Caspian Journal of Internal Medicine 2026 (Summer); 17(3): 480-493
DOI: 10.22088/cjim.17.3.480

Review Article

Global prevalence of recurrent aphthous stomatitis among school and university students: a systematic review and meta-analysis

Ariana Rezaei Majd (DDS) [1]
Hossein-Ali Nikbakht (PhD) [2]
Pouyan Ebrahimi (MD) [3]
Amin Esmaeilnia Shirvani (MD) [3]
Simin Mouodi (MD, MPH, PhD) [2*]

1. Dental Materials Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran
2. Social Determinants of Health Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran
3. School of Medicine, Babol University of Medical Sciences, Babol, Iran

*** Correspondence:**
Simin Mouodi, Social Determinants of Health Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran

E-mail: dr.mouodi@gmail.com

Received: 29 March 2025
Revised: 12 Aug 2025
Accepted: 8 Oct 2025
Published: 1 Sep 2026

Abstract

Background: Aphthous lesions are common oral diseases that can affect the quality of life, especially in students, and are frequently triggered by factors such as stress. This study aimed to assess the global prevalence of recurrent aphthous stomatitis (RAS) among students.

Methods: This systematic review analyzed relevant evidence from international databases, including Scopus, PubMed/Medline, Web of Science, Embase, and Google Scholar, covering data from the earliest available records up to February 2025. Heterogeneity was assessed using Cochran's Q test and the I^2 statistic. Subgroup analyses were conducted based on gender, measurement tools, and target population, while meta-regression analysis was performed considering the study year.

Results: A total of 614 studies were reviewed, of which 28 met the inclusion criteria. Based on the random-effects model, the overall prevalence of RAS among the target population of students (both school and university students) was estimated to be 0.14 (95% CI, 0.06–0.24). The prevalence among school students was 0.12 (95% CI, 0.02–0.28), while among university students it was 0.15 (95% CI, 0.05–0.29). Furthermore, the prevalence of RAS was reported as 0.18 (95% CI, 0.05–0.36) in females and 0.10 (95% CI, 0.04–0.19) in males. Although the prevalence appeared to decrease over time, this reduction was not statistically significant (Reg Coef = -0.13, p = 0.115).

Conclusions: This study estimates the global prevalence of RAS among students to be 14%. The findings highlight the need for standardized strategies for the diagnosis and management of oral aphthous lesions in schools and universities.

Keywords: Aphthous stomatitis, Aphthae, Students, Prevalence, Systematic review.

Citation:
Rezaei Majd A, Nikbakht HA, Ebrahimi P, Esmaeilnia Shirvani A, Mouodi S. Global prevalence of recurrent aphthous stomatitis among school and university students: a systematic review and meta-analysis. Caspian J Intern Med 2026; 17(3): 480-493.

Oral health is a critical factor closely associated with general health and the incidence of various disorders (1). Aphthous lesions are one of the most common oral cavity disorders. Recurrent aphthous stomatitis (RAS), also known as recurrent oral aphthous inflammation, often manifests as recurrent episodes, making it a chronic condition. The prevalence of RAS in the general population is estimated to range from 5% to 25%, with onset typically occurring in childhood or adolescence (2). Aphthous lesions are characterized by painful, round or oval ulcers that are recurrent and self-limiting. Based on the number, size, and distribution of ulcers, RAS is classified into three main types: minor aphthous ulcers, major aphthous ulcers, and herpetiform ulcers (3). Minor aphthous ulcers are the most common form, accounting for approximately 70% to 85% of cases (4). These ulcers are less than 1 cm in diameter, have well-defined margins, and are superficial. They heal spontaneously within two weeks without leaving scars. Major aphthous ulcers are deeper and larger lesions that may take up to six weeks to heal and can leave scars. Herpetiform ulcers appear as numerous small, superficial ulcers that may take several weeks to heal (5).

Although RAS is not considered a severe public health threat, it can significantly impact the person's quality of life, especially depending on the ulcer location (6). Lesions on the tongue may interfere with speaking and eating, while those on the soft palate and posterior pharynx can cause pain during swallowing. The exact etiology of RAS is not clearly identified. However, an immune response is commonly observed, and researchers have proposed several influencing factors, including genetic predisposition, immune system dysregulation, hormonal changes, local trauma, bacterial and viral infections, nutritional factors, and stress (7, 8). Numerous medications have been recommended to alleviate symptoms, and treatment is generally symptomatic and multifaceted, varying based on predisposing factors (9). Students, both school and university students are one of the groups prone to RAS. The primary reason for this phenomenon might be related the high level of stress resulting from academic pressure and anxiety. Intensive schedules and the demand for success in educational programs and exams can reduce their rest time and also, by lowering nutritional quality, expose them to deficiencies in essential nutrients (10). Besides these factors, the peak age of disease onset ranges from 10 to 19 years, encompassing both school and university periods (11). The prevalence of RAS varies widely across studies, ranging from 5% to 60%, depending on the study type, the population under investigation, and the diagnostic criteria used (12).

Due to geographical and cultural differences that may influence the prevalence rate, the global prevalence of RAS has been reported to vary significantly. As we mentioned earlier, school and university students are more susceptible to develop oral aphthous lesions because of lifestyle change, lack of sleep, unbalanced diet, and educational environment, resulting in a higher prevalence of RAS compared to the general population (10). This condition not only affects their oral health but can also negatively impact their academic performance and social interactions. While several review studies have examined the epidemiology and pathophysiology of RAS in the general population (7, 13), few evidence could be found focusing specifically on the students, despite increased vulnerability of university and school students to RAS due to stress, nutritional deficits, and lifestyle factors. This systematic review addresses this critical gap by using data on the global prevalence of RAS specifically in student populations. A more precise understanding of the factors influencing the prevalence of this disease among students can contribute to more effective strategies for prevention and early treatment. Given the importance of this issue in public health, the findings of this research can be valuable for developing appropriate health and therapeutic strategies for school and university students.

Methods

Study design: The present study is a systematic review and meta-analysis on the prevalence of RAS among student populations, including school and university students. The reporting method of this study follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) checklist (14). Additionally, this study has been registered in the PROSPERO database with the registration code CRD420251018567.

Search strategy: We utilized Medical Subject Headings (MeSH) terms from PubMed to identify synonyms and related keywords. Specifically, we used the following MeSH terms: (Prevalence), (Epidemiology), (Students), and (Stomatitis, Aphthous) in our search. The search was conducted using international electronic databases, including Scopus, PubMed/Medline, Web of Science, and Embase, covering data from the earliest available records up to February 2025. Additionally, Google Scholar was searched to identify grey literature (15) (PubMed: ((((("Students"[Mesh] OR "Students, Public Health"[Mesh] OR "Students, Premedical"[Mesh] OR "Students, Pharmacy"[Mesh] OR "Students, Nursing"[Mesh] OR "Students, Medical"[Mesh] OR "Students, Health Occupations"[Mesh] OR "Students, Dental"[Mesh]) OR "Universities"[Mesh]) OR ("Schools"[Mesh] OR "School Nursing"[Mesh] OR "School Health Services"[Mesh] OR "School Dentistry"[Mesh] OR "Schools, Nursing"[Mesh] OR "Schools, Public Health"[Mesh] OR "Schools, Health Occupations"[Mesh] OR "Schools, Veterinary"[Mesh] OR "Schools, Pharmacy"[Mesh] OR "Schools, Nursery"[Mesh])) AND (("Prevalence"[Mesh] OR "Epidemiology"[Mesh] OR "epidemiology" [Subheading]) OR "Incidence"[Mesh])) AND (("Stomatitis, Aphthous"[Mesh]) OR (Recurrent aphthous stomatitis)).

