UNIVERSIDADE FERNANDO PESSOA

KNOWLEDGE OF AND ATTITUDES TOWARDS EROSIVE TOOTH WEAR AMONG STUDENTS OF A PORTUGUESE UNIVERSITY: PILOT SURVEY

Conhecimento e atitudes em relação ao desgaste erosivo dos dentes entre os estudantes de uma universidade portuguesa: estudo piloto

Dissertação de Mestrado

Medicina dentaria

Maria Vittoria Buscemi

Orientador(es):

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DEDICATION

Alla mia famiglia

che mi ha sempre sostenuto

e ha creduto in me fin dall'inizio

senza mai dubitare.

Ai miei nonni

che non sono qui con me

ma sono sicura che mi guardano

e mi proteggono dall'alto.

Spero di rendervi sempre orgogliosi di me.

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P.S.: Siete tutte le mie sorelline preferite.

RESUMO

Objetivos: Avaliar e comparar o conhecimento e as atitudes em relação ao desgaste erosivo dentário entre estudantes universitários da Universidade Fernando Pessoa (UFP). Também realizar uma revisão sistemática de estudos transversais sobre o desgaste erosivo dentário (DED)emitidos.

Métodos: Estudo piloto transversal, observacional, prospetivo, aprovado pelo Comitê de Ética da UFP (FCS/PI-501/23-3) através de um questionário autoadministrado online e formato bilingue (inglês e português) distribuído a todos os estudantes UFP do ano letivo de 2023-2024. Dois grupos foram recrutados, de Medicina Dentária (DSs) e de Áreas não médicas (NMSs), com base em uma amostra de conveniência (n = 344) calculada. Os participantes responderam voluntariamente a questões demográficas, a 15 perguntas (verdadeira/falsa/não respondeu), sobre o conhecimento da DED (itens K1-K15) e a 10 afirmações enquadradas positivamente (itens A1-A10) para pontuar a atitude em relação ao DED com base numa escala de Likert de 5 pontos. As diferenças de pontuação entre os grupos DS e NMS, através de testes não paramétricos, e a correlação entre conhecimentos e atitudes, através do coeficiente de *Pearson*, foram consideradas significativas para P < 0,05. Foi feita uma revisão complementar para discussão, seguindo a abordagem PICO e as diretrizes *STROBE*. A estratégia de pesquisa incluiu cinco termos *MeSH* principais. Foram incluídos apenas artigos completos de estudos transversais publicados entre 2013 e 2023, e escritos em inglês. Foram excluídos os estudos in vitro, em animais, de coortes, de campo, relatórios de casos ou estudos longitudinais, ou artigos incompletos.

Resultados: Um total de 251 (72,9%) estudantes participaram, mas apenas 245 (71,2%) preencheram a totalidade do inquérito online, sendo 164 (66,9%) mulheres. Os valores medianos (Me) e rácio interquartil (IQR) quanto a Conhecimentos e Atitudes dos DSs (Me=12,0; IQR 11,0-13,0 e) foram superiores (P <0,001 e P = 0,019) às dos NMS (Me=8,0; IQR 6,0-10,0 e), respetivamente. Para além disso, os conhecimentos dos estudantes do sexo masculino (P=0,001), dos com mais de 22 anos (P<0,001) e que tem >3 anos curriculares (P<0,001) foram mais elevados. Os valores de conhecimento foram semelhantes (P = 0,330) quanto à nacionalidade dos alunos. A atitude dos estudantes não variou (P >0,05) quanto ao género, idade, nacionalidade e ano curricular. O nível de conhecimento moderado foi mais elevado (P < 0,001) nos alunos DSs (Me= 12,0, IQR 11,0-12,0) do que para nos NMS (Me=10,0, IQR 9,0-10,0). Não foram encontradas diferenças entre os DSs e os NMSs no que respeita aos níveis fraco e elevado (ambos, P >0,05) de conhecimentos. Os DSs e os NMSs revelaram diferenças na distribuição dos níveis de atitude (P<0,001). Não foram encontradas diferenças (P >0,05) entre os sujeitos DSs e NMSs quando comparados cada nível de atitude (negativa, neutra e positiva). Foi sugerida uma correlação entre atitude positiva e conhecimento para todos os alunos (r = 0,101; P> 0,05) e para os DSs (r = 0,031; P> 0,05). Para o grupo dos NMSs foi detetada uma tendência negativa (r = -0,001; P>0,05).

Conclusões: Os conhecimentos e atitudes dos estudantes DS foram maiores do que as dos NMSs, Os estudantes masculinos, com mais de 22 anos e aqueles com mais de 3 anos curriculares na UFP apresentaram pontuações de conhecimento mais altas. As pontuações para atitudes foram semelhantes quanto ao gênero, idade e ano curricular dos estudantes. Conhecimentos e atitudes foram independentes da nacionalidade dos estudantes. A correlação entre as atitudes e conhecimentos não foi significativamente detetada. Os resultados deste estudo piloto e da literatura destacam a necessidade de melhorar o conhecimento e as atitudes em relação ao DED nesta, e em várias outras comunidades.

PALAVRAS-CHAVE: Erosão dentária; Atitude; Conhecimento; Estudantes universitários; Estudo transversal

ABSTRACT

Aims: To assess and compare the knowledge of and attitudes towards erosive tooth wear (ETW) among university students of the Portuguese University Fernando Pessoa (UFP). Also to perform a systematic review of cross-sectional studies on the ETW issued.

Methods: Cross-sectional, observational, prospective pilot study, approved by the UFP Ethics Committee (FCS/PI-501/23-3) for a bilingual (English and Portuguese) online self-administered questionnaire displayed to all UFP students (Ss) of the 2023-2024 academic year. Two groups were recruited, Dentistry (DSs) and Non-Medical (NMSs), based on a convenience sample (n=344) calculated. Participants voluntarily answered to demographic questions, to 15 true/false/don't questions on knowledge of ETW (items K1-K15) and, to 10 positively framed statements (items A1-A10) to score the attitude towards ETW based on a 5-point Likert scale. Differences in scores for DSs and NMSs groups, by non-parametric tests, and the correlation on knowledge of and attitudes, by the Pearson coefficient, were considered significant if $P < 0.05$. A complementary review for discussion purposes was done, following the PICO approach and STROBE guidelines. The search strategy included five main MeSH. Only full text, cross-sectional studies published from 2013 to 2023 years and written in English were scrutinized. In vitro, Animal, Cohort, Field, Case reports or longitudinal studies, or incomplete articles were excluded.

Results: A total of 251 (72.9%) students participated, but only 245 (71.2%) fulfilled the on-line survey, being 164 (66.9%) females. The Knowledge and Attitude scores of the DSs (Md=12.0; IQR 11.0-13.0 and Md=43.0; IQR 40-0-48.0) and were higher (P <0.001 and P = 0.019) than those of NMSs (Md=8.0; IQR 6.0-10.0 and Md=41.0; IQR 38.0-46.0), respectively. Furthermore, the Knowledge score of male (*P*=0.001), of students with more than 22 years old (P<0.001) and of curricular-year > 3-years (P <0.001) were higher. Similar knowledge scores (P = 0.330) were found for students nationality. The attitude score showed similar (P >0.05) results for gender, age, nationality and curricular year. Moderate level of knowledge was higher (P < 0.001) for DSs (Md= 12.0, IQR 11.0-12.0) than for NMSs (Md=10.0, IQR 9,0-10.0) students. No differences were found between DSs and NMSs on behalf of the weak and the high levels (both, P >0.05) of knowledge. DSs and NMSs subjects revealed differences for attitude levels (P< 0.001) distribution. No differences (P >0,05) were found between the DSs and NMSs subjects when comparing each attitude (negative, neutral and positive) level. APositive attitude and knowledge scores correlation was suggested for all students (r = 0.101; P> 0,05) and for DSs (r = 0,031; P> 0,05). For NMSs group, a negative tendency (r = -0.001; P>0.05) was detected.

Conclusions: Both, knowledge and attitude scores of DSs were higher than those of NMSs. Males, students with more than 22 years old and, those with more than 3 curricular years in UFP showed higher knowledge scores. Attitude scores were similar by gender, by students age and curricular year. knowledge and attitudes were similar and independent of students nationality. The attitude and knowledge scores correlation was not significantly detected. The outcome of this pilot study, and the literature, highlighted the needs for improved knowledge and attitudes toward ETW among those, and several other communities.

KEY WORDS: Tooth erosion; Attitude; Knowledge; University students; Cross sectional.

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LIST OF ABBREVIATIONS

DSs- Dentistry Students

NMSs – Non-medical Students

UFP – University Fernando Pessoa

PICO - Population, intervention, control, outcome

MESH - Medical Subject Headings

STROBE - Strengthening the Reporting of Observational studies in Epidemiology.

ETW -erosive tooth we

1. INTRODUCTION

Dental erosion refers to the pathological, chronic degradation of dental hard tissues due to the chemical impact of external or internal acids, excluding bacterial factors. Erosion is influenced by multiple factors and necessitates a comprehensive assessment and history-taking for an accurate diagnosis. Successful management also relies on patient education and adherence for better treatment outcomes (Curtis et al., 2012).

Dental erosion results from the chemical breakdown of dental hard substances due to exposure to acids that originate outside the oral bacteria environment. Intensive loads like those promoted by the tongue, cheeks, or tooth brushing contribute to the accelerated loss of partially demineralized tooth surfaces. The overall depletion of dental hard tissue is termed erosive tooth wear (ETW). Instances of dental hard tissue loss due to frequent acid exposure, such as increased vomiting, yet lacking mechanical stress, are also categorized under tooth erosion (Lussi & Hellwig, 2014).

Teeth are rather exposed to a combination of various types of wear, such as attrition (tooth-tooth contact wear), abrasion (teeth to foreign substance contact wear), and abfraction (fatigue of the cervical part of the tooth), in addition to erosion, it is difficult to isolate these processes in one mouth. Therefore, the terms dental erosive wear and erosive tooth wear are also used to refer to the same phenomenon (Schlueter et al., 2020).

In the past twenty years, researchers have increasingly focused on dental erosion. There has been significant documentation of a relatively high prevalence of dental erosive lesions, particularly among younger demographics, although the reported rates often fluctuate. It is now widely recognized that dental erosion is a complex oral health issue with multiple contributing factors (Al-Ashtal et al., 2015).

Erosive tooth wear is a multifactorial disease that can be caused by intrinsic (e.g., gastric reflux and excessive vomiting) and/or extrinsic (e.g., acidic foods and drinks and acid fumes at work) factors (Hong et al., 2020).

The prevalence and incidence of both caries and dental erosion is high, nowadays. Even though the pathological mechanisms of these diseases are different, they share some

common biological factors such as salivary components and flow rate, tooth formation and structure, immune response, or an individual's variation in taste preferences. Additionally, these factors are under genetic control, and therefore, the genetic background features the dynamic of the development of oral diseases (Tulek et al., 2021). The studies have shown that susceptibility to erosion and caries varies considerably among individuals exposed to similar risks (Mulic et al., 2011; Shaffer et al., 2015; Uhlen et al., 2016). It is also plausible that genes regulate the structure of hard dental substances, the salivary composition and flow, the behavioral patterns, and the immune response (Tulek et al., 2021).

It is important that dental care professionals are able to diagnose the condition as early as possible, ~~to~~ identify the possible etiology of the erosive damage and also ~~to~~ understand the specific host defense factors of importance in each case (Al-Ashtal et al., 2015).

Clinical characteristics include an initial reduction in tooth shine or luster, succeeded by the flattening of convex structures. As acid exposure persists, concavities emerge on smooth surfaces, or through the presence of grooving and cupping on incisal/occlusal surfaces, dental erosion becomes evident. It is crucial to distinguish dental erosion from other forms of tooth wear patterns, as it contributes to overall tissue loss by softening surfaces, consequently modifying physical wear mechanisms (Lussi & Hellwig, 2014). If neglected, this condition can eventually lead to the total depletion of tooth structure (Maladkar et al., 2022).

Clinical diagnosis of dental erosion is considered difficult for dental care practitioners (Al-Ashtal et al., 2015; Donovan et al., 2021). Diagnosis and management of dental erosion include careful clinical examination and evaluation of the patient to identify common signs of erosion (e.g., loss of enamel texture, cupping or flattening on occlusal surfaces), predisposing factors for erosive tooth wear, and options to reduce the probability of exposure to erosive (acidic) drinks, dietary sources and/or other acids of intrinsic or extrinsic origin.

The erosion of tooth structure caused by exposure to mechanical loads is also termed ~~as~~ erosive tooth wear (ETW). Enamel breakdown is closely linked to various chemical factors such as pH, buffer capacity, titratable acidity, viscosity, as well as the concentrations of calcium, phosphate, and fluoride in beverages and foods. These factors

help determine the saturation level of a substance, indicating its potential to demineralize dental hard tissues. Substances with low pH, high titratable acidity, and strong buffer capacity pose a greater risk of erosion, while those with high calcium and phosphate concentrations cause less demineralization. Dentists should evaluate the erosive potential of different food and drink items, consider consumption frequency, and devise tailored preventive and dietary strategies for each patient (Saads Carvalho & Lussi, 2019).

An extrinsic factor associated with dental erosion, the intake of acidic beverages, has been extensively examined, predominantly through in-vitro and short-term in-situ studies (Hara et al., 2014). External factors primarily involve the intake of acidic foods and beverages, such as soft drinks and fruit juices, while intrinsic factors are mainly constituted by eating disorders and gastroesophageal reflux (Hesse et al., 2013). A significant external factor contributing to erosive tooth wear is the elevated intake of acidic beverages and food. In recent times, there has been an increase in both the overall quantity and frequency of consuming acid-containing products due to lifestyle changes (Lussi & Hellwig, 2014).

Knowledge of erosive tooth wear depended on individuals' educational levels and dentistry information received in the past (Verploegen & Schuller, 2019). Some authors reported a low level of awareness and knowledge of erosive tooth wear among adults aged 25 to 45 years in Hong Kong (C. Chu et al., 2010). A knowledge gradient regarding erosive tooth wear has been identified, with dental care professionals having the most knowledge, followed by healthcare professionals and then laypersons (Richards, 2014).

However, the knowledge level of dental care professionals is not as high as expected. Reports from Brazil, the United Kingdom, and Yemen, dental care professionals exhibited insufficient knowledge of erosive tooth wear, which highlights the urgent need to improve education on erosive tooth wear worldwide (Al-Ashtal et al., 2015; Hermont et al., 2011; Richards, 2014)

Relatively little is known about the public attitudes towards erosive tooth wear. Despite the common finding of an increase in tooth wear, especially in the younger population, during the last decade, the number of publications in PubMed dealing with, for example, dental caries, surpasses studies on dental erosion (Johansson et al., 2012).

Therefore, the purpose of this study was to assess the knowledge and attitudes of Portuguese university students, the University Fernando Pessoa (UFP). The following null hypotheses were tested:

1) Dentistry students (DSs) and non-medical students (NMSs) of UFP have similar knowledge of and attitude towards ETW;

2) Male and Female students have similar knowledge of and attitude towards ETW;

3) Students from several nationalities have similar knowledge of and attitude towards ETW;

4) Knowledge of and attitudes towards ETW are correlated, for all UFP students.

