significant differences among students across the three courses in DI-S, PCI,

and D_{3-6}MFT. The BDLT students showed the worst results in these indicators, once again supporting the idea that knowledge of oral diseases and clinical training translate into improved oral health for students. In addition, there were significant differences in the D_{3-6}MFT between the baseline and the final year of BDLT students' academic training, which can be explained by the index's cumulative nature and the lack of significant improvements in these students' attitudes and behaviors.

In IMDM students, periodontal conditions improved significantly, but there was also a significant increase in the D_{3-6}MFT, as in BDLT students. This increase may be associated with other factors that have not been studied. However, some authors report that these oral health students may undergo dental treatment more frequently and more easily than students from other areas.[35]

The qualitative analysis revealed that students acquired and developed knowledge and skills throughout their academic experience, leading to changes in oral health behaviors and the adoption of good practices to control oral diseases. This change was more evident in BDH students, followed by IMDM students. Despite these improvements, students can still achieve better values for oral health indicators to improve their oral self-care and to transmit and practice oral health care efficiently with their patients. Earlier contact with the clinical environment could be beneficial, especially in the IMDM course. BDLT students could also be more involved in the clinical environment and encouraged to attend preventive appointments as patients of their colleagues from other courses to gain more knowledge about self-care and the prevention of oral diseases.

The qualitative analysis indicated that the primary source of information and change regarding students' oral health self-care was obtained during their university training. When asked about the reasons for behavior change and improvement, students admitted that knowledge of etiological factors, perceptions of their susceptibility to oral diseases, and the consequences of oral diseases were important. Though the information received through lectures and theoretical teaching was considered important, clinical practice had a greater impact. These results are supported by the "Health Beliefs Model," which suggests that the probability of an individual engaging in preventive health-related behaviors (such as oral hygiene) depends on their perceptions of the costs and benefits of the decision.[36] Additionally, the "Theory of self-efficacy" of Bandura[37] states that both the ability to develop the behavior and the belief in that ability to implement a behavior (such as toothbrushing or flossing) are essential for healthy behaviors, which is an essential link between knowing and doing. Improving self-efficacy not only increases technical skills but also reinforces the individual's belief that they can perform those tasks and acquire them through personal effort, and, consequently, achieve better health outcomes.

Another factor attributed to the promotion of change was the individual's experience of oral diseases. In fact, learning from experience and observing others' behavior leads to reflecting on their attitudes and, consequently, on their behaviors and experiences, generating learning and potentially implying changes in behavior. Some students admitted not having changed their habits, reflecting the tendency of young people to underestimate health risks and feel invulnerable, since poor oral health behaviors rarely have immediate consequences on their well-being.[38]

The students' interviews also indicated that they felt a sense of responsibility toward the community, suggesting that the social expectations of the community in which these young adults are embedded strongly influence their perceptions and behaviors.[39] However, some students disagreed with the fact that oral health attitudes and behaviors of professionals can influence the ability to teach and motivate their patients, which disagrees with the literature since health professionals' oral self-care usually reflects their understanding of the importance of preventing oral diseases.[4]

Although these results reflect the importance of university context in changing oral health behaviors, that context cannot be separated from human learning and development, as these processes are the product of reciprocal, dynamic interactions between individuals and their respective life contexts.[40] Learning is not independent of human development, and a variety of factors shape the results obtained.

Despite being well-informed and generally well-practiced in oral health behaviors, many students reported difficulty adopting and maintaining these behaviors, particularly daily dental flossing. In fact, there was a discrepancy between the desire to floss and actually flossing daily. Adopting an informed decision to act and translating this intention into behavior are two distinct processes. This suggests that a change in behavior does not depend solely on the acquisition of new knowledge — it requires individual adherence. Changing behavior is complex, even when this change is essential for maintaining health. Young people's resistance to using dental floss may stem from the associated difficulties, skills, and time required.[41,42] The success of a behavioral change requires not only skill but also a strong belief in one's ability to exercise control, suggesting that a greater perceived control corresponds to a greater probability that the behavior will succeed. Furthermore, introducing this behavior at an adult age becomes more difficult, as there is a tendency toward greater resistance to behaviors best promoted early in life.[43]