Scopus: TITLE-ABS-KEY (("Prevalence" OR "Incidence" OR "Epidemiology" OR "Prevalences" OR "Epidemiologies" OR "Epidemics" OR "Morbidity" OR "Outbreaks" OR "Surveillance" OR "Endemics" OR "Occurrence" OR "Frequency" OR "Incidences" OR "Attack Rate" OR "Attack Rates" OR "Rate, Attack" OR "Person-time Rate" OR "Person time Rate" OR "Person-time Rates" OR "Rate, Person-time" OR "Rate, Secondary Attack") AND ("Stomatitis, Aphthous" OR "Aphthous Stomatitides" OR "Aphthous Stomatitis" OR "Stomatitides, Aphthous" OR "Canker Sore" OR "Canker Sores" OR "Sore, Canker" OR "Sores, Canker" OR "Ulcer, Aphthous"

OR "Aphthous Ulcer" OR "Aphthous Ulcers" OR "Ulcers, Aphthous" OR "Aphthae" OR "Periadenitis Mucosa" OR "Necrotica Recurrens" OR "Recurrent aphthous stomatitis") AND ("Students" OR "Student" OR "School" OR "university" OR "universities"))). We also reviewed the reference lists of the retrieved articles to find relevant studies. The data were imported into EndNote X7 software, and duplicated articles were automatically removed. Two researchers independently screened the articles.

Eligibility criteria: All observational (cross-sectional) studies that reported on the prevalence of aphthous stomatitis were included in the study, with no restrictions on time or location. All studies were required to report the prevalence of aphthous stomatitis specifically in university students or school children. Exclusion criteria were as following: 1) case reports, case series, review articles, in vivo, or in vitro studies; 2) studies that did not explicitly report the prevalence of aphthous stomatitis or did not provide sufficient data to calculate its prevalence; 3) studies that did not report the prevalence specifically in school students or college students populations; 4) studies that reported the prevalence in general terms (lifetime prevalence) without specifying a precise time frame or duration; 5) studies for which full-text access could not be obtained after contacting the corresponding author by email, if possible; 6) studies with duplicate data.

In general definition, three categories of prevalence rate are defined: current prevalence, prevalence at a specific time (usually one year), and lifetime prevalence (16). In this study, we used current prevalence as the primary measure, while prevalence over one-month, three-month, six-month, and one-year periods was analyzed as secondary analyses in studies that specifically reported these timeframes. Also, studies included in this systematic review were required to focus on students, defined as individuals enrolled in educational institutions, either at the school level (elementary, middle, or high school) or university level (17). We specifically focused on studies that reported the prevalence of RAS among these student populations. Studies that did not clearly specify the student population or those that involved other populations, such as teachers or general adults, were excluded.

Quality assessment: The qualitative assessment of the included studies was conducted using the Checklist for Prevalence Studies developed by the Joanna Briggs Institute (JBI). This tool evaluates various aspects of methodology and results in primary studies. The final score, based on the study quality, was categorized into one of three risk levels: Low, Moderate, or High (18). Two independent researchers carried out these tasks to ensure consistency and accuracy. Any discrepancies were resolved through discussion with the supervisor of our research team.

Screening of studies: The initial search for studies was conducted by two researchers. Additionally, study screening, data extraction, and quality assessment were independently performed by two individuals. In cases where discrepancies arose between the two reviewers, the team supervisor provided the final decision regarding the article.

Data extraction form: All final articles included in the study underwent data extraction using a pre-prepared checklist. This checklist contained details such as author name, year of publication, study period, sample size, country of study, gender (male/female), mean age, target population (school students/university students), type of assessment tool (questionnaire/examination), and prevalence of RAS.

Statistical analysis: The data were entered into statistical software, and analyses were performed using STATA 17.0 (Stata Corporation, College Station, TX). A random effects model was employed to account for heterogeneity across studies. Heterogeneity was assessed using Cochran's test and Higgins' I^2 test, as well as qualitative evaluations of inter-study differences by the researchers. Forest plots were utilized to display the effect size of each study and pooled estimates. To further investigate heterogeneity, methods such as meta-regression analysis and subgroup analysis were applied. A p-value < 0.05 was considered statistically significant.

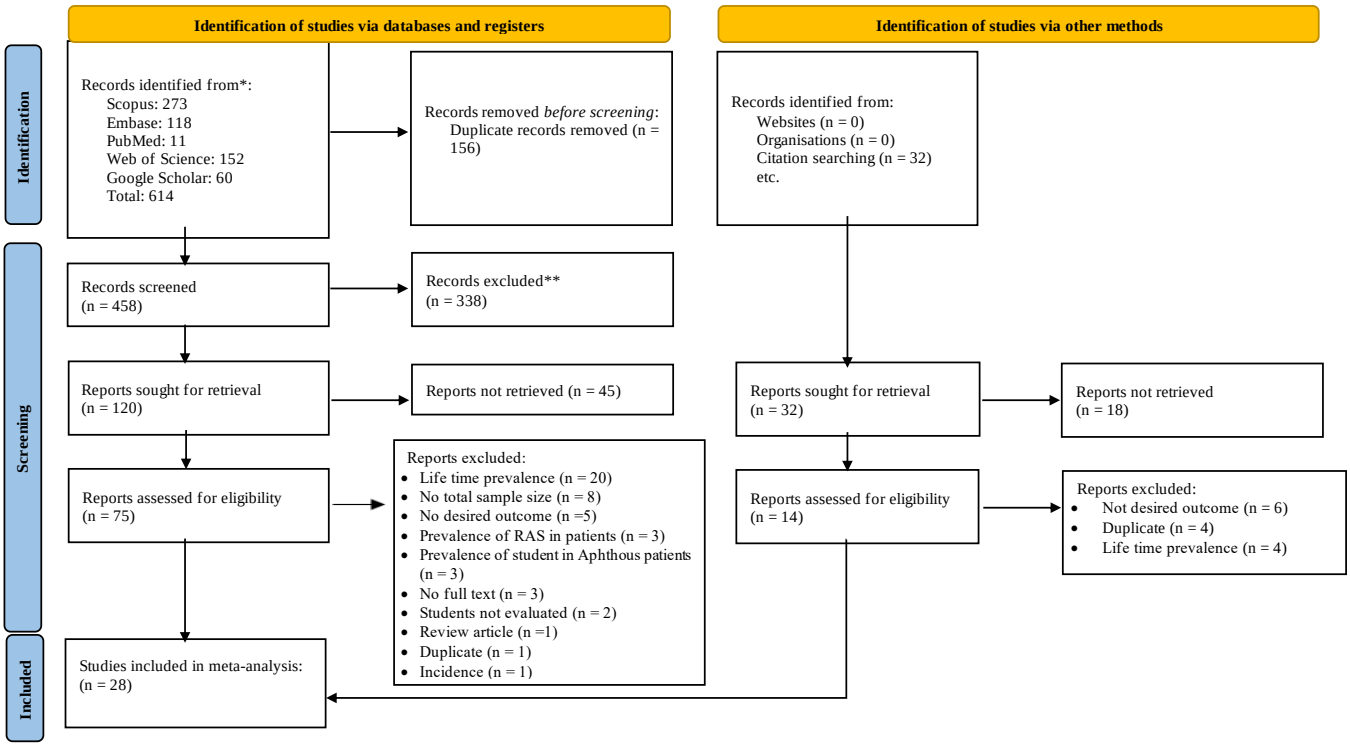
Publication bias: Publication bias was assessed using funnel plots and Egger's weighted regression test (19). If $p > 0.05$, it was assumed that no publication bias was present.

Results

Study selection: A total of 614 articles were identified through searches in national and international databases. After removing duplicate articles, 458 studies proceeded to the title and abstract screening stage. Following this screening, 75 articles were selected for full-text review, of which 28 studies were included in the final analysis. Additionally, the reference lists of the included articles were reviewed to identify any relevant studies. The study selection process is illustrated in figure 1. Despite the inclusion of Google Scholar in our search strategy to capture gray literature such as conference proceedings and dissertations, no eligible studies from these sources were identified during screening. Therefore, all included studies in the meta-analysis were peer-reviewed published articles.