1.1. Objectives

To assess and compare the knowledge of and attitudes towards erosive tooth wear among dentistry students (DSs) and non-medical students (NMSs) of a Portuguese University, the UFP. Also, to perform a systematic review of cross-sectional studies about erosive tooth wear.

2. MATERIAL AND METHODS

2.1. Pilot Study among dentistry (DS) and non-medical students (NMSs) of UFP

2.1.1. Type of study, ethics committee, location and methodology

This cross-sectional, observational, prospective pilot study used a questionnaire. UFP Ethics Committee approval (FCS/PI-501/23-3; 12 February 2024) was obtained prior to study implementation.

This research aimed to assess and compare the knowledge of and attitudes towards erosive tooth wear among dentistry students (DSs) and non-medical university students (NMSs) of a Portuguese University, the UFP, by responding to the survey.

After the translation of the questionnaire to Portuguese language it was revised. It was displayed in both languages, Portuguese and English, to evaluate knowledge of and attitudes towards erosive tooth wear among different nationalities of students at the University Fernando Pessoa.

The questionnaire includes demographic questions concerning gender, age, ~~and~~ scientific course, faculty, academic year and nationality.

The remainder of the questionnaire was divided into 2 sections to assess knowledge and attitudes. The knowledge section of the questionnaire included 15 true/false/don't know questions on knowledge of erosive tooth wear (items K1-K15; or C1-C15 in the Portuguese version). The participants were asked to answer each question with "true", "false", or "don't know". Each correct response received a score of 1, while an incorrect or "don't know" answer received a score of 0. The knowledge scores ranged from 0 to 15, and were calculated by summing the scores for the items in the knowledge section. The knowledge score described the respondent's knowledge of erosive tooth wear; higher sum scores indicated more accurate knowledge.

The attitude section of the questionnaire collected information using 10 positively framed statements (items A1-A10). The attitude score was based on a 5-point Likert scale, an instrument widely used in research on opinions, beliefs, and attitudes. For the five response options, items were assigned 1 point for "strongly disagree", 2 points for

"disagree", 3 points for "neither agree nor disagree", 4 points for "agree", and 5 points for "strongly agree". The attitude scores ranged from 10 to 50, and were calculated by summing the scores for the items in the attitude section of the questionnaire. The attitude score described the respondent's attitude towards erosive tooth wear; higher scores indicated a more positive attitude.

The levels of knowledge and attitudes were defined based on Bloom's original cut-off points: scores that reached over 80% of the total score indicated a high level of knowledge or a positive attitude; scores that reached 60–80% of the total score indicated a moderate level of knowledge or a neutral attitude; and scores that reached below 60% of the total score indicated a low level of knowledge or a negative attitude. Therefore, knowledge scores < 9, between 9 and 12, and > 12 indicated weak, moderate, and high levels of knowledge of erosive tooth wear, respectively. Attitude scores < 34, between 34 and 42, and > 42 were indicative of negative, neutral, and positive attitudes towards erosive tooth wear, respectively.

The research question, based on the PICO approach (**Table 1**) was: *Does Dentistry students (DSs) and non-medical students (NMSs) of UFP have similar knowledge of and attitude towards ETW?*

Table 1 - PICO strategy

IDENTIFIED	**APPLIED**
Population (P):	Students of a Portuguese University, the University Fernando Pessoa (UFP), namely dentistry students (DSs) and non-medical students (NMSs).
Intervention/Exposure(I):	knowledge of and attitudes towards erosive tooth wear (ETW).
Comparison (C):	Comparison between UFP-DSs and UFP-NMSs.
Outcome (O):	DSs and NMSs, male and female, and students from several nationalities have similar knowledge of and attitude towards ETW.

2.1.2. Population and Sample

The questionnaire was distributed to all university students of all curricular years and of, two majors' professional scientific fields: dentistry students (DSs) and non-medical students (NMSs).

According to the estimated population of students (N=3281) in the academic year 2023-2024 a convenience sample of 344 students, with a margin error of 0.05. The sample size was calculated based on a formula by Cochran stating. Considering the response rates for dental erosion surveys (45–79%), a sample of 341 to 237 (95% confidence level) university students was considered sufficient.

DSs were recruited only from the Faculty of Health sciences (FHS). NMSs were recruited from FHS, Faculty of Humanities and Social Sciences (FHSS) and Faculty of Science and Technology (FST). All students were invited to participate in this study during 2023-2024 academic year.

The questionnaire was displayed on-line during the 12th march 2024 and the 2sd may 2024.

Inclusion criteria

All students of University Fernando Pessoa (UFP) from the FHS, FHSS and FST who freely agree to take part of this survey by completing the questionnaire, after signed the informed consent.

Exclusion criteria

UFP students who do not agree to participate in the study or who do not complete the entire survey. Students from other external health institutions or external high-schools

2.1.3. Complications and risks

No risks for participants. A introduction text explaining the study design, the consent form, and the questionnaire were displayed by email to the students UFP using the online Google Form survey system (**Annex 1**), by the UFP Communication and Image Office and the principal investigator (P.M.M).

The participation of the students was entirely voluntary, and the data were anonymously collected and analyzed, as the participants were not requested to provide their names or any other information that could be used to personally identify them.

2.1.4. Data confidentiality and research

Participation were completely voluntary and free of charge. The analytical results were completely confidential and at no time will the identities of the participants be revealed or disclosed. Identity and personal data will not be disclosed in accordance with current data protection legislation. The description of the terms of confidentiality of data and research was described in the informed consent applied to the questionnaire for this research.

The analytical results were completely confidential and at no time will the identities of the participants be revealed or disclosed. Data storage was the responsibility of the Principal Investigator and will be destroyed after the survey concludes.

2.1.5. Reliable and scientifically recognized alternative acts/interventions and risk of non-monitoring

This cross-sectional, observational, prospective pilot study used a questionnaire in both, Portuguese and English languages, provided by the authors (Hong DW, et al., 2020).

The questionnaire was developed in English and the face validity of the questionnaire was confirmed by 2 senior experts in the field of preventive dentistry. Essential revisions of the included items were made based on feedback from the consultation, by the authors (Hong DW, et al., 2020). The principal investigator of this UFP research (P.M.M), contacted on December 5th, 2023, the author, Professor Dent-Wei Hong, and asked if it would be possible to send the survey in the English version, in order to adapt it to the Portuguese language. On December 8th, the English version was sent to be adapted to the Portuguese version, by the authors.

2.1.6. Statistical analysis

Knowledge and attitude levels were defined according to Bloom's initial thresholds: scores above 80% of the total score indicated a high level of knowledge or a positive attitude; scores between 60 and 80% of the total score indicated a moderate level of

knowledge or a neutral attitude; and scores below 60% of the total score indicated a low level of knowledge or a negative attitude. Therefore, knowledge scores < 9, between 9 and 12 and > 12 indicated low, moderate and high levels of knowledge about erosive tooth wear, respectively. Attitude scores < 34, between 34 and 42 and > 42 indicated negative, neutral and positive attitudes towards erosive tooth wear, respectively.

Demographic data (gender, age, nationality, curricular year and DSs versus NMSs) were subjected to descriptive statistical analysis according to respondent age, knowledge and attitude scores. To assess the age variable, a cut-off value was assumed according to the sample's age median (Md) and Interquartile Ratio (IQR) values. Data distribution was graphically assessed by histograms and by the Shapiro-Wilk hypothesis test analysis (**Annex 2**).

The Mann-Whitney U test was applied to compare knowledge and attitude scores by gender, age, nationality, curricular year and DSs/NMSs groups. Knowledge (weak, moderate and high) and attitudes (negative, neutral and positive) levels for the DSs and NMSs groups were compared by Kruskal-Wallis and Mann-Whitney U tests. Association analysis of knowledge correct answers (scored as 1) and neutral/positive attitudes (scored as Likert 3, 4 or 5) for DSs or NMSs groups were tested through the Pearson Chi-square test.

The correlation between knowledge and attitude scores was assessed using Pearson's correlation coefficient. Scatter plot graphs were generated to visually display the possible correlations.

All data were computerized and analyzed using IBM Corp. Released 2023. IBM SPSS Statistics for Macintosh, Version 29.0.2.0 Armonk, NY: IBM Corp. Statistically significant differences were considered for P values < 0.05.

2.2. Systematic qualitative review of cross-sectional studies on Erosive Tooth Wear

2.2.1. Type of review and Research question

This systematic review followed the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines (von Elm et al., 2008).

According to the strategy, the research qualitative question, based on the PICO model was:

Does cross-sectional studys evidence needs improvement in the knowledge of and attitude towards ETW in students and other populations?

2.2.2. Search Strategy and Data Collection Process

A methodic search was performed by one member (M.V.B) using PubMed, Web of Science and Google Scholar from October 21th, 2023, up to January12thr, 2024. The search strategy included 5 main Medical Subjects Headings (MeSH), “Tooth erosion”, “Attitude”, “Knowledge”, “University students”, “Cross sectional”. The following terms, from the tree structures, "dental erosion," "opinion," "epistemology," "students," "longitudinal," "cohort," "systematic review," and "meta-analysis," were combined using Boolean operators ("OR" and "AND"), based on the relevance of the research question. Controlled vocabulary, MeSH terms, and keywords from tree structures of the search strategy are presented in **Table 2**. The search terms were included in the title and/or abstract and were appropriately modified for each database.

Table 2 Search strategy used in each electronic database

Search Field	**MeSH and keywords from tree structures of the search strategy**
Search field 1	(“tooth erosion” OR “Dental Erosion“)
	AND
Search field 2	(“Attitude” OR “ Opinions” OR “ Knowledge” OR ” epistemology)
	AND
Search field 3	(“student ” OR “ University students ” OR “ cross sectional ”)

2.2.3. Inclusion criteria, exclusion criteria and eligibility

For this review only reports of ETW cross-sectional studies were included. The STROBE diagram was used, conducting a thorough review of selected articles through the PubMed and B-On, according to inclusion and exclusion criteria. Also, only articles written in

English language and published in the last 10 years (2013 up to December 2023) were scrutinized for this review.

Other types of published research beyond those considered in the inclusion criteria, such as those with distinct methodologies from the studies included, such as, In vitro studies, Animal studies, Cohort studies, Field studies, Case reports, Longitudinal studies, or studies with incomplete abstracts or incomplete texts, were excluded.

2.2.4. Study screening and selection

The articles found through the search terms were transferred to Mendeley desktop Reference Manager v2.94.0 software for duplicate checking. Two independent examiners (M.V.B and P.M.M.) conducted an initial screening of record titles and abstracts, considering the inclusion and exclusion criteria, the research objectives, and the PICO research question. The studies that passed this initial screening underwent full-text assessment for eligibility and qualitative synthesis. Each eligible study was assigned by the authors and year of reference.

2.2.5. Quality assessment of each cross-sectional study

The quality assessment for each cross-sectional study was performed according to the STROBE guidelines (von Elm et al., 2008).

The STROBE checklist consisted of 22 criteria (items) related to the title and abstract (item 1), introduction (items 2 and 3), methods (items 4–12), results (items 13–17), discussion (items 18–21) and information on funding (item 22), that should be part of cross-sectional studies reports. Each criteria was scored as “0” if the particular checklist item was not fulfilled and a score of “1” if the particular checklist item was fulfilled with the page number. And “not applicable, n.a” if a particular checklist item was not applicable for the specific publication.

Item scores for each study were summed to create a total quality score out of 22 and this was represented as a percentage (100% = 1) of the total possible score (Vandenbroucke et al., 2007). The researchers (P.M.M and M.V.B) devised cut-off scores in order to allow ease of description of the quality of each of the studies. Studies that scored below 50% were considered to be of ‘poor quality’ and were excluded from the review. Studies scoring 50-74% were rated as of moderate quality and studies scoring above 75% were

graded as high quality. Both moderate and high-quality studies were included in this review, as these were considered sufficiently robust for the synthesis.

2.2.6. Data synthesis

Data collected were the study aims, population (N), local where the observational study was performed, methodology (examination and/or questionnaire/self- administered questionnaire), sample size and/or response rate, and ETW prevalence (clinical examination ETW, knowledge, attitude, awareness), etiology, and main conclusion. A qualitative analysis was performed (needs or no needs for knowledge/attitude/awareness in several students/young population/dentists populations), in order to describe and answer the PICO question, according to the cross-sectional conclusions reported.

3. RESULTS

3.1. Pilot Study among UFP university students results

A total of 245 UFP students answered the survey, after signing the informed consent. Six more students, returned the questionnaire and declined to participate. The survey response and participation rates were 71.2% and 72.9%, respectively, considering the convenience sample of all UFP students (N= 344). A graphic representation was performed for data distribution analysis. A normal distribution was not found ($p < 0.05$) for all of the variables tested (**Annex 2**). In order to further investigate the socio-demographic distribution of the sample, five variables (gender, age, nationality, curricular year and graduation training) were analyzed to obtain useful insights and information.

Among the 245 students, there were 139 (56.7%) DSs and 106 (43.3%) NM students age varied from 18 to 75 years-old (Md= 22; IQR 20-25). From those 164 (66.9%) were females, 225 (91.8%) had European Union (EU) nationalities, 139 (56.7%) belonged to the 1st, 2sd 3td curricular year of the UFP training course. **Table 3** represents the age and gender, nationality, curricular year and DSs/NMS distribution of the participants.

Table 3 - Participants demographic description according to responders (n= 245) age, knowledge and attitude scores.

Students Characteristics (n; %)	Age Median (P_{25} – P_{75})	Knowledge score Median (P_{25} – P_{75})	P-value	Attitude score Median (P_{25} – P_{75})	P-value
Gender					
Male (n=81; 33.1%)	24.0 (21.5-28.0)	12.0 (9.0-13.0)	**0.001**	42.0 (39.0-48.0)	0.808
Female (n=164; 66.9%)	22.0 (20.0-24.0)	10.0 (7.0-12.0)		43.0 (38.3-48.0)	
Age (min.-max. 18-75 years-old)					
≤22 years (n=124; 50.6%)	22.0 (20.0-25.0)	9.0 (6.0-11.0)	**<0.001**	43.0 (39.3-48.8)	0.628
>22 years (n=121; 49.4%)		12.0 (10.0-13.0)		42.0 (39.0-47.5)	
Nationality					
EU (n=225; 91.8%)	22.0 (20.0-24.0)	11.0 (8.0-12.0)	0.330	43.0 (39.0-48.0)	0.161
Non-EU (n=20; 8.2%)	38.5 (32.3-54.5)	10.0 (8.0-11.0)		39.5 (36.3-49.0)	
Curricular year					
≤ 3 years (n=134; 54.7%)	20.0 (19.0-22.0)	9.0 (6.0-11.0)	**<0.001**	42.0 (39.0-48.0)	0.791
> 3 years (n=111; 45.3%)	24.0 (23.0-27.0)	12.0 (11.0-13.0)		43.0 (39.0-48.0)	
DSs and NMSs					
DSs (n=139; 56.7%)	24.0 (22.0-27.0)	12.0 (11.0-13.0)	**<0.001**	43.0 (40.0-48.0)	**0.019**
NMSs (n=106; 43.3%)	20.0 (19.0-22.0)	8.0 (6.0-10.0)		41.0 (38.0-46.0)	

P-value by Mann-Whitney U Test; EU = European Union; DSs= Dentistry Students; NMSs= Non medical students.