On the other hand, although students know the importance of avoiding frequent consumption of refined, processed, or sugary foods, especially between main meals, eating habits seem deeply ingrained, making it more difficult to adopt healthy ones. In fact, eating habits established in childhood and adolescence influence healthy behaviors in adulthood, which are difficult to change once established.[44] Additionally, it is known that sugar is an addictive food, capable of triggering a feeling of momentary pleasure.[45] The students reported increasing the consumption of carbohydrates during the exams, which was a time when they faced more stress, and this association is described in the literature.[46]

Regarding preventive appointments with the oral health professional, some participants indicated they did not attend them frequently, citing the high cost and the absence of complaints. This result reflects a lack of care for oral health and difficulty accessing these services. Some students also felt less concerned about visiting an oral health professional, as they were aware of their own health because they were examined by their colleagues or teachers during some clinical practice

sessions. It is essential to promote a regular and preventive visit early in the course to promote and encourage an improvement in this behavior.

Conclusions

At the start of their academic training, students showed no significant differences in their attitudes, behaviors, or oral health habits. At the end of their course, students from BDH and IMDM significantly improved their HUDBI values. There was also a significant reduction in gingival bleeding across all courses. In general, there was a positive trend across the various oral health indicators; however, BDLT students showed less improvement than BDH and IMDM students.

Oral health students considered that the university context improved their oral health behaviors. Nevertheless, some behaviors should be improved, like the daily flossing and the frequency of sugary food and drink consumption. It is crucial to implement strategies that promote oral dental self-care for all students, ideally early and regularly throughout the course. Curricular enhancements should integrate earlier preventive strategies and emphasize self-care as a foundation for professional practice.

Conflict of interest

The authors have no conflicts of interest to declare.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed their work center protocols on access to patient data and for its publication.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

CRediT authorship contribution statement

Sílvia Areias: Conceptualization, Methodology, Resources, Formal analysis, Investigation, Data curation, Writing – original draft. **Sandrine Almeida:** Conceptualization, Methodology, Resources, Formal analysis, Investigation, Data curation, Writing – original draft. **Sónia Ferreira:** Methodology, Resources, Investigation, Data curation, Writing – review & editing. **Teresa Albuquerque:** Conceptualization, Methodology, Validation, Supervision, Writing – review & editing. **Mário Bernardo:** Conceptualization, Methodology, Validation, Supervision, Writing – review & editing. **Sónia Mendes:** Conceptualization, Methodology, Validation, Supervision, Writing – review & editing.

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Mudanças nos comportamentos, atitudes e status oral dos estudantes de saúde oral durante a formação académica

RESUMO

Objetivos: Analisar a progressão das atitudes, comportamentos e saúde oral dos estudantes de saúde oral ao longo da sua formação académica e identificar fatores que influenciam essas mudanças. ***Métodos:*** Estudo longitudinal com estudantes de Licenciatura em Higiene Oral (LHO), Licenciatura em Prótese Dentária (LPD) e Mestrado Integrado em Medicina Dentária (MIMD) da Faculdade de Medicina Dentária da Universidade de Lisboa. Os dados foram recolhidos em três momentos: 1.°, 3.° e 5.° anos (este último só para MIMD). A análise quantitativa incluiu um questionário com o Hiroshima University Dental Behavioural Inventory (HUDBI) e exames intraorais para avaliar o índice de higiene oral (DI-S), a hemorragia gengival (CPI) e a cárie dentária (DMFT segundo os critérios da OMS). Foram usados os testes de Kruskal-Wallis, Wilcoxon e

Friedman (α=0,05). Foi efetuada análise qualitativa através de grupos focais a alguns estudantes do MIMD.

Resultados: O HUDBI melhorou nos estudantes do MIMD (p=0,004) e da LHO (p=0,007). O DI-S apresentou melhorias na LHO (p=0,016). A hemorragia gengival (CPI) diminuiu em todos os cursos, sendo a maior redução observada na LHO (p<0,001). Os dados qualitativos indicaram o aumento de conhecimento, prática clínica e responsabilidade profissional como os principais motivadores para a mudança de comportamento.

Conclusões: A formação académica tem um impacto positivo nos comportamentos, sendo mais significativa nos estudantes com exposição clínica precoce. No entanto, persistem desafios como o uso do fio dentário e o consumo de açúcar. Os currículos devem integrar estratégias preventivas precoces e enfatizar o autocuidado como base para a prática profissional.

Palavras-chave:
Educação em Saúde Oral
Estudantes
Comportamento de Saúde
Saúde Oral
Higiene Oral
Medicina Dentária Preventiva