Study characteristics: The 28 eligible studies, conducted over different time periods, investigated the prevalence of

RAS among students (school/university level), either as a whole or stratified by gender. Of these, 26 studies reported overall prevalence (both genders), while 7 studies provided prevalence data for females and 7 studies for males. Our comprehensive search strategy covered all relevant studies from the earliest available records up to February 2025 without any restriction on the starting year, and the included studies were published from 1962 to 2024. The majority of studies were conducted in India (ten studies), Iran (four studies), and Indonesia (four studies). Additionally, the method of diagnosis in 17 studies was based on questionnaires, while clinical examination was used in 11 studies. Furthermore, with the exception of five studies that reported the prevalence of aphthous stomatitis in school students, the remaining studies focused on college students. The average age of the overall population was 18.45 years with a standard deviation of 1.40 years. This data was derived from the 11 studies that reported the mean age and the 10 studies that provided the standard deviation for age. The descriptive characteristics of these studies are presented in table 1.



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).
**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation to ols.

Figure 1. Preferred reporting items for systematic reviews and meta-analyses (PRISMA) 2020 flow diagram for new systematic reviews, including database and other source searches.

Table 1. Basic information of included studies in the systematic review and meta-analysis

ID	Author (published year)	Year_Start	Country	Age range (Mean±SD)	sex	Instrument	Participants group	Total sample size	Quality assessment
1	**Afridi (2014) (28)**	2014	Pakistan	NA (NA)	All sex	Questionnaire	college students	200	Moderate
2	**Arma (2022) (29)**	2022	Indonesia	20 – 23 (21.3±0.77)	All sex	Questionnaire	college students	73	Moderate
3	**Aswad (2024) (30)**	2024	Iraq	21 – 28 (NA)	Female	Questionnaire	college students	148	Moderate
4	**Azfar (2021) (31)**	2020	Pakistan	> 18 (22.9±1.65)	All sex	Questionnaire	college students	150	Moderate
5	**Bisar (2021) (32)**	2018	India	18 – 25 (NA)	All sex	Questionnaire	college students	75	High
6	**Cankovic (2015) (33)**	2014	Serbia	23 – 26 (24.8±1.4)	All sex	Clinical Examination	college students	100	Moderate

ID	Author (published year)	Year_Start	Country	Age range (Mean±SD)	sex	Instrument	Participants group	Total sample size	Quality assessment
7	Darwis (2024) (34)	2023	Indonesia	16 – 22 (NA)	Female	Clinical Examination	college students	60	Moderate
8	Donatsky (1973) (35)	1973	Denmark	≥ 19 (mean = 21)	All sex	Questionnaire	college students	512	Moderate
9	Dua (2022) (36)	2021	India	18 – 24 (NA)	All sex	Questionnaire	college students	314	Moderate
10	Fathima (2024) (37)	2023	India	> 17 (10.5±1.8)	All sex	Questionnaire	college students	198	High
11	Hali (2023) (38)	2019	Iran	7 - 14 (NA)	All sex	Clinical Examination	school students	1780	High
12	Hameed (2018) (39)	2017	Iraq	NA (NA)	All sex	Questionnaire	college students	302	Moderate
13	Jahanbani (2012) (40)	2011	Iran	12 – 15 (13.2±0.9)	All sex	Clinical Examination	school students	1020	Moderate
14	Manoj (2023) (21)	2019	India	18 – 30 (NA)	All sex	Questionnaire	college students	681	Moderate
15	Mohammed Ali (2019) (41)	2019	Iraq	19 – 24 (NA)	All sex	Clinical Examination	college students	566	Low
16	Nivia (2014) (42)	2014	India	18 – 25 (NA)	All sex	Questionnaire	college students	314	High
17	Parlak (2006) (43)	2002	Turkey	13 – 16 (14.2±0.18)	All sex	Clinical Examination	school students	993	High
18	Pratibha (2012) (44)	2012	India	NA (NA)	All sex	Questionnaire	college students	341	Low
19	Probosari (2023) (45)	2022	Indonesia	9 – 13 (10.81±0.94)	All sex	Clinical Examination	school students	79	Low
20	Purnama (2021) (46)	2021	Indonesia	20 – 22 (NA)	All sex	Clinical Examination	college students	36	Low
21	Shirzaiy (2020) (47)	2015	Iran	12 – 17 (20.3±1.79)	All sex	Clinical Examination	school students	800	Low
22	Sawair (2010) (48)	2008	Jordan	17 – 29 (NA)	All sex	Questionnaire	college students	1000	Low
23	Sharma (2016) (49)	2014	India	17 – 28 (NA)	All sex	Clinical Examination	college students	500	Moderate
24	Sharma (2017) (50)	2017	India	NA (21.7±1.5)	All sex	Questionnaire	college students	160	Moderate
25	Ship (1967) (51)	1962	United States	NA (NA)	All sex	Clinical Examination	college students	343	Low
26	Thevara (2020) (52)	2020	India	18 – 22 (NA)	All sex	Questionnaire	college students	100	Moderate
27	Verma (2023) (53)	2006	India	NA (NA)	All sex	Questionnaire	college students	1134	Moderate
28	Ziaei (2022) (54)	2020	Iran	NA (22.2±2.4)	All sex	Questionnaire	college students	100	Moderate

Quality appraisal: The quality assessment results are shown in table 1. Based on the evaluation using the relevant checklist, 5 studies were classified as high quality, 16 as moderate quality, and 7 as low quality.

Results of the meta-analysis: Studies were first arranged based on the year of publication, and prevalence estimates were stratified by gender (male/female), target population (school students/university students), and assessment tool (questionnaire/examination). Additionally, a meta-regression analysis was performed based on the study year.

Pooled prevalence of RAS: A total of 28 studies met the inclusion criteria and were included in this systematic review. However, the primary meta-analysis focusing on the point prevalence (current prevalence) of recurrent aphthous stomatitis was conducted using data from 16 studies that specifically reported prevalence at a defined point in time. The remaining studies reported prevalence over varying timeframes such as one-month, three-month,

six-month, or one-year periods, and these were analyzed separately as secondary analyses. Based on the random-effects model, the overall prevalence was estimated at 0.14 (95% CI, 0.06–0.24) (I^2 = 99.19%, p < 0.001) (figure 2). Moreover, sensitivity analysis indicated that removing individual studies did not substantially alter the overall prevalence estimate (figure 3). A secondary analysis examined RAS prevalence over different timeframes: One-month prevalence (11 studies): 0.16 (95% CI, 0.12–0.20). Three-month prevalence (3 studies): 0.20 (95% CI, 0.07–0.39); Six-month prevalence (3 studies): 0.32 (95% CI, 0.18–0.48); One-year prevalence (6 studies): 0.38 (95% CI, 0.28–0.49) (figure 4).

Subgroup analysis of pooled prevalence of RAS based on gender, target population, and assessment tools: The prevalence of RAS by gender indicated a higher prevalence among females. Specifically, in 7 studies, the prevalence in females was estimated at 0.18 (95% CI, 0.05–0.36), while in 7 studies, the prevalence among males was 0.10 (95% CI, 0.04–0.19) (figure 5). Furthermore, prevalence by target population revealed that RAS prevalence was 0.12 (95% CI, 0.02–0.28) among school students (5 studies) and 0.15 (95% CI, 0.05–0.29) among university students (11 studies) (figure 6). Regarding assessment tools used in studies, findings indicated that RAS prevalence was higher in studies using clinical examination as a measurement tool. Specifically, in 9 studies, the prevalence estimated via clinical examination was 0.20 (95% CI, 0.07–0.39), while in 7 studies, the prevalence estimated via questionnaire-based assessments was 0.07 (95% CI, 0.03–0.12) (figure 7; table 2).