The Knowledge score and Attitude score of the DSs (Md=12.0; IQR 11.0-13.0 and Md=43.0; IQR 40-0-48.0) and were higher (P <0.001 and P = 0.019) than those of NMSs (Md=8.0; IQR 6.0-10.0 and Md=41.0; IQR 38.0-46.0), respectively. Furthermore, the Knowledge of male (Md=12.0, IQR 9.0-13.0; P=0.001), students with more than 22 years old (Md=12.0, IQR 10.0-13.0) and students with curricular-year > 3-years (Md=12.0; IQR 11.0-13.0; P <0.001) showed significantly higher scores for ETW than female, students younger or with 22 years old and students with curricular years ≤ 3-years, respectively. Similar ETW knowledge scores were found for Students of different nationalities (P = 0.330). The students attitude score showed similar (P >0.05) results for gender, age, nationality and curricular year (**Table 3**).

The DSs showed higher scores for 12 (P < 0.05) of the 15 knowledge questions. DSs and NMSs tendencies showed similar (P >0.05) knowledge of ETW for the K3, K4 and K14 questions in the Knowledge section of the survey (**Table 4**) the correct answer to K3 question was more prevalent (P< 0.001) in the DSs (85.5%) group than in the NMSs group.

In the DSs group, high (Md=13.0, IQR 13.0-14.0) and moderate (Md=12.0, IQR=11.0-12.0) levels of Knowledge were similar (P > 0.05) for 37.4% (n= 52) and 54.7% (n=76), respectively, but significantly different (P = 0,045) of 7.9% (n=11) with a weak (Md= 6.0, IQR 0-8.0) level of knowledge. The NMSs group revealed similar (P > 0.05) high (Md=13.5, IQR 13.0-N.A) and moderate (Md=10.0, IQR 9.0-10.0) levels of Knowledge only for 1.9% (n= 2) and 42.5% (n=45), respectively, but significantly different (P = 0,045) of 55.7% (n=59) with weak (Md=6.0, IQR 4.0-7.0) level of knowledge. Moderate level of knowledge was significantly high (P < 0.001) for DSs (Md= 12.0, IQR 11.0-12.0) than for NMSs (Md=10.0, IQR 9,0-10.0) students. No differences were found between DSs and NMSs participants on behalf of the weak and the high levels of knowledge (both, P >0.05) of knowledge (**Table 5**).

The Attitude score of the DSs was higher than those of NMSs (P =0.019). However, no differences (P > 0.05) were found for ETW attitude scores for gender, age, nationality and curricular-year and (**Table 3**).

The DSs showed higher median values, and frequency of the Likers scale scored 3 to 5, (P < 0.05) in all attitude scores except, for A1 and A2 questions of the survey attitude section (**Table 6**).

Table 4 - Knowledge of ETW, scores comparison of dentistry students (DSs) and non-medical students (NMSs).

Item number-content	Knowledge score "answered correctly" n (%)		P value [(a)]	Knowledge Global score Median (P_{25} - P_{75})		P-value [(b)]
	DSs	NMSs		DSs	NMSs	
K1- Erosive tooth wear is a form of cavities and tooth decay	117 (84.2)	23 (21.7)	**<0.001**	1.0 (1.0-1.0)	0.0 (0.0-0.0)	**<0.001**
K2- Erosive tooth wear is caused by bacteria	116 (83.5)	19 (17.9)	**<0.001**	1.0 (1.0-1.0)	0.0 (0.0-0.0)	**<0.001**
K3- Erosive tooth wear is an irreversible disease	56 (40.3)	56 (52.8)	0.051	0.0 (0.0-1.0)	1.0 (0.0-1.0)	0.051
K4- One leading cause of tooth wear is acid in our food and drinks	119 (85.6)	83 (78.3)	0.136	1.0 (1.0-1.0)	1.0 (1.0-1.0)	0.137
K5- Saliva is one of the most important defense mechanisms against erosion	119 (85.6)	59 (55.7)	**<0.001**	1.0 (1.0-1.0)	1.0 (0.0-1.0)	**<0.001**
K6-Erosive tooth wear can occur if you often work in acidic environments	106 (76.3)	28 (26.4)	**<0.001**	1.0 (1.0-1.0)	1.0 (0.0-1.0)	**<0.001**
K7-Erosive tooth wear can occur if you often have to vomit	132 (95.0)	57 (53.8)	**<0.001**	1.0 (1.0-1.0)	1.0 (0.0-1.0)	**<0.001**
K8-Brushing your teeth immediately after consuming acidic food or drinks may make erosive tooth wear worse	114 (82.0)	42 (39.6)	**<0.001**	1.0 (1.0-1.0)	0.0 (0.0-1.0)	**<0.001**
K9-Drinking before going to bed is a risk factor for developing erosive tooth wear	91 (65.5)	32 (30.2)	**<0.001**	1.0 (0.0-1.0)	0.0 (0.0-1.0)	**<0.001**
K10-Drinking immediately after strenuous exercise increases a person's risk for erosive tooth wear	99 (71.2)	51 (48.1)	**<0.001**	1.0 (0.0-1.0)	0.0 (0.0-1.0)	**<0.001**
K11-Erosive tooth wear may lead to pain and sensitivity	133 (95.7)	88 (83.0)	**<0.001**	1.0 (1.0-1.0)	1.0 (0.0-1.0)	**<0.001**
K12.Erosive tooth wear can lead to the progressive loss of the surface of the tooth	134 (96.4)	76 (71.7)	**<0.001**	1.0 (1.0-1.0)	1.0 (0.0-1.0)	**<0.001**
K13-Drinking a whole bottle of soda in several sittings rather than in just one sitting decreases a person's risk for erosive tooth wear	85 (61.2)	50 (47.2)	**0.029**	1.0 (0.0-1.0)	0.0 (0.0-1.0)	**0.030**
K14-Using a fluoride toothpaste will prevent erosive tooth wear	99 (71.2)	68 (64.2)	0.239	1.0 (0.0-1.0)	1.0 (0.0-1.0)	0.240
K15- Using a straw when you drink soda may help avoid erosive tooth wear	83 (59.7)	49 (46.2)	**0.036**	1.0 (0.0-1.0)	0.0 (0.0-1.0)	**0.036**

(a) P-value by Pearson Chi-square Test; (b) P-Value by Mann-Whitney U test; DSs = Dentistry Students; NMSs = Non-medical Students.

Table 5 - Knowledge of ETW, levels distribution of dentistry (DSs) and non-medical (NMSs) students.

Student Study Groups	Knowledge levels						Total Median (P_{25}-P_{75})	P-value*
	Weak		Moderate		High			
	n (%)	Median (P_{25}-P_{75})	n (%)	Median (P_{25}-P_{75})	n (%)	Median (P_{25}-P_{75})		
DSs (n=139)	11 (7.9)	6.0 (0.0-8.0)[a]	76 (54.7)	12.0 (11.0-12.0)[b]	52 (37.4)	13.0 (13.0-14.0)[b]	12.0 (11.0-13.0)	**<0.001**
NMSs (n=106)	59 (55.7)	6.0 (4.0-7.0)[a]	45 (42.5)	10.0 (9.0-10.0)[b]	2 (1.9)	13.5 (13.0-NA)[b]	8.0 (6.0-10.0)	**<0.001**
P-value**		0.948		**<0.001**		0.771	**<0.001**	

* P - Value- Kruskal-Wallis test; ** P - Value- Mann Whitney U test; Knowledge scores: < 9, between 9 and 12, and > 12 indicated weak, moderate, and high levels of knowledge of erosive tooth wear, respectively; a,b – different letters show significant differences according to Mann-Whitney U test; NA – Not applicable.

Table 6 - Attitude toward ETW, scores comparison of dentistry students (DSs) and non-medical students (NMSs).

Item number-content	Attitude scored as 3, 4 or 5 n (%)		P-Value (a)	Attitude Global score Median (P_{25} - P_{75})		P-value (b)
	DSs	NMSs		DSs	NMSs	
A1- I think oral health is just as important as general health	139 (100.0)	106 (100.0)	0.264	5.0 (4.0-5.0)	5.0 (4.0-5.0)	0.274
A2- I think prevention is better than a cure	138 (99.3)	106 (100.0)	0.161	5.0 (5.0-5.0)	5.0 (4.0-5.0)	0.053
A3- It is essential to visit a dentist at least every half year for a regular dental check-up	139 (100.0)	104 (98.1)	0.086	5.0 (4.0-5.0)	5.0 (3.0-5.0)	**0.031**
A4-I would think that it is bad if I learned that my teeth had been damaged by acid	137 (98.6)	104 (98.1)	**<0.001**	5.0 (4.0-5.0)	4.0 (4.0-5.0)	**<0.001**
A5-It is worth spending more time and energy on studying knowledge about erosive tooth wear	138 (99.3)	100 (94.3)	**<0.001**	4.0 (4.0-5.0)	4.0 (3.0-4.0)	**<0.001**
A6- I am concerned with whether or not drinks I consume are acidic	133 (95.7)	77 (72.7)	**<0.001**	4.0 (4.0-5.0)	3.0 (2.0-4.0)	**<0.001**
A7-I am concerned with whether or not a toothpaste contains fluoride	136 (97.8)	81 (76.5)	**<0.001**	4.0 (4.0-5.0)	4.0 (3.0-4.0)	**<0.001**
A8- To prevent erosive tooth wear, I would change my dietary habits (such as controlling my consumption of soft drinks)	136 (97.8)	97 (91.6)	**0.001**	4.0 (4.0-5.0)	4.0 (3.0-5.0)	**<0.001**
A9- To prevent erosive tooth wear, I would change my behaviour habits (such as drinking from a straw)	139 (100.0)	98 (92.5)	**<0.001**	4.0 (4.0-5.0)	4.0 (3.0-5.0)	**<0.001**
A10-I would see a doctor immediately if I learned that my teeth had been damaged by acid	137 (98.6)	101 (95.3)	**0.009**	5.0 (4.0-5.0)	4.0 (4.0-5.0)	**0.001**

(a) P-value by Pearson Chi-square Test; (b) P-value by Mann-whitney U Test; DSs = Dentistry Students; NMSs= Non-medical Students.

Table 7 - Attitude toward ETW, levels distribution of dentistry students (DSs) and non-medical students (NMSs).

Student Study Groups	Attitude levels						Total Median (P_{25}-P_{75})	P-value*
	Negative		Neutral		Positive			
	n (%)	Median (P_{25}-P_{75})	n (%)	Median (P_{25}-P_{75})	n (%)	Median (P_{25}-P_{75})		
DSs (n=139)	5 (3.4)	29.0 (29.0-31.5)[a]	56 (40.3)	40.0 (38.0-40.0)[b]	78 (56.1)	48.0 (45.0-50.0)[c]	43.0 (40.0-48.0)	**<0.001**
NMSs (n=106)	6 (5.7)	32.0 (30.0-33.0)[a]	57 (53.8)	39.0 (36.0-41.0)[b]	43 (40.6)	49.0 (44.0-50.0)[c]	41.0 (38.0-46-0)	**<0.001**
P-value**	0.126		0.387		0.890		**0.019**	

* P - Value- Kruskal-Wallis test ** P - Value- Mann Whitney U test; Attitude scores < 34, between 34 and 42, and > 42 indicated negative, neutral, and positive attitudes towards erosive tooth wear, respectively); a,b,c – different letters show significant differences according to Mann-Whitney U test.

DSs and NMSs subjects reveled differences ($P < 0.001$) for attitude levels distribution. In DSs group, 56.1% (n=78) of participants showed significant (P < 0.04) positive (Md=48.0, IQR 45.0-50.0) attitude for ETW when compared to 40.3% (n=56; $P < 0.04$) and 3.4% (n=5; $P < 0.001$) of neutral (Md= 40.0, IQR 38.0-40.0) and negative (Md=29, IQR 29.0-31.0) attitudes, respectively. In NMSs group, 53.8% (n=57) of participants registered neutral (Md= 39.0, IQR 36.0-41.0) attitude level for ETW when compared with 40.6% (n=43; P =0,04) and 5.7% (n=6; $P < 0.001$) with positive (Md= 49.0, IQR 44.0-50.0) and negative (Md=32.0, IQR 30.0-33.0) attitudes, respectively. No differences (P >0,05) were found between DSs and NMSs subjects when compared each attitude (negative, neutral and positive) level (**Table 7**).

The attitude score only suggested a positive correlation (*Pearson correlation coefficient;* r = 0.101; P > 0,05) with the knowledge score. Furthermore, the DSs group also suggested (r = 0,031; P > 0,05) positive correlation between attitude and knowledge scores. For the NMSs group, a tendency (P >0.05) to a negative (r = -0.001) correlation between attitude and knowledge scores. **Figure 1**, **Figure 2** and **Figure 3** illustrates the scatter plots diagrams that correlated the attitude and the knowledge scores distributions.

Figure 1 - Scatter plot depicting the relationship between the knowledge and the attitude scores (Each point on the plot represents an individual data point, indicating the attitude and knowledge scores for that particular observation).

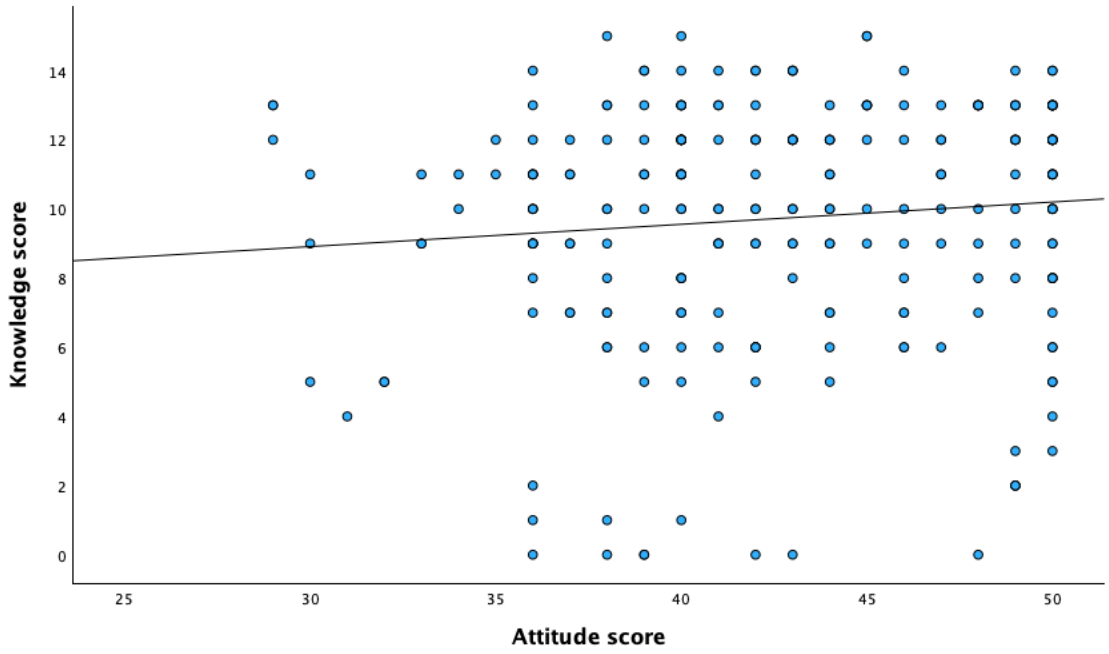


Figure 2 - Scatter plot depicting the relationship between the knowledge and the attitude scores in the DSs group of participants (Each point on the plot represents an individual data point, indicating the attitude and knowledge scores for that particular observation).