Table 2. Meta-analysis results and heterogeneity assessment of aphthous stomatitis prevalence among students

Subgroup presently prevalence		N of Study	Effect estimate	95 % CI	I^2 %	P-value
Total		16	0.14	0.06 – 0.24	99.19	<0.001
Gender	Male	7	0.10	0.04 – 0.19	97.49	<0.001
	Female	7	0.18	0.05 - 0.36	99.00	<0.001
Instrument	Clinical Examination	9	0.20	0.07 – 0.39	99.54	<0.001
	Questionnaire	7	0.07	0.03 – 0.12	92.89	<0.001
Participants	School students	5	0.12	0.02 – 0.28	99.48	<0.001
	College students	11	0.15	0.05 – 0.29	98.83	<0.001

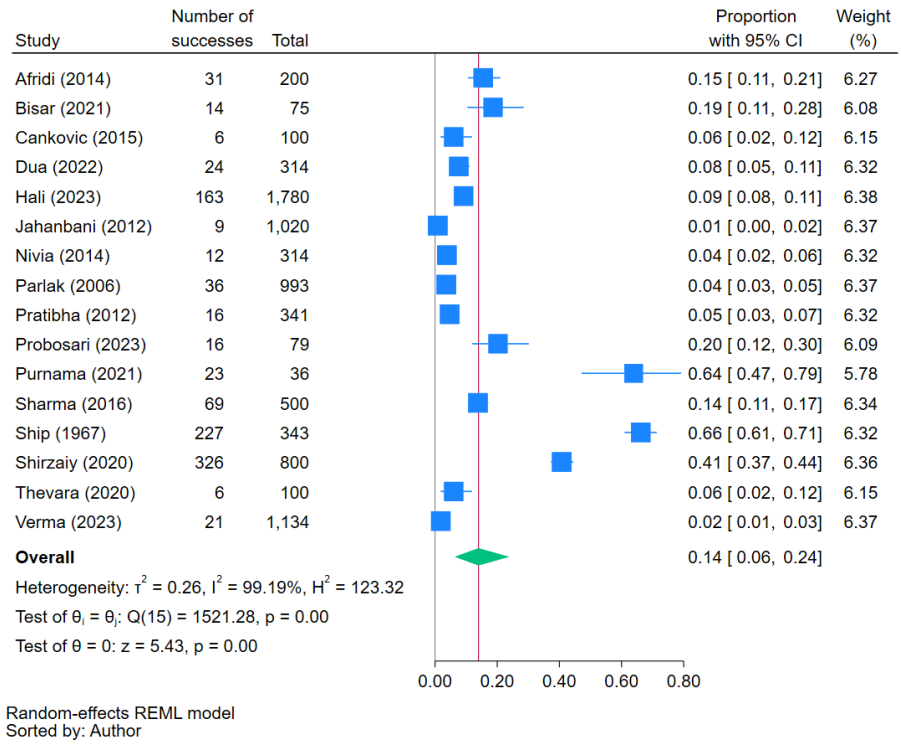


Figure 2. Forest plot illustrating the prevalence of aphthous stomatitis among students.

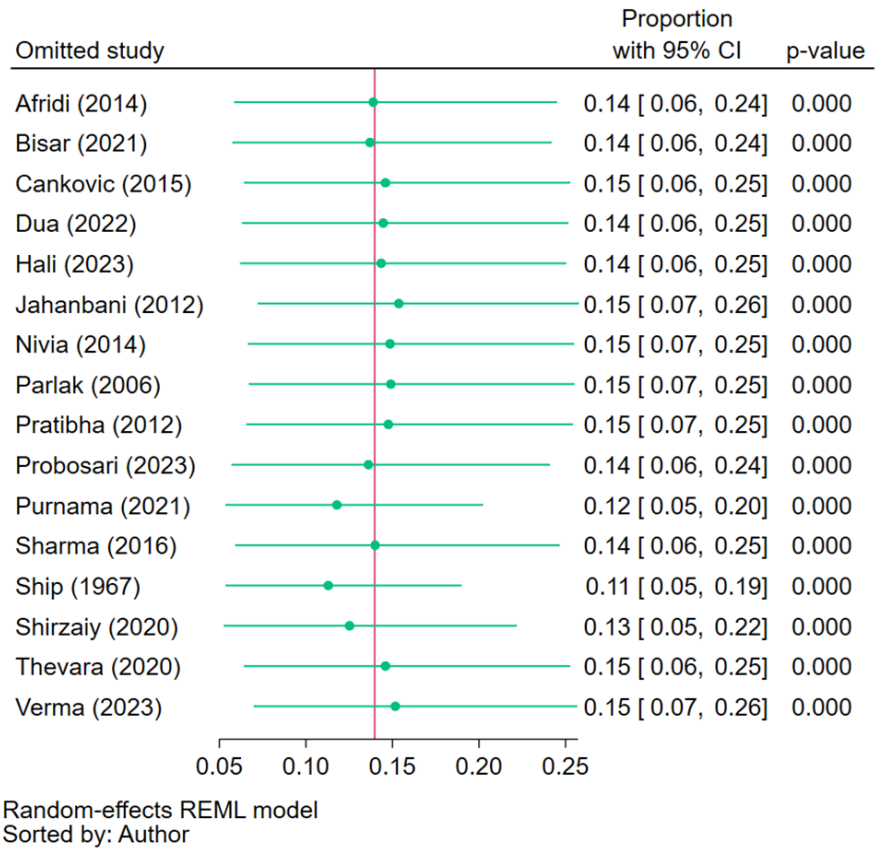


Figure 3. Sensitivity analysis results of the studies included in the meta-analysis with the exclusion of one study.

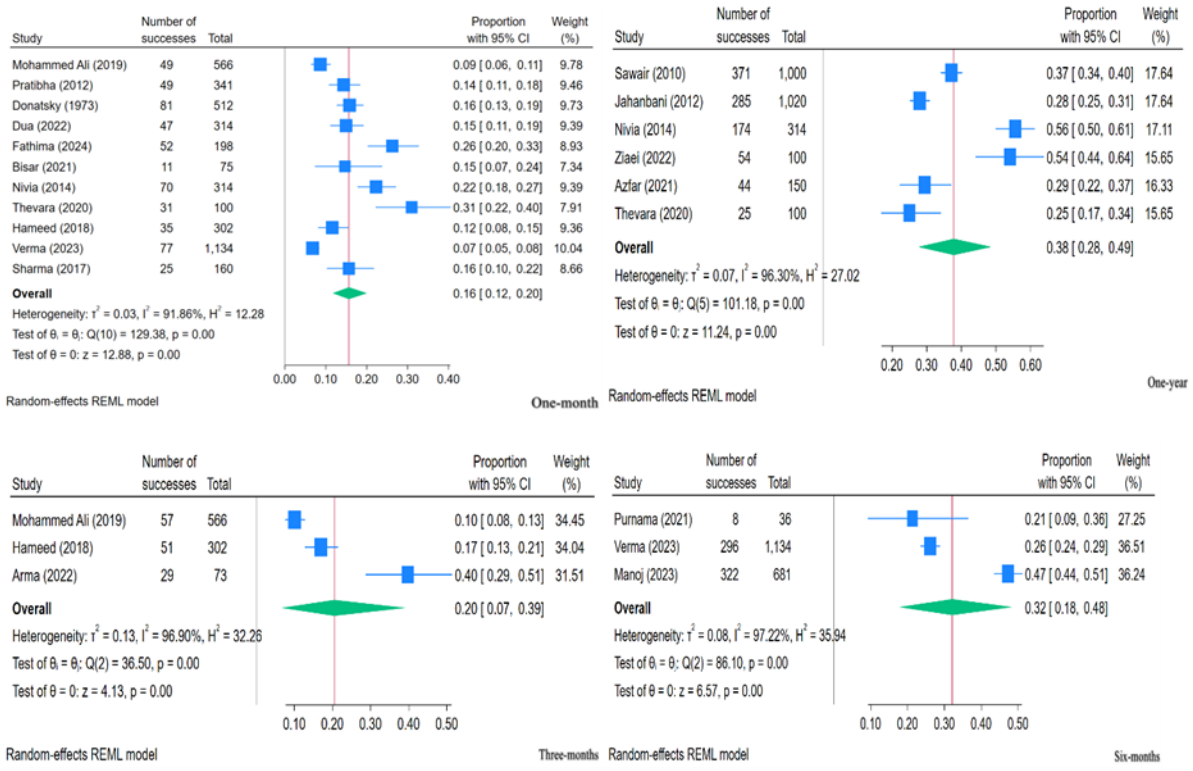


Figure 4. Forest plot of aphthous stomatitis prevalence among students, categorized by one-month, three-month, six-month, and one-year prevalence estimates.

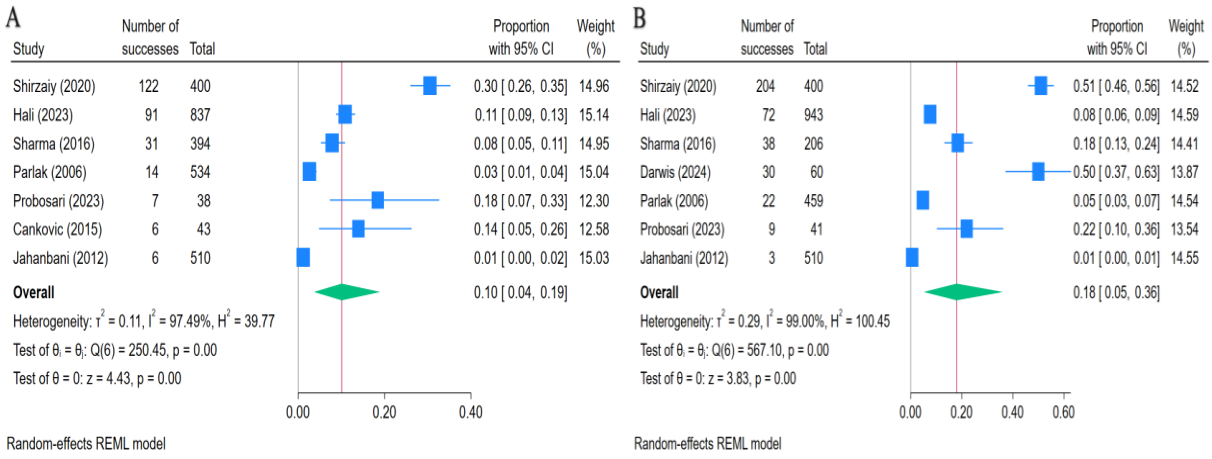


Figure 5. Forest plot depicting the prevalence of aphthous stomatitis stratified by gender (A: Male, B: Female).

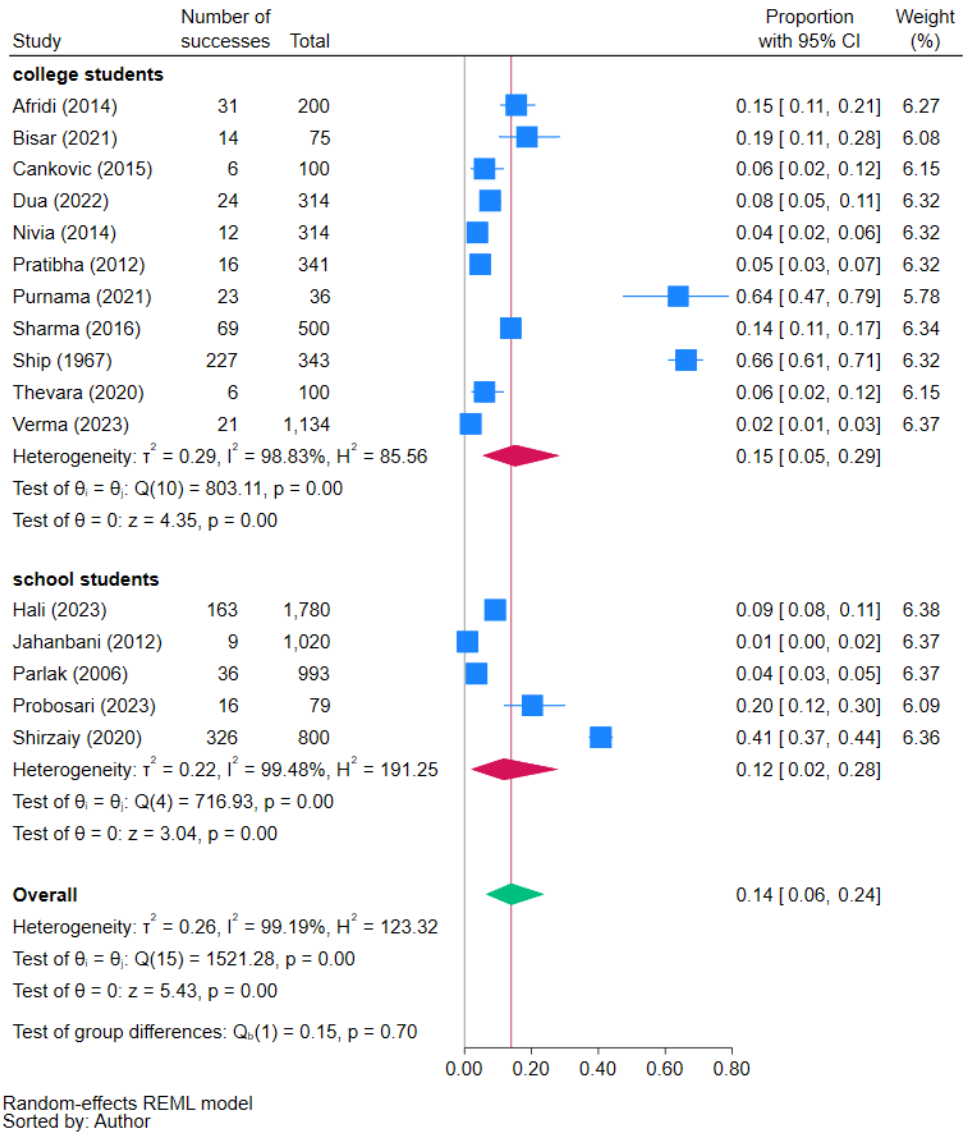


Figure 6. Subgroup meta-analysis of aphthous stomatitis prevalence among students, categorized by participant group.