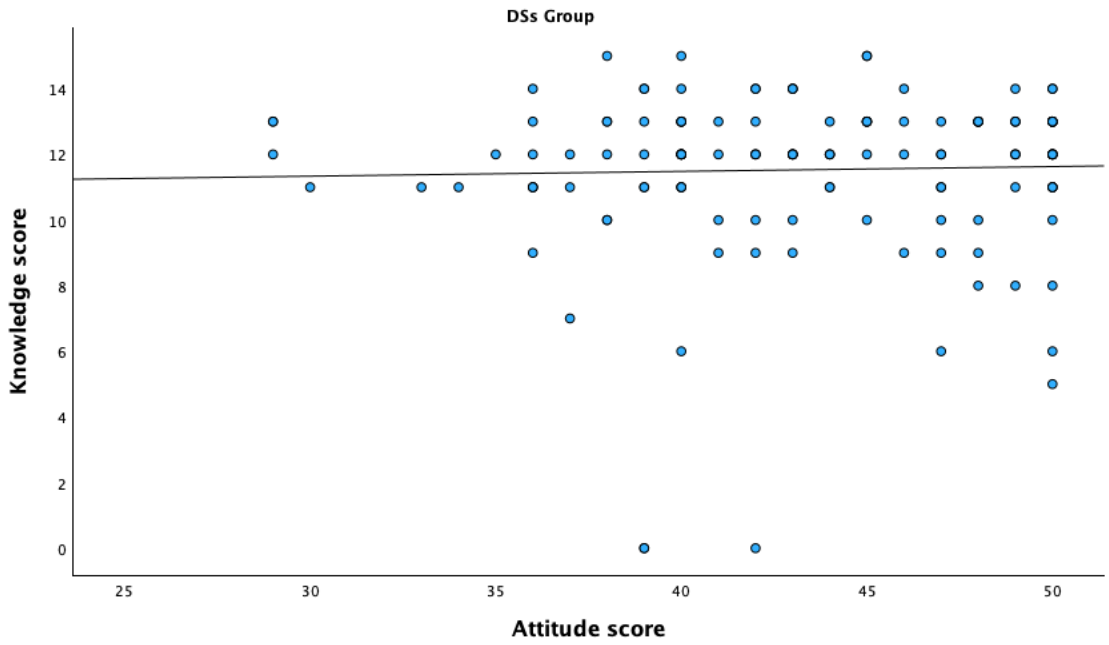
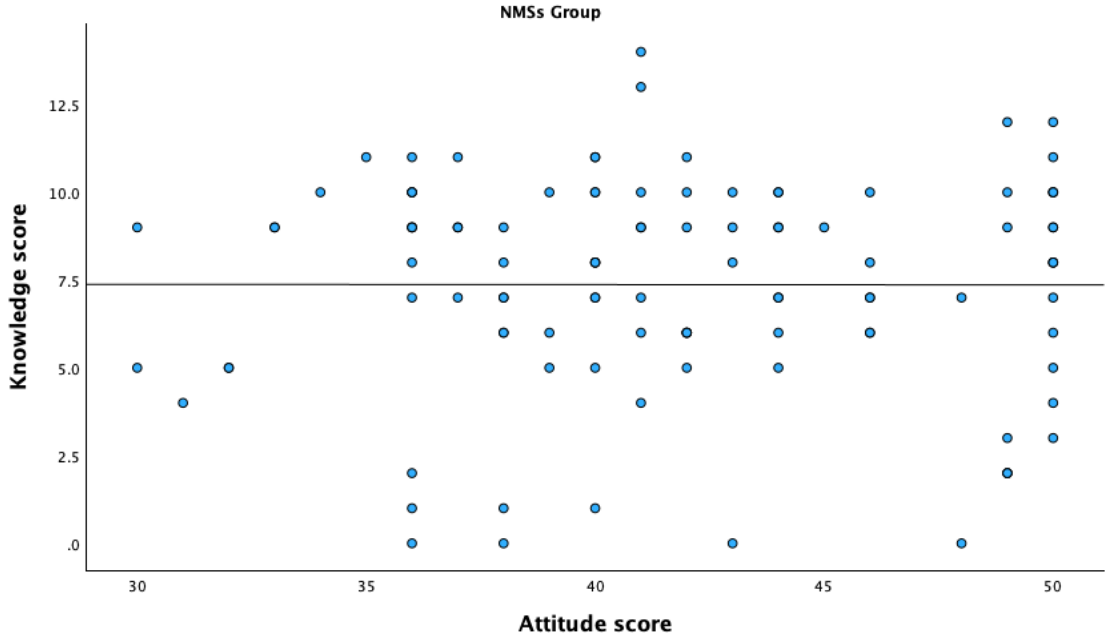


Figure 3 - Scatter plot depicting the relationship between the knowledge and the attitude scores in the NMSs group of participants (Each point on the plot represents an individual data point, indicating the attitude and knowledge scores for that particular observation).

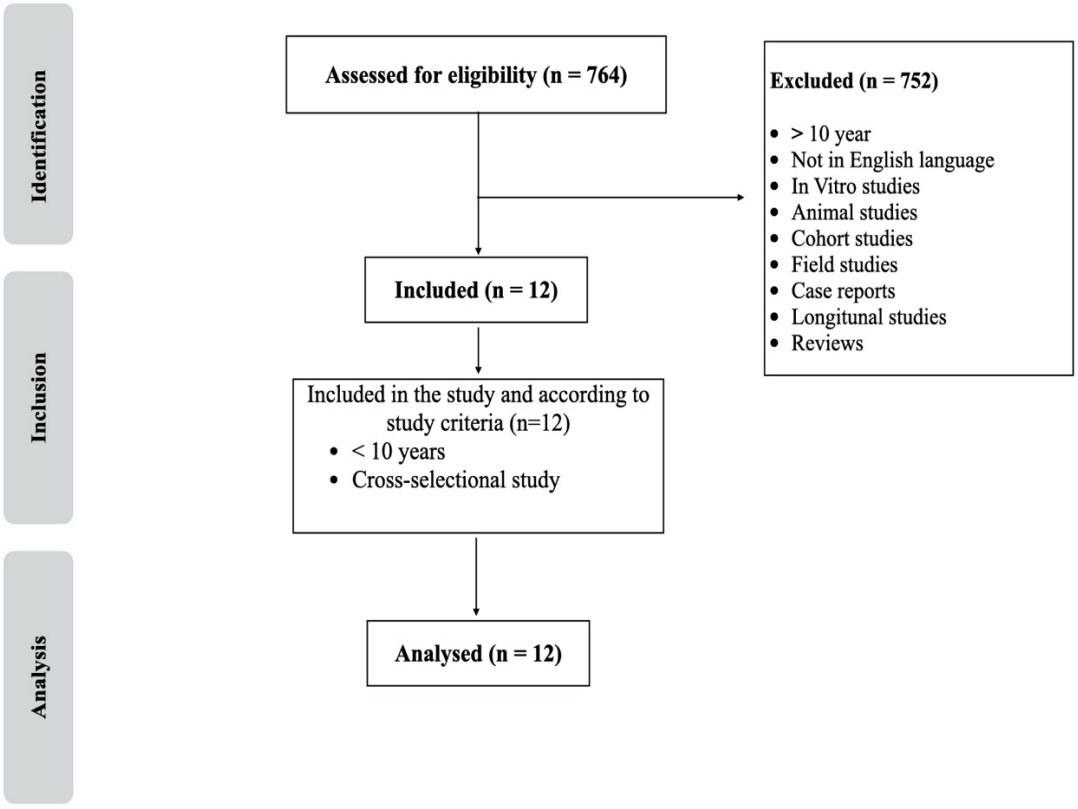


3.2. The systematic qualitative review of ETW cross-sectional studies results

Through electronic database search a total of 764 preliminary references were identified (**Figure 4**). After excluding duplicates and removing articles not relevant to the previously developed inclusion criteria (n= 752), such as cohort studies, longitudinal studies, field studies, case-control studies, comparative studies, reviews, 12 articles were

screened at full-text level. Twelve cross-sectional studies met the eligibility criteria and were included in this study for qualitative and quantitative data collection. The selected studies, reference, population studied, population control (when applicable), results and Conclusion, and main details are summarized in **Table 8**. Main abstracts description of those studies are provided in **Annex 3** (**Table 8.1**).

Figure 4 - STROBE flow diagram for cross-sectional studies. Own elaboration, Adapted from (Va ndenbroucke et al., 2007b).



The detailed assessment of the methodological quality of the cross-sectional studies are shown in **Table 9.** All the 12 studies scored as STROBE high quality (Vandenbroucke et al., 2007).

Table 8 - Main outcomes, aims, population, local, methodology, sample size/response rate (if applicable), ETW prevalence (clinical ETW, knowledge, attitude, awareness)/etiology), main conclusion of the 12 cross-sectional studies.

Reference	Population and Control (if applicable) - (N)	Local	Methodology	Sample size and/or Response rate	ETW prevalence (ETW, knowledge, attitude, awareness)/ aetiology	Main Conclusions
Skudutyte-Rysstad et al., 2013	18-yr-old subjects (N = 3,206)	Oslo Public Dental Service clinics	Scheduled for routine examination	1,456 agreed to participate; response rate of 45%).	* 88% with ETW; * 56% aware of ETW (only 47% could recall their dentist mentioning, the condition).	Needs for attitudes (YES)
CHU et al., 2015	1st Year University Chinese students (aged 18-21 years-old)	Dental clinic (University campus in Hong Kong).	Questionnaire + BEWE Examination (by 3 dentists) and DMFT index	n= 600 .	**44% showed some signs of dental erosion; The total BEWE scores were found to be associated with age and self-perception of tooth misalignment; Females, those whose last dental check-up was more than a year ago and those who perceived having dental decay or tooth wear had higher caries experience.	Needs for attitudes (YES)

Reference	Population and Control (if applicable) - (N)	Local	Methodology	Sample size and/or Response rate	ETW prevalence (ETW, knowledge, attitude, awareness)/ aetiology	Main Conclusions
Al-Ashtal et al., 2015	General dental practitioners (n = 323) Fifth year dental students (n = 97)	University of Science and Technology, Sanaa, Yemen	Self-administered questionnaire	Response rate of 79 %.	** 61 % learned about DE from dental school, 27 % from their own studies and the rest from continuing education courses and the media. **DE was most frequently on incisors (46 %) and on premolars and molars (24 %). ***48 % reported DE to be more common in male patients, no gender differences were reported by 20 % of respondents. ***Acidic drinks were believed to be causative factors for DE by 41 % of dentists and 52 % of students, while 90 % of respondents believed that patients' dietary history is important during DE diagnosis. ****Younger respondents (≤35 years) were more likely to identify the commonly-known causative factors for DE (P = 0.024). Twenty-seven percent of the respondents reportedly used an index to grade DE. Dental students were more likely than dentists to use such an index (P <0.001) and to more frequently advise their patients to reduce intake of acidic drinks (P = 0.02) compared to dentists.	Urgent need for enhancing awareness and knowledge about DE within the Yemeni dental community (YES).

Reference	Population and Control (if applicable) - (N)	Local	Methodology	Sample size and/or Response rate	ETW prevalence (ETW, knowledge, attitude, awareness)/ aetiology	Main Conclusions
Søvik et al., 2015	Of 846 adolescents (aged 16–18 years)	Norway	Scheduled for dental recall examinations + self-administered questionnaire	795 (94%) accepted to participate.	** 37% had ≥3 surfaces with dental erosions; **The tooth-brushing frequency was not significantly associated with dental erosive wear. Additionally, to the best of our knowledge, the results are the first to indicate a dose-response relationship between the daily consumption of acidic drinks and dental erosive wear.	NEEDS for attitudes (YES)
Brandt et al., 2017	N=14 351 adolescents	Public and private high schools of Campina Grande, Paraiba, Brazil, north-eastern Brazil.	Bulimic Investigatory Test of Edinburgh +Dental examinations, anthropometric measurements, and eating habits and oral hygiene were performed.	850 randomly selected female adolescents (15-18 years old).	** 10% with Dental Erosion; **Adolescents with high severity eating disorder condition were not more likely to show dental caries (p = 0.329; OR = 2.2, 95% CI: 0.35–13.72) or dental erosion (p = 0.590; OR = 2.33; 95% CI: 0.56–9.70). Adolescents with high body mass index (BMI) were five times more likely to have high severity eating disorder condition (p = 0.031; OR = 5.1; 95% CI: 1.61–23.07).	High severity risk behavior for EDs was not significantly associated with dental caries and dental erosion. However, high BMI was a risk factor for developing eating disorders and should be an alert for individuals with this condition. Needs for knowledge and attitude (YES)

Reference	Population and Control (if applicable) - (N)	Local	Methodology	Sample size and/or Response rate	ETW prevalence (ETW, knowledge, attitude, awareness)/ aetiology	Main Conclusions
Antunes et al., 2017	108 runners/ amateur athletes	Rio de Janeiro, Brazil.	Standardized, semi-structured questionnaire	n=108	*Prevalence of dental erosion was 19.4%. Dental erosion ($P < 0.05$).	Frequency of exercise per week and gastroesophageal reflux were risk factors for dental erosion Needs for attitudes (YES)
Verploegen & Schuller, 2019	331 young adults (20–25 years old).	Attending 25 dental care practices in six European countries (United Kingdom;Finland; Latvia;Estonia;Netherlands; Germany)	Questionnaire	N=331	The definition of erosive tooth wear was known in 71% . **88-94% had heard about erosive tooth wear. There were, however, major variations between different countries, with the highest levels of tooth wear being observed in the United Kingdom (54%) and the lowest in Finland and Latvia/Estonia (18%). An epidemiological study of adults in the Netherlands in 2013 using a 5-point ordinal occlusal/incisal grading scale for tooth wear showed prevalence's of 13% for mild tooth wear, 80% for moderate tooth wear, and 6% for severe tooth wear. These prevalence's were 31%, 65% and 2% respectively in the youngest age group (25-34 years) and 4%, 82% and 12% in the oldest age group (65-74 years) for mild, moderate and severe tooth wear.	Needs for attitudes (YES)

Reference	Population and Control (if applicable) - (N)	Local	Methodology	Sample size and/or Response rate	ETW prevalence (ETW, knowledge, attitude, awareness)/ aetiology	Main Conclusions
Dynesen et al., 2018	260 Persons with EDs	Persons with EDs	Electronic questionnaire.	N=260	**21.2% of children showed signs of erosion. The participants' knowledge the condition of their own teeth, close to one-half (n = 108, 42%), while one-quarter (n = 66, 26%) reported no tooth damage. The remaining participants (n = 81, 32%) did not know whether or not their teeth were damaged.	Needs for attitudes (YES)
Hong et al., 2020	120 students	Dental, medical, and non-medical university students of two Chinese universities.	Questionnaire	n = 635	**19.4% prevalence of dental erosion. The knowledge score of the DSs (11.5 ± 3.4) was significantly higher than those of the NSs (5.5 ± 4.0) and MSs (6.1 ± 4.0) ($P < 0.001$). The attitude score of the DSs (45.2 ± 6.5) was significantly higher than those of the NSs (41.1 ± 6.9) and MSs (41.8 ± 6.4) ($P < 0.001$)	Needs for attitudes (YES)
Schmidt & Huang, 2022	418 students	Australian University	Online questionnaire.	418 subjects were included in the final sample, leading to a completion rate of 96.3%	*385 participants (92.1%) showed the aware- ness of dental erosion. p = 0.001, OR = 0.933, 95% CI: 0.896, 0.971 ($p \geq 0.171$)	Needs for attitudes (YES)

Reference	Population and Control (if applicable) - (N)	Local	Methodology	Sample size and/or Response rate	ETW prevalence (ETW, knowledge, attitude, awareness)/ aetiology	Main Conclusions
Jász & Szőke, 2022	579 randomly selected children aged 12 (287 boys and 292 girls)	14 different regions in Hungary.	Clinical examinations and a self-administered questionnaire .	N=579	**21.2% of children have dental erosion. BEWE scores in urban areas (p = 0.0058). Soda consumption correlated with BEWE scores < 3: frequent (83.6%) vs. less frequent (90%), p = 0.034. Children of mothers with a higher diploma have BEWE scores ≥ 3 less frequently (8.4% vs. 22.5%, p = 0.000).	Needs for attitudes (YES)
Ramirez et al., 2022	Adult (18 to 46 years old) sampling (n = 553)	Health Centre in San Bernardo, Chile.	Dental exams were performed by two trained and calibrated examiners, according to the BEWE index and a hetero-applied questionnaire.	n = 553	**Our interest was individuals with severe erosion tooth wear (BEWE ≥ 14). Logistic regression models reporting crude odds ratio (OR) and adjusted OR by age, 95% confidence interval (95%CI), and p-values were estimated. 36%, erosion prevalence	Needs for attitudes (YES)

Table 9 - Quality assessment of the cross-sectional studies using the STROBE

STROBE (page number)	**Item No**	**Skudutyte-Rysstad et al., 2013**	**CHU et al., 2015**	**Al-Ashtal et al., 2015**	**Søvik et al., 2015**	**Brandt et al., 2017**	**Antunes et al., 2017**	**Verploegen & Schuller, 2019**	**Dynesen et al., 2018**	**Hong et al., 2020**	**Schmidt & Huang, 2022**	**Jász & Szőke, 2022**	**Ramirez et al., 2022**
Title and abstract	1	(1)	(1)	(1)	(1)	(1)	(1)	(3)	(2)	(2)	(2)	(1)	(1)
	2	(1)	(2)	(1)	(2)	(1)	(1)	(3)	(2)	(2)	(2)	(1)	(1)
Objectives	3	(1)	(2)	(1)	(2)	(1)	(1)	(3)	(2)	(2)	(2)	(1)	(2)
Study design	4	(2)	(3)	(3)	(2)	(1)	(2)	(7)	(3)	(2)	(2)	(1)	(2)
Setting	5	(2)	(3)	(2-3)	(2)	(1)	(2)	(7)	(2)	(2)	(2)	(1)	(2)
Participants	6	(2)	(3)	(2-3)	(2-3)	(2)	(2)	(7)	(2)	(2)	(2)	(1)	(2)
Variables	7	(2)	(3)	(2-3)	(3)	(2)	(2)	(7)	(3)	(2)	(2)	(1)	(3)
	8	(2)	(4)	(2-3)	(4)	(2)	(2)	(7)	(3)	(2)	(2)	(1)	(3)
Bias	9	(2)	(4)	(2-3)	(4)	(2)	(3)	(10)	(6)	(2)	(2)	(1)	(4)
Study size	10	(2)	(4)	(3)	(4)	(2)	(3)	(7)	(6)	(2)	(2)	(3)	(4)
Quantitative variables	11	(2)	(4)	(4)	(4)	(2)	(3)	(10)	(6)	(2)	(2)	(3)	(4)
Statistical methods	12	(2)	(4-5)	(4-5)	(5)	(3)	(3)	(10)	(6)	(2)	(2)	(3)	(4)
Participants	13	(2)	(5)	(3)	(5)	(3)	(4)	(7)	(6)	(2)	(3)	(3)	(5)
Descriptive data	14	(3)	(6)	(6-7)	(6)	(3)	(4)	(7)	(2)	(2)	(3)	(3)	(6)
	14	(3)	(6)	(6-7)	(7)	(3)	(5)	(7)	(6)	(2)	(3)	(3)	(6)
Outcome data	15	(3)	(6)	(6-7)	(7)	(3)	(5)	(7)	(6)	(2)	(3)	(3)	(6)
Main results	16	(3)	(6-7)	(7-8)	(7)	(3)	(5)	(10)	(6)	(2)	(3)	(4)	(6)
Other analyses	17	(3)	(7)	(7-8)	(7)	(3)	(5)	(10)	(6)	(2)	(3)	(4)	(7)
Key Results	18	(3)	(7)	(7-8)	(7)	(3)	(5)	(10)	(6)	(2)	(10)	(4)	(7)
Limitations	19	(3)	(7-8)	(8)	(7-8)	(3)	(5)	(10)	(6)	(2)	(10)	(4)	(7)
Interpretation	20	(3)	(8)	(8)	(8)	(3)	(5)	(10)	(6)	(2)	(10)	(4)	(7)
Generasibility	21	(3)	(8)	(8)	(8)	(3)	(5)	(10)	(6)	(2)	(10)	(4)	(7)
Funding	22	(3)	(8)	(8)	(8)	(8)	(5)	(3)	(2)	(2)	(10)	(4)	(7)
Reliability		**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

4. DISCUSSION

Based on the outcomes of this pilot study the null hypothesis that, dental students (DSs) and non-medical students (NMSs) of UFP have similar knowledge of and attitude towards ETW was rejected. The Knowledge and Attitude scores of the DSs were significantly higher than those of NMSs. There was a notable disparity in ETW moderate level of knowledge between DS and NMS students. Also, the moderate and high levels of knowledge in DSs were higher and distinct of those with weak level of knowledge. However, in NMSs group, the weak level of knowledge of ETW was more prevalent than the moderate and high levels. Moreover, DSs showed more frequently positive attitudes, than those with neutral and, those with negative attitudes. Similarly, results were detected for NMSs subjects. However no differences were detected between DSs and NMs, for each attitude level toward ETW. Al-Ashtal et al. (2015) and Hong et al. (2020) assessed knowledge and attitudes towards dental erosion among dental professionals and students. Those authors found that only half of respondents had in-depth knowledge of dental erosion/ETW. Hong et al. (2020) pointed out that dental students had better knowledge and more positive attitudes towards dental erosion than students of other disciplines. Specific field of education appeared to be a determining factor in the perception and knowledge of ETW/dental erosion. Hong et al., (2020) pointed out that participants with dental training demonstrated greater knowledge of dental erosion, suggesting that interprofessional education could extend this awareness beyond the healthcare sector. Verploegen & Schuller, (2019) and Søvik et al. (2015) underlined the importance of educating young people on the effects of acidic foods and drinks and dental erosion, while Al-Ashtal et al, (2015) emphasize the need for dental professionals to be more aware of these factors. On the other hand, Verploegen & Schuller (2019) and Dynesen et al. (2018) investigated knowledge levels and the need for specific information on dental erosion. Those authors study found that the majority of young adults preferred to receive information from oral health professionals. Dentists should acquire empathetic communication skills towards patients with eating disorders (Dynesen et al., 2018).

Our null hypothesis that tested that female and male students have similar knowledge of and attitude towards ETW was partially rejected. Students gender and age influenced the knowledge scores, but no differences were detected for gender regarding the attitudes scores. Male students, those with more than 22 years old, and with more than 3 curricular years in UFP showed significant higher knowledge scores than females, students aged 22 year or youngers and those with less than 3 curricular years in UFP. However attitude toward ETW scores were similar by gender, by students age and the university curricular year frequency. Furthermore, the null hypothesis that students nationality, that were EU and non-EU students nationality groups at UFP, have similar levels of knowledge and attitudes towards ETW was accepted, since no significant differences within those scored was observed for those students groups.

Our findings reveled that the attitude and knowledge scores were not significantly correlated, though a slight positive correlation tendency was observed for all UFP students and for DSs participants, and a slight negative correlation tendency for NMSs group. Scatter plots displayed a slight positive relationship between attitude and knowledge scores (Figure 1) suggesting that other factors might be influencing the knowledge scores independently of the attitude scores. The DSs Group exhibited (Figure 2) a slight positive relationship between attitude and knowledge scores, with less variability and fewer low knowledge scores when compared to those of all participants, that reveled weaker and more dispersed relationship between attitude and knowledge scores. The NMSs group scatter plot tendency showed no correlation between attitude and knowledge scores, with high variability and a wide distribution of knowledge scores for any given attitude score. This contrasts with the previous overall plot (Figure 1) and the DSs group (Figure 2), both of which suggested a slight positive correlation. The DSs group, in particular, displayed more consistency in knowledge scores for similar attitude scores, whereas the NMSs group exhibited a more dispersed and variable relationship between these two variables. So the null hypothesis was rejected, since students' knowledge and attitudes were not significantly correlated.

This pilot study among UFP university students provided valuable insights on demographic characteristics, response rate and comparison of knowledge and attitude scores regarding dental erosion/ETW among dentistry and non-medical students. Those findings highlighted

the needs for knowledge of ETW among NMSs but especially the high-needs of measures in order to promote more positive attitudes towards ETW among all this community, including some investment in positive attitudes of DSs students toward all university students community.

The study conducted by Schmidt & Huang (2022) emphasized the importance of oral health education and the changing of acid-drinking behavior, suggesting that health professionals should actively educate people on ETW/dental erosion. The importance of educating young adults about dental erosion, as those with higher levels of education and those who received dental information from professionals showed a better understanding of the subject (Verploegen & Schuller, 2019). In addition, a significant correlation was identified between the severity of dental erosion and education level (Jász & Szőke, 2022), which highlights the importance of focusing information efforts on less-educated young adults. However, it is important to note that other studies (Sanhouri et al., 2010) found no significant correlation between parental education and dental erosion in children.

The outcomes of twelve cross-sectional studies (Al-Ashtal et al., 2015; Antunes et al., 2017; Brandt et al., 2017; Chu et al., 2015; Dynesen et al., 2018; Hong et al., 2020; Jász & Szőke, 2022; Ramirez et al., 2022; Schmidt & Huang, 2022; Skudutyte-Rysstad et al., 2013; Søvik et al., 2015; Verploegen & Schuller, 2019) qualitatively indicate the needs for, additional research on etiological factor that may be associated with ETW and for promotion the knowledge, the attitude and the awareness toward to ETW in several populations.

Main outcomes of several studies, thought different evaluation methodologies applied, evidenced the needs for attitudes and in some cases the urgent needs for enhancing awareness and knowledge of dental erosion/ETW in several communities (Al-Ashtal et al., 2015; Brandt et al., 2017; Chu et al., 2015; Dynesen et al., 2018; Hong et al., 2020; Jász & Szőke, 2022; Ramirez et al., 2022; Schmidt & Huang, 2022; Skudutyte-Rysstad et al., 2013; Søvik et al., 2015; Verploegen & Schuller, 2019). For the pertinence of this issue, cross-sectional surveys have been applied in several communities, and in young populations of different countries such us, children (12 years old) and young adults (18 to 25 years old) in Hungary, United Kingdom, Finland, Latvia, Estonia, Netherlands and Germany (Jász & Szőke, 2022; Verploegen & Schuller, 2019), in adolescent of public and private high schools of the

northeastern Brazil (Brandt et al., 2017), in runners/ amateur athletes of Rio de Janeiro, Brazil (Antunes et al., 2017), in 18-yr-old subjects of Oslo Public Dental Service clinics, Norway (Skudutyte-Rysstad et al., 2013), in the 1st year (aged 18-21 years-old) training of University campus of Hong Kong (Chu et al., 2015), inthe fifth year dental students of University of Science and Technology, Sanaa, Yemen (Al-Ashtal et al., 2015), in dental, medical, and non-medical university students of two major Chinese universities (Hong et al., 2020), in students of Australian University (Schmidt & Huang, 2022). Furthermore, in a consecutive adult (18 to 46 years old) sampling of the Health Center in San Bernardo, Chile (Ramirez et al., 2022).

In Portugal, despite the scientific and professional community's growing interest in researching this topic, there are few data relative to dental erosion or ETW in adults, and as far as the authors known, no students or other populations insights have been collected to investigate the risk factors, the knowledge of, the awareness or attitudes toward this oral condition. Therefore, this pilot survey emphasized the needs for evidence of knowledge and attitudes of different students profiles attending several scientific fields of higher education, as the included ones, from humanities and social sciences, science and technology, pharmaceutical sciences and nutrition sciences, in regards to ETW/dental erosion, an oral condition with multifactorial etiology, of endogenous (e.g. gastro-esophageal reflux) or exogenous origins (da Silva Fonseca et al., 2024; Marschner et al., 2024; Nota et al., 2022), associated or not with the diversity of lifestyles and behaviors or consumption practices. The growing concerns and promotion of healthy lifestyles among the younger population (Brennan et al., 2020) and, university students, can influence dietary and consumption of products with low sugar content but high acidic composition. This frequent and prolonged contact over time can lead to hard dental tissues visible changes that are not cariogenic, but rather erosive and wear, since enamel dissolution is significantly associated pH, buffer capacity, titratable acidity, viscosity, as well as calcium, phosphate and fluoride concentrations in the beverages and foods. As recently stated by Saads Carvalho & Lussi, current reviews outcomes reveled that frequent consumption of carbonated/soft drinks, Vitamin C, natural fruit juices and acidic snacks or sweets were significantly associated with more ETW (Saads Carvalho & Lussi, 2019).

Studies performed by Antunes et al. (2017) and by Hong et al. (2020) identified specific dental erosion risk factors such, as gastroesophageal reflux disease and frequency of exercise. However, Antunes et al. (2017) study do not reported a significant association of dental erosion with isotonic beverage consumption, but only with gastroesophageal reflux and exercise frequency. Furthermore, Brandt et al. (2017) explored the relationship between eating disorders and dental erosion, finding no significant association, but highlighting high body mass index (BMI) as a risk factor for eating disorders. Ramirez et al. (2022) study reported some factors associated with severe dental erosion in Chilean adults, such as the age, alcohol consumption, esophagitis, gastric symptoms, anorexia and vitamin C intake. Various intrinsic factors, such as exposure to gastric contents in conditions such as acid reflux or voluntary/involuntary vomiting, have been identified that can cause dental erosion when persistent in susceptible individuals (Chu et al., 2015). On the other hand, external factors include the individual's environment, prescription medications, dietary choices and lifestyle, all of which can contribute to dental erosion (Creeth et al., 2015). Contact with erosive acids can demineralize tooth enamel surfaces, making them more susceptible to abrasive forces and contributing to ETW. Acid sources can be attributed to both external and internal factors, and the intensity of erosion is influenced by the quality and quantity of saliva (Schlueter et al., 2020). The presence of acids in the oral cavity reduces salivary pH value, which eventually leads to the loss of minerals from the tooth surface. This process can lead to the dentin exposure, resulting in sensitivity, discomfort and degradation of the tooth structure (Maladkar et al., 2022). Eating habits and lifestyles plays a crucial role in dental erosion. A significant correlation was observed between daily consumption of erosive beverages and dental erosion (Jász & Szőke, 2022). Similarly, lack of awareness of dental erosion can influence the perception of ETW/dental erosion severity, as pointed out by some authors (Chu et al., 2015). In terms of clinical implications, dental erosion/ETW can cause pain, sensitivity and functional and aesthetic limitations. However, access to optimal dental erosion management remains a challenge, particularly in developing countries, due to limited costs and resources (Hong et al., 2020).