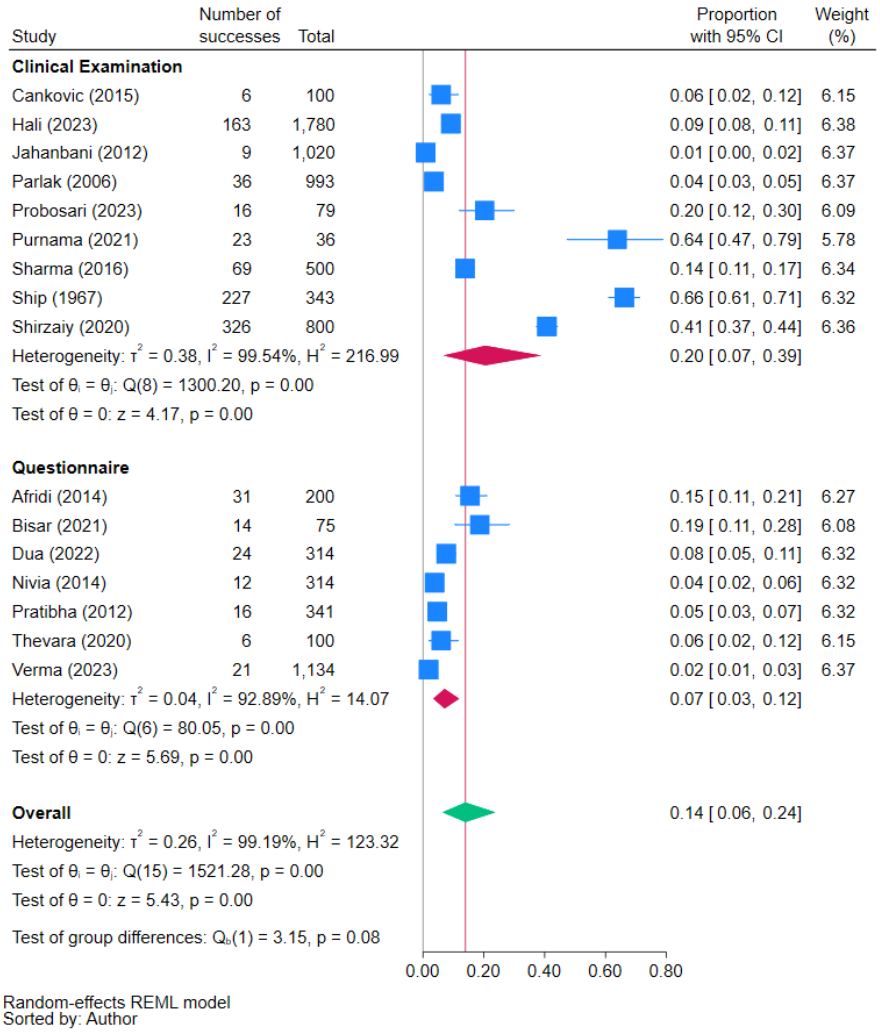


Figure 7. Subgroup meta-analysis of aphthous stomatitis prevalence among students, categorized by measurement instrument.

Meta regression of pooled prevalence of RAS based on start-year of data collection: The meta-regression analysis showed that although the prevalence of RAS declined in more recent studies, this trend was not statistically significant (Reg Coef = -0.13 (0.008), p = 0.115) (figure 8).

Publication bias evaluation: Finally, a funnel plot was constructed to assess publication bias in the prevalence estimates of RAS in the target population. The Egger test did not confirm the presence of publication bias (Bias: 5.62 (3.15), p = 0.074) (figure 9).

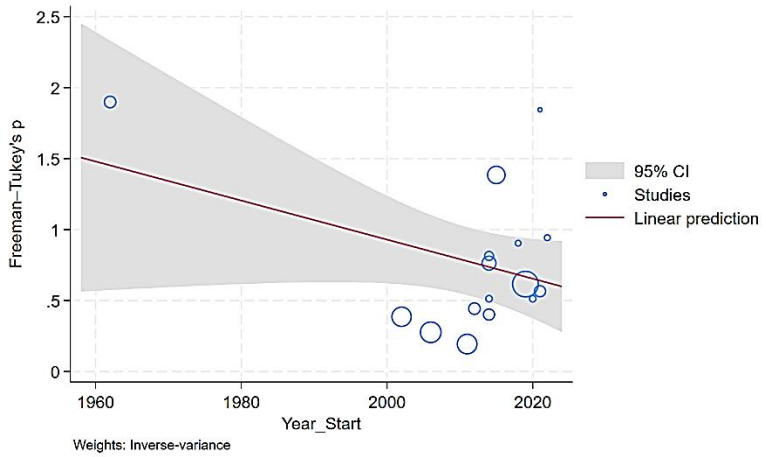


Figure 8. Meta-regression analysis of aphthous stomatitis prevalence among students based on the year of study

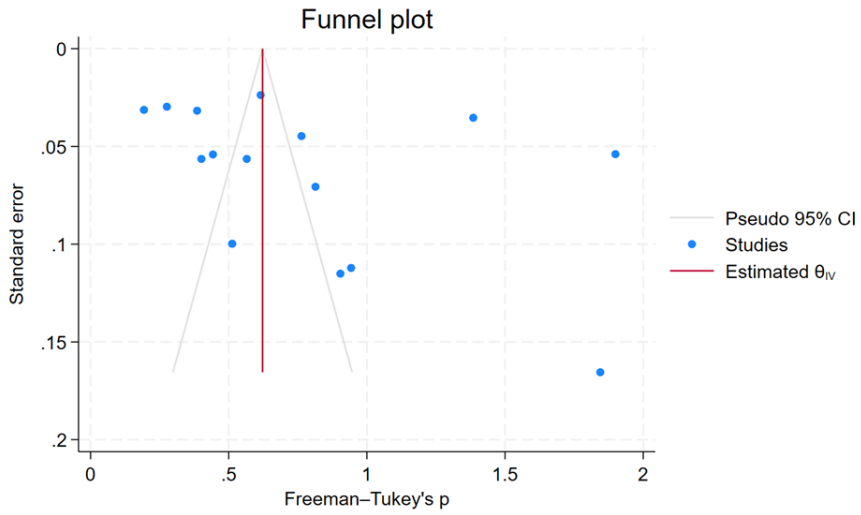


Figure 9. Funnel plot assessing publication bias in the included meta-analysis studies.

Discussion

This systematic review and meta-analysis estimated the global prevalence of RAS among students at 14%. The analysis based on the target population revealed no significant difference in prevalence between school students (12%) and university students (15%). A comparison of assessment tools used in different studies indicated that studies employing clinical examination reported a higher prevalence of RAS, with a rate of 20% using clinical examination and 7% using questionnaires. The prevalence analysis based on gender showed that women exhibited a higher prevalence of RAS at 18%, compared to 10% in men. Furthermore, the prevalence increased with the study timeframe, ranging from 16% for a one-month period to 38% for a one-year period.

Several studies worldwide have examined the prevalence of RAS among students. Taheri et al. investigated the prevalence of recurrent aphthous ulcers among 223 dental students at Kabul University of Medical Sciences, Afghanistan, using a questionnaire and reported a prevalence of 30% (20). Similarly, Manoj et al. conducted a survey-based study in India among 681 students from four colleges in Mangalore, finding that 322 participants (47.2%) had experienced RAS in the past six months, including 131 men (40.6%) and 191 women (59.3%) (21). Another study by Al-Johani et al. in Saudi Arabia assessed various aspects of RAS using a questionnaire among dental students. Out of 382 participants, 83 individuals (22%) had a history of RAS, comprising 45 women and 38 men (22). These findings align with our study, confirming a higher prevalence of RAS in women. In Iran, Haleh et al. conducted a study on 1,790 elementary school students from public schools and reported an overall prevalence of 32.8% based on medical history, while 9.2% were diagnosed at the time of examination. Interestingly, the prevalence at the time of examination was higher in boys (10.9%) than in girls (7.6%), whereas the lifetime prevalence was higher in girls (23). The higher prevalence of aphthous ulcers in women may be attributed to hormonal, immune, nutritional, and psychological factors. Fluctuations in estrogen and progesterone, particularly during menstruation or contraceptive use, can trigger or exacerbate these ulcers (24). Additionally, women's more active immune system predisposes them to autoimmune diseases, including RAS (25). Moreover, higher levels of stress and anxiety in women are recognized as contributing factors to the development of these ulcers (26). It is important to note that many of the individual studies, as well as the pooled estimate, had wide confidence intervals (6% - 24% for pooled prevalence of RAS). These wide intervals reflect a high degree of variability and uncertainty in the data, which may be attributed to factors such as heterogeneity in study populations, diagnostic methods, and geographical differences. While the sensitivity analysis suggested that no single study substantially altered the overall prevalence estimate, the wide confidence intervals highlight the need for caution when interpreting the findings. Further research with more homogenous study populations and standardized diagnostic criteria is needed to provide more precise estimates of the prevalence of RAS.