On the present pilot study the self-administered questionnaire response and participation rates were of 71.2% (n=245) and of 72.9% (n= 251), respectively, and considered sufficient and representative of the studied population, the UFP DS and NMS students. This cross-

sectional pilot study was based on a convenience sample (N=344; 95% confidence interval and 5% margin of error), considered for 50% of response distribution, that corresponded to the largest sample size, calculated by the Sample Size Calculator software (Inc.RaoSoft®, Seattle, WA, USA) and, based on the formula by Cochran stating, as required for the pilot study effectiveness. Considering the self-administered response rates for dental erosion of 45-79% in similar surveys (Al-Ashtal et al., 2015; Amaechi & Higham, 2005; Campos Serra Danielle Turssi et al., 2009; Hermont et al., 2011; Hong et al., 2020; Skudutyte-Rysstad et al., 2013; Verploegen & Schuller, 2019), the sample for this trial could varied between 341 and 237 individuals, respectively. A recent on-line questionnaire applied in a Australian University reported a 96.3% completion rate (Schmidt & Huang, 2022).

The ETW questionnaire applied in this pilot-study was developed in English language and was provided by the authors of a survey conducted among Chinese University Students, of two major universities in Fujian Province, China (Hong et al., 2020). After author's permission, the questionnaire was translated to Portuguese by two dentistry academic teachers (L.P.S and B.L.) and then reviewed by three independent bilingual seniors experts, dentistry academic teachers (P.M-M, L.T. and J.D). The two versions were pretested for critical assessment and technical functionality on 25 UFP Dentistry teachers and Students (not included in the final sample of the pilot study), that fulfilled the questions individually for detection of possible discrepancies of language or contextual inconsistencies. Some translated questions were reviewed. Different guidelines and theoretical approaches to achieve content validation of instruments are discussed in literature (da Silva et al., 2015) Thought the statistic validity and reliability was not performed for the Portuguese inquiry version the translation and review procedures were performed to ensure that when fulfilling the questionnaire the students had no doubts and had access to the equivalent questions. As University Fernando Pessoa Students have bilingual learning (English and Portuguese) the questionnaire was provided to all students in both languages.

The main purposes of some cross-sectional studies focused on assessment the knowledge, the awareness or attitudes toward ETW or dental erosion (Al-Ashtal et al., 2015; Dynesen et al., 2018; Hong et al., 2020; Schmidt & Huang, 2022; Skudutyte-Rysstad et al., 2013; Verploegen & Schuller, 2019), on the prevalence and severity of ETW or dental erosion (Chu

et al., 2015; Jász & Szőke, 2022; Ramirez et al., 2022; Schmidt & Huang, 2022; Skudutyte-Rysstad et al., 2013; Antunes et al., 2017) as well as, evaluation of both dental erosion and dental decay (Brandt et al., 2017; Chu et al., 2015). Also, two main designs of cross-sectional surveys for ETW/dental erosion data collection in younger populations and students can be literately evidenced; only questionnaire (Al-Ashtal et al., 2015; Antunes et al., 2017; Dynesen et al., 2018; Hong et al., 2020; Schmidt & Huang, 2022; Verploegen & Schuller, 2019a), only clinical examination (Skudutyte-Rysstad et al., 2013), or both, clinical observation and insights questionnaires (Brandt et al., 2017; Chu et al., 2015; Jász & Szőke, 2022; Ramirez et al., 2022; Søvik et al., 2015).

With regard to ETW prevalence, Jász & Szőke, (2022) study revealed a higher prevalence of dental erosion in adolescents attending private schools compared to those in public schools, underscoring the influence of socio-economic status on this disparity. Those finding aligns with European research, which has linked a lower prevalence of dental erosion to higher socio-economic status, probably due to healthier diets. However, in developing countries, lower socio-economic status was associated with lower dental erosion prevalence, probably due to limited access to expensive, erosive soft drinks.

So, some limitations of this pilot study can be reported such as, the statistical validity and reliability of Portuguese version that was not performed, the non-inclusion of other higher education students, inclusively of other health groups such as those of medical field, and even from other universities (public or other private) in different regions of Portugal, or other populations associated with teaching/training and student learning outcomes; the relatively low participation rate of non-EU students (only 8.2%, n=20) compared to EU students (91.8%; n= 225), which may had contributed to the present outcomes.

However, it underlined the needs for policies to raise awareness of this clinical condition, being important in the near future to gather insights from more students, if possible on a national scale but also from others stakeholders, like their teachers as agents of transmitting knowledge and attitudes with influence in the students learning outcomes. In addition to the application of self-assessment surveys, it is also essential to carry out an adequate clinical assessment of hard dental structures and their respective records, by acceptable instruments and methodologies such as, the Basic Erosive Wear Examination (BEWE) (Aránguiz et al.,

2020) or other Indexes for detection of scientific and clinical needs as some trials had performed (Brandt et al., 2017; Chu et al., 2015; Jász & Szőke, 2022; Ramirez et al., 2022; Søvik et al., 2015).

This work helped to highlight the worth for education and prevention strategies as well as the integration of dentistry professionals' interventions in the community and in the multidisciplinary management of related diseases, such as eating or other disorders.

5. CONCLUSION

This study assessed the knowledge of and attitudes on ETW, of students from a Portuguese private University, the UFP. As outcomes was possible to state the following conclusions.

The survey response and participation rates were of 71.2% and of 72.9%, respectively.

The outcomes highlights needs for knowledge of ETW among NMSs but especially the high-needs of measures in order to promote more positive attitudes towards ETW among all university students, DS and MNS.

The Knowledge score and Attitude score of the DSs were higher than those of NMSs.

Students gender and age influenced the knowledge scores, but no differences were detected for attitudes scores. Male students, students with more than 22 years old, and those with more than 3 curricular years in UFP showed higher knowledge scores. However attitude toward ETW scores were similar by gender, by students age and curricular year. Furthermore, EU and non-EU students at UFP have similar levels of knowledge and attitudes towards ETW, with no significant differences observed.

There was a notable disparity in ETW moderate level of knowledge between dentistry (DS) and non-medical (NMS) students at UFP. Also, the moderate and high levels of knowledge in DSs were higher and distinct of those with weak level of knowledge. However, in NMSs group, the weak level of knowledge of ETW was more prevalent than the moderate and high levels.

Attitude toward ETW was not similar between DS and NMS subjects. Dentistry students showed more frequently positive attitudes, than those with neutral and, those with negative attitudes. Similarly, results were detected for NMSs subjects. However no differences were detected between DSs and NMs, for each attitude level toward ETW.

The attitude and knowledge scores were not significantly correlated, though a slight positive correlation tendency could be observed in all UFP students and in DSs, and a slight negative correlation tendency in NMSs.

The pilot study among UFP university students provided valuable insights into the demographic characteristics, response rate, and comparison of knowledge and attitude scores regarding dental erosion/ETW among dentistry students and non-medical students, being important in future research implementation of multicenter designs applied to same populations, in Portugal, as well as, the adequate clinical assessment of hard dental structures and their respective records, by acceptable instruments and methodologies such as, the Basic Erosive Wear Examination.

The systematic review of ETW cross-sectional studies noted a diverse range of factors associated with dental erosion identified in several countries, and populations. Both intrinsic factors, such as acid reflux, and extrinsic factors, including dietary habits and lifestyle choices, were found to contribute to dental erosion/ETW. Furthermore, a large range of dental erosion or ETW prevalence varied across different populations studied, with factors like education level and socio-economic status playing significant roles.

The review underline the importance of education in raising awareness about dental erosion, with studies indicating that individuals with higher levels of education tend to have better knowledge and attitudes towards dental erosion. Additionally, the correlation between daily consumption of erosive beverages and dental erosion underscores the importance of lifestyle factors in oral health.

In terms of clinical implications, the review emphasized the need for improved access to dental erosion management, particularly in developing countries where resources may be limited, more accuracy and better skills on communication by dentistry professionals within populations, and integration of those professionals in the multidisciplinary management of individuals/population with risk of ETW/dental erosion by related diseases.

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ANNEXES

Annex 1 - Information and Self-Administered Survey

ASSUNTO: Conhecimento e atitudes sobre desgaste dentário erosivo em estudantes numa Universidade Portuguesa- Estudo piloto

Caro/a Estudante da Universidade Fernando Pessoa (UFP),

O **desgaste erosivo dentário** constitui uma alteração oral e dentária muito prevalente em alguns grupos populacionais e apresenta etiologia multifatorial, estando muito associada a diversidade de hábitos nutricionais/dietéticos e comportamentos de consumos da atualidade, característicos da respetiva cultura e/ou geração.

Convidamos a comunidade de estudantes da UFP a participar neste estudo piloto, que tem como objetivo inicial analisar o conhecimento e atitudes dos estudantes universitários sobre desgaste erosivo dentário**.**

Para responder á questão: "*Qual o conhecimento e atitudes dos estudantes universitários de diversas áreas científicas, sobre desgaste erosivo dentário*" desenhamos esta investigação, inicialmente um estudo piloto, na Faculdade de Ciências da Saúde, com a equipa de investigação inicial: Prof. Doutora Patricia Manarte Monteiro, Mestre Joana Domingues, Mestre Lígia Pereira da Silva (Docentes do Mestrado Integrado em Medicina Dentária UFP e Médicas Dentistas). Foi convidada a participar numa parte deste estudo a aluna do Mestrado Integrado em Medicina Dentária-UFP, Maria Vittoria Buscemi (39633).

Nesta investigação realizaremos o levantamento de dados demográficos, académicos, sobre o conhecimento e sobre as atitudes dos estudantes da UFP, sobre desgaste erosivo dentário.

Solicitamos a sua colaboração, respondendo ao INQUÉRITO com uma duração de cerca de 15 minutos.

A **SUA PARTICIPAÇÃO é MUITO** importante para o sucesso desta investigação académica e futuras linhas de apoio a dinamizar e prestar á comunidade académica de estudantes da UFP no âmbito da Saúde oral.

Para qualquer esclarecimento adicional, por favor, contactar a investigadora principal: patmon@ufp.edu.pt

Muito obrigado!

Subject: Knowledge of and attitudes towards erosive tooth wear among students of a Portuguese University: Pilot survey

Dear Fernando Pessoa University (UFP) ***Student****,*

Erosive tooth wear is a very prevalent oral condition in some population groups. It has a multifactorial etiology and is closely associated with a variety of current nutritional/dietary habits and consumption behaviours that are characteristic of the respective culture and/or generation.

We invite the UFP student community to take part in this pilot study, whose initial aim is to analyse the knowledge and attitudes of university students among erosive tooth wear.

To answer the question: "What is the knowledge and attitudes of university students from different scientific areas about erosive tooth wear?" we designed this research, initially a pilot study, at the Faculty of Health Sciences, with the initial research team: Professor Patricia Manarte Monteiro, Master Joana Domingues, Master Lígia Pereira da Silva (Professors of the UFP Integrated Master's Degree in Dentistry and Dentists). Maria Vittoria Buscemi (39633), a student on the UFP Integrated Master's Degree in Dentistry, was invited to take part in part of this study.

In this research we will collect demographic, academic, the knowledge and attitudes data of UFP students regarding erosive tooth wear. In addition, if you give your permission and agree to take part in future activities on the subject, you should provide your UFP student email address so that we can continue the project. If so, we will contact you.

We ask for your collaboration by answering the SURVEY*, which will take about 15 minutes.*

YOUR PARTICIPATION IS VERY IMPORTANT for the success of this academic research and future lines of support to be dynamized and provided to the academic community of UFP students in the field of oral health. For any further information, please contact the principal investigator: patmon@ufp.edu.pt

Thank you very much!

A- Inquérito /Survey

Consentimento Informado para acesso ao Formulário

Compreendi a explicação que me foi fornecida acerca da participação na investigação a realizar, bem como do estudo em que serei incluído. Foi-me dado oportunidade de fazer perguntas que julguei necessárias e de todas obtive resposta.

Foi-me informado que tenho o direito a todo o tempo a minha participação no estudo, sem que isso possa ter qualquer prejuízo pessoal. Foi-me assegurado que os registos em suporte digital serão confidenciais e utilizados única e exclusivamente para o estudo em causa, sendo guardados em local seguro durante a pesquisa e destruídos após a conclusão.

Aceito e autorizo participar nesta investigação mediante o preenchimento do seguinte inquérito constituído por 4 grupos de questões (dados demográficos, académicos, sobre o conhecimento e sobre as atitudes).

_____Sim
_____Não

____Autorizo que os dados agora recolhidos sejam usados pela equipa de investigação, de forma totalmente anonimizada para publicação científica devidamente autorizada.

____Sim
____Não

Solicitamos a sua colaboração, respondendo ao seguinte INQUÉRITO**, com uma duração de cerca de 15 minutos.**

Informed consent to access the form

I have understood the explanation given to me about taking part in the research to be carried out, as well as the study in which I will be included. I was given the opportunity to ask any questions I felt necessary, and all of them were answered.

I was informed that I have the right to participate in the study at all times, without any personal detriment. I have been assured that the digital records will be confidential and used solely and exclusively for the study in question, and that they will be kept in a safe place during the research and destroyed once it is finished.

_____*I accept and authorize participation in this research by completing the following survey consisting of 4 groups of questions (demographic, academic, knowledge and attitudinal data; information and informed consent for future lines of support to be promoted and provided to the academic community of UFP students in the field of oral health).*

_____ *Yes*
_____*No*

____*I consent to the data now collected being used by the research team in a totally anonymized form for duly authorized scientific publication.*

____*Yes*
____*No*

We ask for your co-operation by answering the following SURVEY ***which will take about 15 minutes.***

ONLY those who accept to participate – LINK to Survey.

1- Dados Demográficos

1- Demographic data

1.1 - Data de Nascimento/ *Date of birth***: ____/___/_____ (DD/MM/AAAA; DD/MM/YYYY)**
1.2 – Idade (anos) / *Age (years)***:_____**
1.3 - Género / *Gender***:**
Masculino/Male
Feminino/ Female
1.4- Nacionalidade / *Nationality***:_____**
2- Dados Académicos atuais
2- *Current Academic data*
2.1 –Curso que está a frequenter / Course you are attending_____
2.2 –Faculdade na UFP / *UFP Faculty***:**
Selecionar uma opção / Select one option:

Faculdade de Ciências Humanas e Sociais (FCHS)
Faculty of Human and Social Sciences UFP (FHSS)

Faculdade de Ciências e Tecnologia (FCT)/
Faculty of Sciences and Technology (FST)

Faculdade de Ciências da Saúde (FCS)
Faculty of Health Sciences (FHS)
2.3 – Ano Curricular em que está inscrito / *Curricular year in which you are enrolled***:**
Selecionar uma opção / Select one option:

- **1º ano /1st year**
- **2º ano /2nd year**
- **3º ano /3nd year**
- **4º ano /4nd year**
- **5º ano /5nd year**
- **Mestrado Cientifico**
  Scientific Master's
- **Doutoramento**
  Doctorate
- **Outra condição**
  Other condition

2.4- Há quantos anos é aluno na UFP? / *How many years have you been a student at UFP?:_____(resposta aberta Numero de anos)/(Open response: Number of years)*
3- Dados Sobre Conhecimento de desgaste erosivo dentário
3- Data on knowledge of erosive tooth wear.

C1- O desgaste dentário erosivo é uma forma de cárie dentária
K1- Erosive tooth wear is a form of cavities and tooth decay
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C2- O desgaste erosivo dos dentes é causado por bactérias.
K2- Erosive tooth wear is caused by bacteria
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C3- O desgaste erosivo dos dentes é uma doença irreversível.
K3- Erosive tooth wear is an irreversible disease
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C4- Uma das principais causas do desgaste dos dentes é o ácido presente nos alimentos e nas bebidas
K4- *One leading cause of tooth wear is acid in our food and drinks*
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C5- A saliva é um dos mecanismos de defesa mais importantes contra a erosão
K5- Saliva is one of the most important defence mechanisms against erosion
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C6- O desgaste dentário erosivo pode ocorrer se trabalhar frequentemente em ambientes ácidos
K6- Erosive tooth wear can occur if you often work in acidic environments
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C7- A erosão dentária pode ocorrer se vomitar frequentemente.
K7- Dental erosion can occur if you often have to vomit.
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C8- Escovar os dentes imediatamente após o consumo de alimentos ou bebidas ácidas pode agravar o desgaste dentário erosivo
K8- Brushing your teeth immediately after consuming acidic food or drinks may make erosive tooth wear worse
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C9- Beber antes de ir dormir é um fator de risco para o desenvolvimento de desgaste dentário erosivo
K9- Drinking before going to bed is a risk factor for developing erosive tooth wear
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C10- Beber imediatamente após um exercício físico intenso aumenta o risco de desgaste dentário erosivo
K10 - Drinking immediately after strenuous exercise increases a person's risk for erosive tooth wear
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C11-*O desgaste erosivo dos dentes pode causar dor e sensibilidade*
K11- Erosive tooth wear may lead to pain and sensitivity
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C12- O desgaste dentário erosivo pode levar a perda progressiva das superfícies dentária
K12- Erosive tooth wear can lead to the progressive loss of the surface of the tooth
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C13- Beber uma garrafa inteira de refrigerante em várias sessões, em vez de apenas numa sessão, diminui o risco de desgaste dentário erosivo
K13-Drinking a whole bottle of soda in several sittings rather than in just one sitting decreases a person's risk for erosive tooth wear
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Don´t know

C14- A utilização de uma pasta dentífrica com flúor previne o desgaste erosivo dentário
K14-Using a fluoride toothpaste will prevent erosive tooth wear
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

C15- Usar uma palhinha quando bebe refrigerantes pode ajudar a evitar o desgaste erosivo dos dentes
K15- Using a straw when you drink soda may help avoid erosive tooth wear
(Um opção apenas)
Verdadeiro /True
Falso / False
Não sabe /Dón´t know

4- Dados Sobre Atitudes e desgaste erosivo dentário
4- Data on attitudes and erosive tooth wear.

A1- Acho que a Saúde oral é tão importante como a saúde geral.
A1- I think oral health is just as important as general health
(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree

Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

A2- Acho que prevenir é melhor do que remediar
A2 - I think prevention is better than cure.
(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree
Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

A3- É essencial visitar um dentista pelo menos de seis em seis meses para um check-up dentário regular
A3- It is essential to visit a dentist at least every half year for a regular dental check-up
(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree
Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

A4- Pensaria que é mau se soubesse que os meus dentes foram danificados por ação de ácidos
A4 - I would think that it is bad if I learned that my teeth had been damaged by acid

(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree
Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

A5- Vale a pena dedicar mais tempo e energia ao estudo do conhecimento sobre o desgaste dentário erosivo
A5. It is worth spending more time and energy on studying knowledge about erosive tooth wear
(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree
Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

A6- **Tenho a preocupação de saber se as bebidas que consumo são ácidas ou não**
A6- I am concerned with whether or not drinks I consume are acidic
(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree
Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

A7- Tenho a preocupação em saber se uma pasta de dentes contém ou não flúor

A7- I am concerned with whether or not a toothpaste contains fluoride
(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree
Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

A8- Para prevenir o desgaste erosivo dos dentes, mudaria os meus hábitos alimentares (como controlar o consumo de refrigerantes)
A8-To prevent erosive tooth wear, I would change my dietary habits (such as controlling my consumption of soft drinks)
(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree
Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

A9- Para prevenir o desgaste erosivo dos dentes, eu alteraria os meus hábitos de comportamento (como, beber usando uma palha)
A9- To prevent erosive tooth wear, I would change my behavior habits (such as drinking from a straw)
(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree
Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

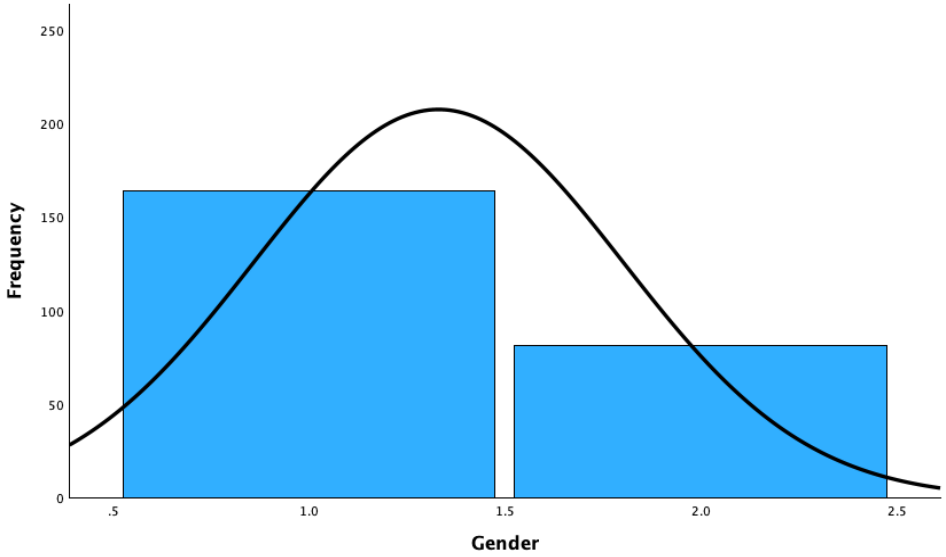
A10- Eu procuraria um médico dentista imediatamente se soubesse que meus dentes foram danificados por ação ácida
A10- I would see a doctor immediately if I learned that my teeth had been damaged by acid
(Um opção apenas)
Discordo bastante / strongly disagree
Discordo / disagree
Não concordo nem discordo / neither agree nor disagree
Concordo / Agree
Concordo bastante / strongly agree

FONTE: Hong, D.-w., Lin, X.-j., Wiegand, A. e Yu, H., (2020). Knowledge of and attitudes towards erosive tooth wear among students of two Chinese universities. *BMC Oral Health* [em linha]. **20**(1). [Consultado em 1 de dezembro de 2023]. Disponível em: doi: 10.1186/s12903-020-01105-7

Annex 2 - Histograms and Shapiro-wilk test for UFP Students gender, age, nationality (EU and non-EU), curricular year, graduation training (DSs and NMSs), Knowledge of and attitude of ETW, data distribution.

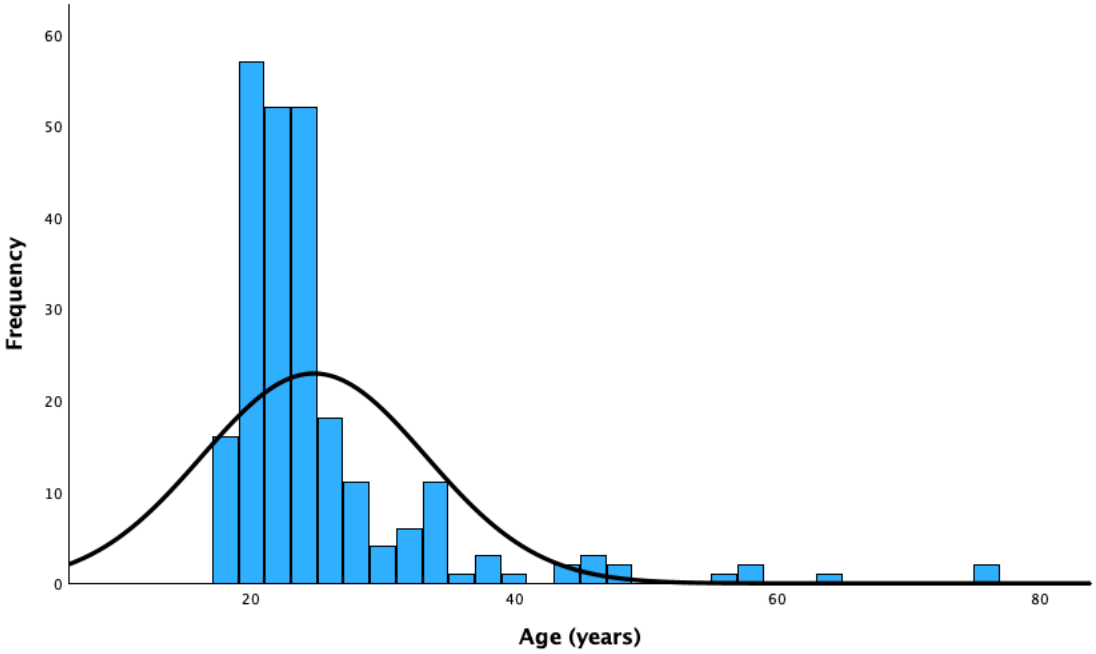
Gender (n; %)

Female	n=164 (66.9%)
Male	n=81 (33.1%)
Shapiro-Wilk Normality test	**<0.001**



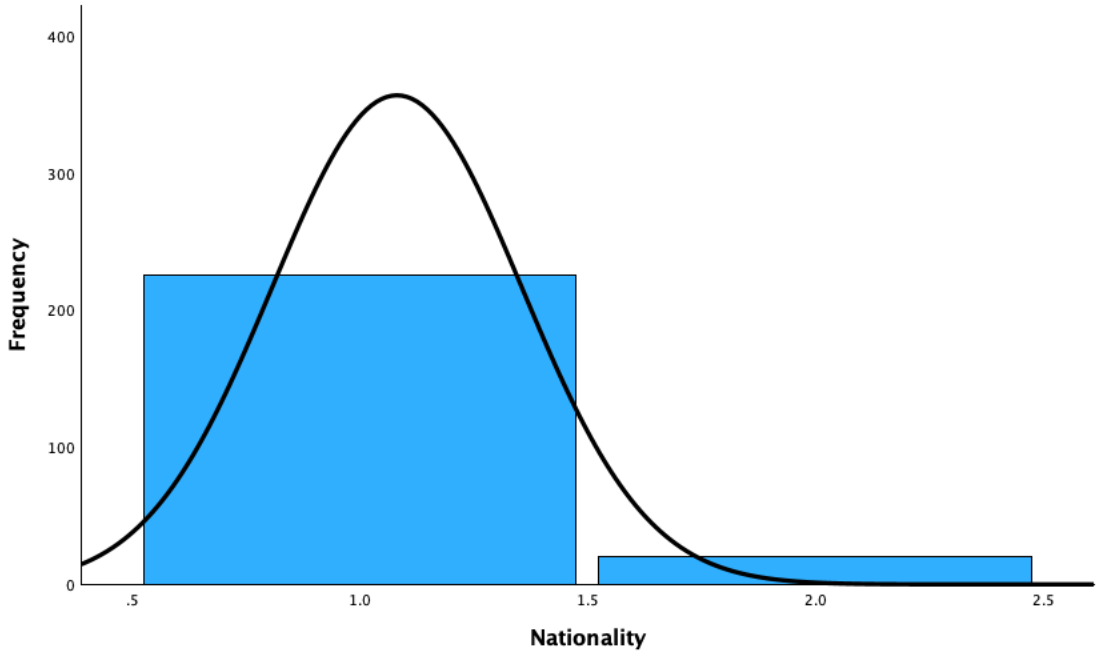
Age (years)

Shapiro-Wilk Normality test	**<0.001**



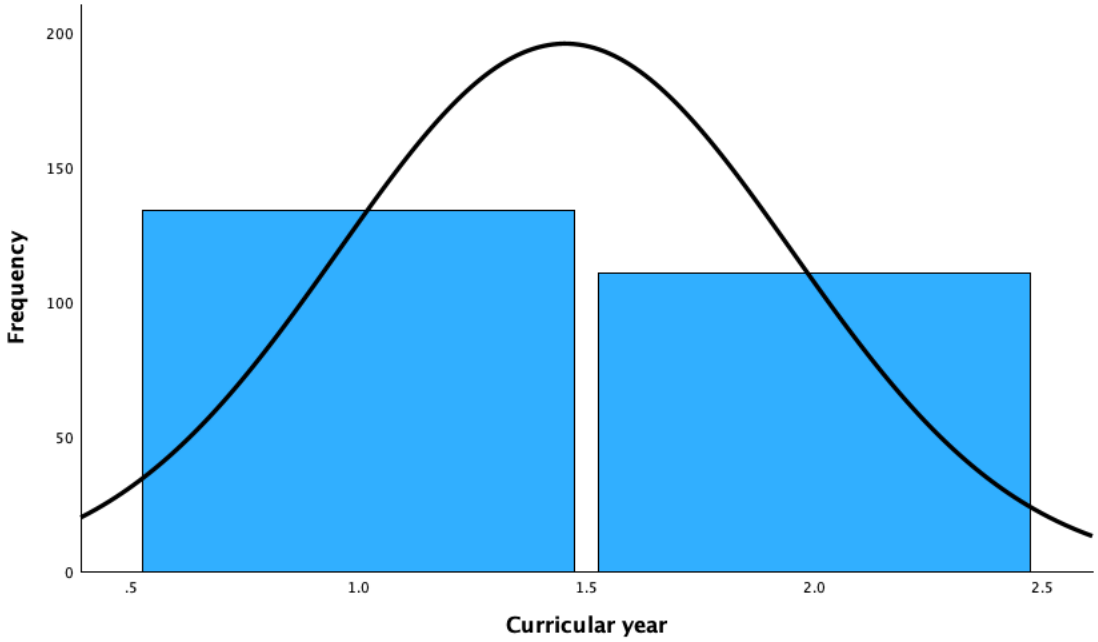
Nationality (n; %)

EU students	n=225 (91.8%)
Non-EU students	n=20 (8.2%)
Shapiro-Wilk Normality test	**<0.001**