Our meta-analysis revealed that the prevalence of recurrent aphthous stomatitis (RAS) was higher when assessed through clinical examination (20%) compared to self-reported questionnaires (7%). This significant

difference may be attributed to several factors. One potential reason is detection bias, where clinical examination allows for more accurate identification of aphthous ulcers that may not be self-reported by individuals. Participants may not be fully aware of or may misinterpret the symptoms of RAS, particularly in cases where the ulcers are small or in locations that are difficult for individuals to observe, such as the posterior regions of the mouth. Additionally, self-reporting bias may play a role, as individuals may over-report or under-report their symptoms based on recall ability, social desirability, or lack of understanding of the condition. A study conducted in India also highlighted the limited reliability of self-assessment questionnaires in evaluating dental and periodontal health status as well as treatment needs among study participants (27). These factors suggest that clinical examination is a more reliable method for assessing RAS prevalence, as it minimizes the potential biases inherent in self-reporting.

This study provides a comprehensive evaluation of the global prevalence of RAS among students. The key strengths of this research include the use of multiple studies with large sample sizes and broad geographical diversity, enhancing the generalizability of the findings. Additionally, subgroup analyses based on gender, diagnostic duration, and assessment methods have contributed to a more detailed depiction of the disease prevalence. However, several limitations exist. These include heterogeneity among primary studies, variations in diagnostic criteria, and differences in reporting methods, all of which could impact the accuracy of the findings. Therefore, while our analyses provide valuable insights into the global prevalence of RAS, the substantial heterogeneity suggests that further research with standardized methodologies and more homogeneous study populations is needed to better understand the true prevalence of RAS. Moreover, many studies reported the prevalence of RAS as a lifetime measure, without a defined time frame, making it incompatible with inclusion in our meta-analysis. Additionally, the discrepancy in prevalence based on assessment methods was evident in our study, revealing a 20% prevalence with clinical examination versus 7% with questionnaires. This finding suggests that the pooled estimate was influenced by the different reporting methods and indicates potential underestimation of the true prevalence and influence of recall bias in questionnaire-based studies. Also, we acknowledge that the small number of studies in certain subgroups, such as the 5 studies for school students, may limit the statistical power. However, these analyses are valuable as they provide insights into the prevalence of RAS in specific populations, helping to identify variations across groups. Despite the limited statistical power, reporting these results enhances the understanding of the global prevalence of RAS and informs targeted interventions for vulnerable populations like school students. Although the sensitivity analysis indicated that no single study substantially altered the overall prevalence estimate, we acknowledge the potential impact of combinations of studies on the overall prevalence. Also, the wide confidence intervals reflect considerable uncertainty in the pooled prevalence estimate, and this variability should be considered when interpreting the results.

Based on our findings, the prevalence of RAS among students was estimated at 14%. This prevalence is highly dependent on diagnostic methods, highlighting the need for standardized assessment approaches. Given that students are particularly vulnerable to RAS due to academic stress and lifestyle changes, our findings emphasize the importance of establishing standardized strategies for the diagnosis and management of RAS. The clinicians who manage the health-care of the students should be aware that RAS is a common condition in this population, and maintain a high level of suspicion, particularly considering the potential exacerbation by academic stress. Diagnostic approaches should prioritize thorough clinical examination, as our results indicate this method yields higher detection rates compared to potentially less reliable self-reported questionnaires. Integration of oral health education into school and university health-care programs can help these students to receive timely services. Future studies employing standardized methodologies, defined time frames, and key risk factors are essential to enhance our understanding of the condition and improve treatment strategies in this population.

Acknowledgments

We are grateful to Health Research Institute, Babol University of Medical Sciences for its support in preparing this manuscript.

Funding: There is no funding support for this project.
Ethics approval: The research protocol was approved by the Ethics Committee of Babol University of Medical Sciences, Iran with identification number: IR.MUBABOL.REC.1404.107.
Conflict of interests: There is no conflict of interest.
Consent for publication: Not applicable.
Authors' contribution: The concept for this study was developed by P.E. and H.A.N. Data searches and extraction

were carried out by A.R.M., P.E., and A.E.S. The data sets were analyzed and the results interpreted by H.A.N. and P.E. The manuscript was drafted and edited by P.E., A.E.S., H.A.N., and S.M. After incorporating feedback and revisions, the final version of the manuscript was collaboratively drafted by all authors. The final manuscript was thoroughly reviewed and approved by all authors.

Data availability: Detailed data are included in the manuscript and supplementary files. Upon reasonable request, the corresponding author can provide additional data.

References

1. Fiorillo L. Oral health: The first step to well-being. Medicina (Kaunas) 2019; 55: 676.
2. Belenguer-Guallar I, Jimenez-Soriano Y, Claramunt-Lozano A. Treatment of recurrent aphthous stomatitis. A literature review. J Clin Exp Dent 2014; 6: e168-74.
3. Xiao X, Shi Z, Song Z, Liu S. A bibliometric study on research trends and hotspots of recurrent aphthous stomatitis. J Dent Sci 2024; 19: 1564-70.
4. Queiroz S, Silva M, Medeiros AMC, et al. Recurrent aphthous ulceration: an epidemiological study of etiological factors, treatment and differential diagnosis. An Bras Dermatol 2018; 93: 341-6.
5. Ashwinirani SR, Rajmane Y, Suragimath G, et al. Prevalence of recurrent aphthous stomatitis in western population of Maharashtra, India. J Oral Res Rev 2017; 9: 25-8.
6. Giannetti L, Murri Dello Diago A, Lo Muzio L. Recurrent aphtous stomatitis. Minerva Stomatol 2018; 67: 125-8.
7. Edgar NR, Saleh D, Miller RA. Recurrent aphthous stomatitis: A review. J Clin Aesthet Dermatol 2017; 10: 26-36.
8. Xu K, Zhou C, Huang F, et al. Relationship between dietary factors and recurrent aphthous stomatitis in China: a cross-sectional study. J Int Med Res 2021; 49: 3000605211017724.
9. Femiano F, Buonaiuto C, Gombos F, Lanza A, Cirillo N. Pilot study on recurrent aphthous stomatitis (RAS): a randomized placebo-controlled trial for the comparative therapeutic effects of systemic prednisone and systemic montelukast in subjects unresponsive to topical therapy. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010; 109: 402-7.
10. Rahmadhany IP, Mahdani FY, Surboyo MDC, Parmadiati AE, Cecilia PH, Sukmawati NF. Predisposing Factors for Recurrent Aphthous Stomatitis among Undergraduate Dental Students. J Health Allied Sci NU 2022; 13: 053-9.
11. Sánchez J, Conejero C, Conejero R. Recurrent aphthous stomatitis. Actas Dermo-Sifiliográficas (English Edition) 2020; 111: 471-80. [in English, Spanish]
12. Jurge S, Kuffer R, Scully C, Porter SR. Mucosal disease series. Number VI. Recurrent aphthous stomatitis. Oral Dis 2006; 12: 1-21.
13. Chavan M, Jain H, Diwan N, et al. Recurrent aphthous stomatitis: a review. J Oral Pathol Med 2012; 41: 577-83.
14. Page MJ, McKenzie JE, Bossuyt PM, et al. Updating guidance for reporting systematic reviews: development of the PRISMA 2020 statement. J Clin Epidemiol 2021; 134: 103-12.
15. Bonato S. Google Scholar and Scopus. J Med Libr Assoc 2016; 104: 252-4.
16. The National Institute of Mental Health. What is Prevalence? NIH 2025. Available from: https://www.nimh.nih.gov/health/statistics/what-is-prevalence. Accessed Oct 11, 2025.
17. Wikipedia. Student. WIKI 2025. Available from: https://en.wikipedia.org/wiki/Student#cite_note-1. Accessed Oct 11, 2025.
18. Munn Z MS, Lisy K, Riitano D, Tufanaru C. Methodological guidance for systematic reviews of observational epidemiological studies reporting prevalence and incidence data. Int J Evid Based Healthc 2015; 13: 147-53.
19. Begg CB, Berlin JA. Publication bias and dissemination of clinical research. J Natl Cancer Inst 1989; 81: 107-15.
20. Taheri MH, Eshraqi AM, Anwari A, Stanikzai AM. Prevalence of recurrent aphthous ulcers among dentistry students' in Kabul, Afghanistan: A questionnaire-based study. Clin Cosmet Investig Dent 2022; 14: 275-9.
21. Manoj MA, Jain A, Madtha SA, Cherian TM. Prevalence and risk factors of recurrent aphthous stomatitis among college students at Mangalore, India. PeerJ 2023; 11: e14998.
22. Al-Johani K. Prevalence of recurrent aphthous stomatitis among dental students: A cross sectional study. J Contemp Dent Pract 2019; 20: 893-5.
23. Hali H, Salehi Sarookollaei M, Molania T, et al. Evaluating the prevalence of recurrent aphthous stomatitis among children studying at public elementary schools in Sari County, Northern Iran in 2019 - Consensus. Tabari Biomed Student Res J 2023; 5: 11-6.
24. Isher DK, Behl AB, Singh A, et al. Prevalence of recurrent aphthous ulcers (RAUs) in the population of

ludhiana. J Indian Acad Oral Med Radiol 2022; 34: 437-41.
25. Gleicher N, Barad DH. Gender as risk factor for autoimmune diseases. J Autoimmun 2007; 28: 1-6.
26. Matud MP. Gender differences in stress and coping styles. Pers Individ Diff 2004; 37: 1401-15.
27. Balappanavar AY, Sardana V, Nagesh L, et al. Questionnaire vs clinical surveys: the right choice?--A cross-sectional comparative study. Indian J Dent Res 2011; 22: 494.
28. Afridi S, Kundi JA, Hayat F. Self-reported prevalence & associated factors for occurrence of recurrent aphthous stomatitis (RAS) in undergraduate medical & dental students. J Gandhara Med Dent Sci 2014; 1: 26-31.
29. Utmi Arma UA, Yenita Alamsyah YA. Relationship of sleep quality to the incidence of recurrent aftosa stomatitis, study in dentistry students of Baiturrahmah University, Indonesia. Int J Innovative Sci Res Techno 2022; 7: 1112-5.
30. Aswad FG. Recurrent aphthous ulceration prevalence and the factors associated with it among dentistry students/Tikrit University. Indones J Health Sci Med 2024; 1: 10-21070.
31. Azfar M, Qureshi S. Awareness regarding oral aphthous ulcers and its risk factors among BDS and MBBS students-A cross-sectional survey. J Pak Dent Assoc 2021; 30: 215-8.
32. Bisar R, Dharman D, Manohar D, et al. A study on aphthous ulcer and its association with stress among college students 2021; 10: 1526-31.
33. Cankovic M, Bokor-Bratic M, Tovilovic T, Vuletic J. Oral mucosa lesions and risk habits: a cross-sectional study in North Serbia student population. J Oral Health Oral Epidemiol 2015; 4: 38-45.
34. Darwis AF, Harahap AS. Correlation between dietary habits and recurrent aphthous stomatitis in dental students of Universitas Sumatera Utara. AIP Conference Proceedings; AIP Publishing LLC 2024; 3127: 020034.
35. Donatsky O. Epidemiologic study on recurrent aphthous ulcerations among 512 Danish dental students. Community Dent Oral Epidemiol 1973; 1: 37-40.
36. Dua N, Sharma T, Sharma P, Mahajan S, Kaur H. Prevalence of aphthous stomatitis or recurrent aphthous ulcers in dental students. J Oral Med Oral Surg Oral Pathol Oral Radiol 2022; 8: 10-5.
37. Narmadha M. Evaluating the psychological stress level with recurrent aphthous stomatitis among undergraduate dental college students in Chengalpattu district Tamil Nadu-A cross sectional survey. Innovations 2024; 76: 1001-12.
38. Hali H, Salehi Sarookollaei M, Molania T, et al. Prevalence of recurrent aphthous stomatitis among children studying at public elementary schools in Sari County in 2019. Tabari Biomed Student Res J 2023; 5: 11-6.
39. Hameed DH, Bakose RY, Adnan RJ. The association between aphthous stomatitis and certain risk factors among undergraduate students at the University of Baghdad College of Medicine during the 2017–2018 academic year. Baghdad Uni College Med 2018; pp: 1-33.
40. Jahnfar JD, Douglas EM, Alinejad H. Prevalence of oral lesions and normal variants of the oral mucosa in 12 to 15-year-old students in Tehran, Iran. Arch Iran Med 2012; 15: 142-5.
41. Ali AKM, Abdul-Aziz A, Hussein JA. Frequency of aphthous ulcer and its association with stress among a group of students of Tikrit Medical College. J Kirkuk Med Coll Vol. 2019; 7: 12-8.
42. Nivia M. Correlation of stress with recurrent aphthous ulcer among dental students: a cross sectional study. President's Message. Int J Women's Dental Council 2014; 2: 1-48.
43. Parlak AH, Koybasi S, Yavuz T, et al. Prevalence of oral lesions in 13- to 16-year-old students in Duzce, Turkey. Oral Dis 2006; 12: 553-8.
44. PK P, Prerna J, Meena A, Bhat K, PK C, Bhat G. Association of recurrent aphthous ulcers with stress among students in an Indian dental institution. Nat J Integr Med Res 2012; 3: 141-7.
45. Probosari N, Syifa NA, Budirahardjo R, et al. Prevalence and distribution of recurrent aphthous stomatitis in 10-13 years old: observational study in elementary school. Padjadjaran J Dent 2023; 35: 247-52.
46. Purnama T, Sofian R, Sasongko BG, et al. Academic stress on the incidence of recurrent aphthous stomatitis: a cross sectional study. J Drug Deliv Ther 2021; 11: 61-4.
47. Shirzaiy M, Sarabadani J, Damle SG. Recurrent aphthous stomatitis and related factors among 12-17-year-old Students in Zahedan, Iran. J Res Dent Maxillofac Sci 2020; 5: 34-9.
48. Sawair FA. Does smoking really protect from recurrent aphthous stomatitis? Therapeutics and clinical risk management. Ther Clin Risk Manag 2010; 6: 573-7.
49. Sharma B, Pandey S, Pant VA, et al. Regenerative periodontal therapy and its clinical implication. Indian J Contemp Dent 2016; 4: 1-6.

50. Sharma M, Gupta R, Singh S. Correlation of psychological stress with recurrent aphthous stomatitis among dental students in an educational institution. Int J Appl Dent Sci 2017; 3: 455-8.
51. Ship II, Brightman VJ, Laster LL. The patient with recurrent aphthous ulcers and the patient with recurrent herpes labialis: a study of two population samples. J Am Dent Assoc 1967; 75: 645-54.
52. Thevara MC, Shilpashree K, Murthy A, et al. Prevalence of recurrent apthous stomatitis and its association with stress among undergraduate students in a dental institution–a cross sectional study. Int J Appl Dent Sci 2020; 6: 458-62.
53. Verma S, Srikrishna K, Srishti, et al. Recurrent oral ulcers and its association with stress among dental students in the Northeast Indian population: A cross-sectional questionnaire-based survey. Cureus 2023; 15: e34947.
54. Ziaei S, Shahraki HR, Dehkordi SD. The association of recurrent aphthous stomatitis with general health and oral health related quality of life among dental students. Int J Physiol Pathophys Pharm 2022; 14: 254-61.