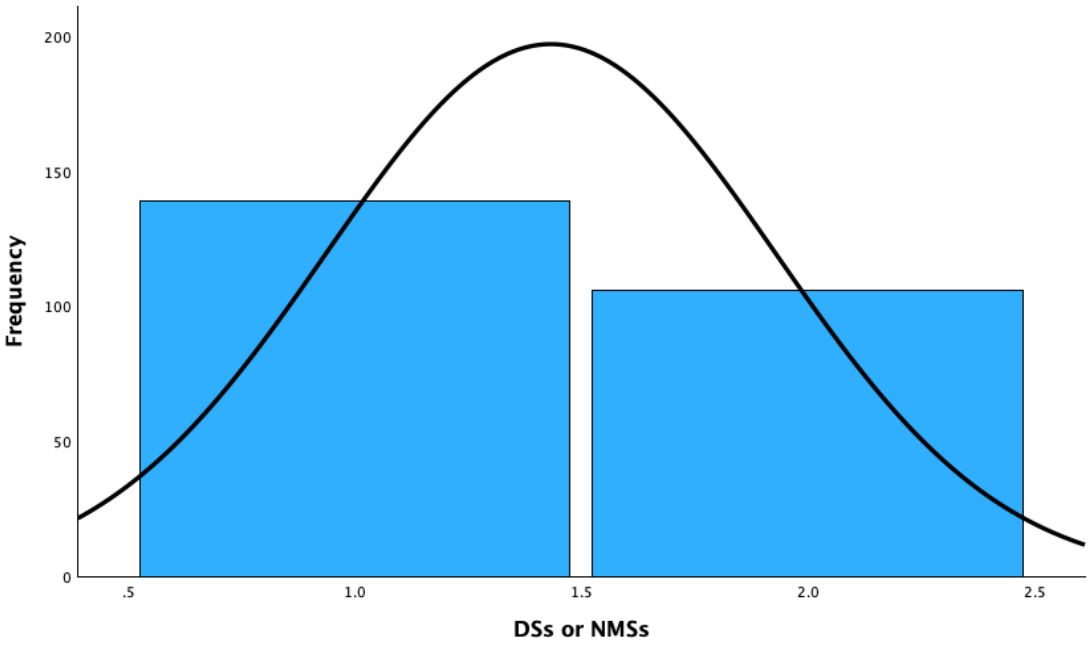


Curricular year (n; %)

≤ 3 years	n=134 (54.7%)
> 3 years	n=111 (45.3%)
Shapiro-Wilk Normality test	**<0.001**

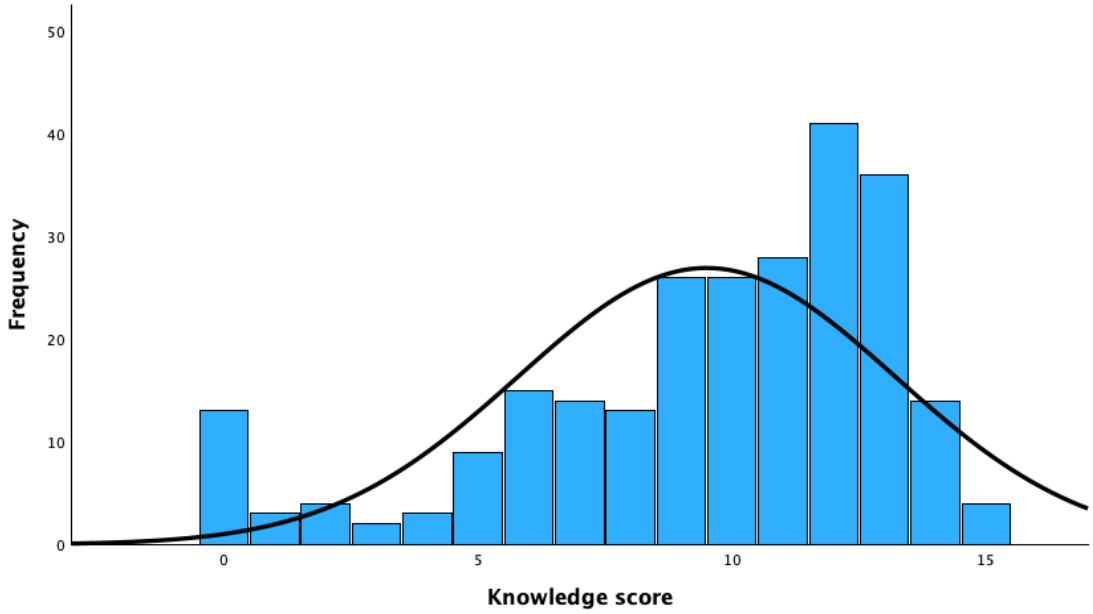


DSs	n=139 (56.7%)
NMSs	n=106 (43.3%)
Shapiro-Wilk Normality test	**<0.001**



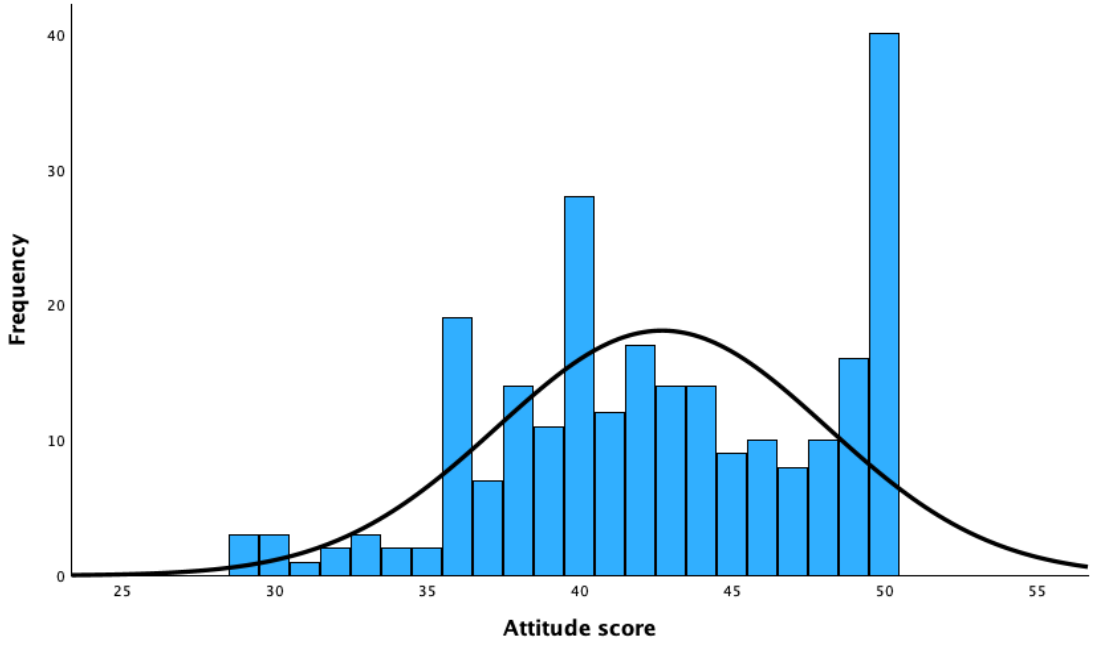
Knowledge score

Shapiro-Wilk Normality test	**<0.001**



Attitude score

Shapiro-Wilk Normality test	**<0.001**



Annex 3 - Main description of the Cross-sectional studies of Erosive Tooth Wear from 2013 to 2023.

REFERENCE	AIMS	POPULATION AND CONTROL (IF APPLICABEL)	MAIN RESULTS	MAIN CONCLUSIONS
Skudutyte-Rysstad et al., (2013)	To describe awareness and attitudes related to dental erosive wear.	In Oslo, all 18-year-old subjects (n = 3,206) scheduled for routine examination at the Oslo Public Dental Service clinics in 2008 were invited.	45% of 18-year-olds participated. 88% had erosive tooth wear (ETW), but only 56% were aware of it, and 47% recalled their dentist mentioning it.	Participants with erosive wear were more likely to have low or moderate positive attitudes towards acidic drink consumption and to be reluctant to change.
C. H. Chu et al., (2015)	To describe the prevalence and severity of dental erosion and caries experience of Chinese university students in Hong Kong.	First-year Chinese students were invited to a dental clinic at a university campus in Hong Kong during their freshman orientation. Factors affecting dental status were investigated through a questionnaire, and clinical examinations were conducted by three calibrated dentists.	Among 600 participants aged 18-21, 44% showed some dental erosion signs, with severe erosion found in 1%. Most (69%) had caries experience, with a mean DMFT score of 2.5	Nearly half of the Chinese Hong Kong university students had signs of dental erosion, but very few showed signs of severe erosion. Caries experience was widespread but not high.
Al-Ashtal et al., (2015)	This study explored Yemeni dentists' and dental students' knowledge about the associated factors, approaches to diagnosis and preventive methods of dental erosion (DE), as well as any associations between DE awareness and some potentially related variables.	General dental practitioners (n = 323) in Sanaa and fifth-year dental students (n = 97) at the University of Science and Technology, Sanaa, Yemen, were surveyed from July to November 2013 using a self-administered questionnaire. Descriptive and	79% response rate. 61% learned about dental erosion from dental school, while 27% from their own studies. Most respondents believed acidic drinks caused dental erosion and considered dietary	In-depth knowledge about causative factors, diagnosis and preventive methods of DE was apparent among only half the respondents and approaches to early diagnosis were insufficient. There would appear to be an urgent need for enhancing awareness and knowledge about

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		logistic regression analyses were performed.	history important for diagnosis.	DE within the Yemeni dental community.
Søvik et al., (2015)	This study aimed to investigate the association between dental erosive wear and potential background, behavioural and dietary risk indicators and to assess whether there is a dose-response relationship between the level of acidic beverage consumption and dental erosive wear among adolescents.	Of 846 adolescents (aged 16–18 years) scheduled for dental recall examinations, 795 (94%) participated. Logistic regression analyses were conducted to assess the association between erosive lesions and risk indicators.	Knowledge about erosive tooth wear depended on educational level and past dental information received. Most preferred acquiring information from oral health care professionals.	In the present study, multivariate logis- tic analyses revealed a significant association between the dental erosive wear and high consumption of sour sweets and sports drinks.
Brandt et al., (2017)	The aim of this study was to evaluate whether there is an association between risk behavior for eating disorders (EDs) and dental erosion and caries.	A controlled cross-sectional study in Brazil involved 850 randomly selected female adolescents.	260 individuals with eating disorders completed the questionnaire. Many were concerned about their teeth and desired their dentist's intervention regarding their eating disorders.	Therefore, high severity risk behavior for EDs was not significantly associated with dental caries and dental erosion. However, high BMI was a risk factor for developing eating disorders and should be an alert for individuals with this condition.
Antunes et al., (2017)	This cross-sectional study assessed the prevalence and potential risk factors for dental erosion in amateur athletes at running events.	108 runners from Rio de Janeiro, Brazil, were selected and examined for dental wear by a single trained evaluator.	Dental students had significantly higher knowledge and attitude scores towards erosive tooth wear compared to	In conclusion, dental erosion was not associated with use of isotonic drinks. However, frequency of exercise per week and gastroesophageal reflux were risk factors for dental erosion.

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			medical and non-medical students.	
Verploegen & Schuller, (2019)	The aim of this study was to learn more about levels of knowledge relating to erosive tooth wear and about the most desirable way of disseminating dental information among young adults.	A cross-sectional study of 331 young adults (20–25 years old) attending 25 dental care practices was conducted. Participants completed a questionnaire on their background and knowledge of erosive tooth wear.	Dental erosion awareness rate was 92.1%. Greater age and studying certain subjects correlated with lower awareness. Better awareness correlated with reduced acidic beverage consumption.	There is a lack of knowledge among young adults about erosive tooth wear. They prefer to receive information from the oral health care professionals accompanied by tailored information in writing. Further research should focus on developing this tailored information in line with the advice given by the oral health care professional.
Dynesen et al., (2018)	This study aimed to uncover knowledge, experience, and attitude of oral health and oral health behavior among persons with EDs.	260 persons with eating disorders completed an electronic questionnaire in a cross-sectional study.	21.2% of children showed signs of erosion, with higher scores in urban areas. Daily consumption of carbonated drinks was associated with lower erosion prevalence.	However, participants with less-positive experiences stated that there is a need for dentists with spe- cialized knowledge about EDs and communication skills that emphasize an open, empathic, recognition approach from the dentist toward patients with EDs.
(Hong et al., 2020)	To assess the knowledge of and attitudes towards erosive tooth wear among dental, medical, and	A pilot study (n = 120 students) analyzed the psychometric properties of a questionnaire on knowledge and attitudes towards	19.4% prevalence of dental erosion among runners. Factors like gastroesophageal reflux	Dental students had more accurate knowledge of and more positive attitudes towards erosive tooth wear than medical and non-

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	non-medical university students of two Chinese universities.	erosive tooth wear. The questionnaire was distributed to dental, medical, and non-medical students (n = 635) via an online survey system.	and running frequency correlated with erosion.	medical students. In this population, a positive correlation was established between knowledge of and attitudes towards erosive tooth wear.
Schmidt & Huang, (2022)	This study aimed to measure the awareness of dental erosion to establish the relationships among sociodemographic factors, awareness and knowl- edge of dental erosion, and beverage consumption behaviours, in a sample of university students in Australia.	All undergraduate students enrolled in specific programs at an Australian University were invited to participate in a study involving an online questionnaire.	Adolescents with high severity eating disorders were not significantly more likely to show dental caries or erosion.	Erosive tooth wear is a relevant matter in dentistry, nutrition and public health. Within a university setting, the effect of education on oral health literacy and beverage consumption behaviour is confirmed. Dental and health professionals should actively educate the individuals and communities about dental erosion and motivate them to change acidic beverage consumption behaviours.
Jász & Szőke, (2022)	This cross-sectional observational study evaluated the frequency of dental erosion in 12-year-old school- children in Hungary and its connection to gender, geographical region, eating/drinking habits, and to socioeconomic factors, such as the educational level of their mothers.	A cross-sectional study examined 579 randomly selected children aged 12 in Hungary. Clinical examinations and self-administered questionnaires were used to assess oral hygiene, nutritional habits, and socioeconomic status.	A dose-response relationship was found between daily acidic drink consumption and dental erosive wear.	The prevalence of dental erosion among 12- year-old children in Hungary is not as high as reported previously in Western European countries. A positive correlation was observed between the consumption of carbon-

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Ramirez et al., (2022)	To explore the relationship between intrinsic and extrinsic factors and a high cumulative score of the Basic Erosive Wear Examination (BEWE) in a Chilean adult group.	A consecutive adult sampling (n = 553) from the Health Center in San Bernardo, Chile, was selected from September 2016 to January 2017. Dental exams were performed, and a hetero-applied questionnaire was administered to identify factors related to severe erosion tooth wear (BEWE ≥ 14).	Various factors like age, alcohol consumption, and health issues were associated with severe dental erosion.	Age, alcohol consumption, self-reported esophagitis, history of gastric symptoms, anorexia, and vitamin C intake were related as risk factors to high BEWE scores in this sample of Chilean adults in San Bernardo, Chile.