



Predisposing Factors for Recurrent Aphthous Stomatitis among Undergraduate Dental Students

Indriasari Putri Rahmadhany¹ Fatma Yasmin Mahdani² Meircurius Dwi Condro Surboyo²
Adiastuti Endah Parmadiati² Pamela Handy Cecilia³ Natasya Fauzia Sukmawati³

¹ Profession Program, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia

² Mahdani FY, Surboyo MDC, Parmadiati AE: Department of Oral Medicine, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia

³ Cecilia PH, Sukmawati NF: Bachelor Program, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia

Address for correspondence Fatma Yasmin Mahdani, DDS., MDS, Faculty of Dental Medicine, Department of Oral Medicine, Universitas Airlangga, Jln. Prof. Dr. Moestopo 47 Surabaya, 60132, Indonesia (e-mail: fatmayasminmahdani@fkg.unair.ac.id).

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Abstract

Objectives The prevalence of recurrent aphthous stomatitis (RAS) among the general population worldwide is 20%. This study aims to discover any correlations between RAS predisposing factors and the gender and year of study of undergraduate dental students at the Faculty of Dental Medicine at Airlangga University.

Methods A cross-sectional analytical study using simple random sampling was performed. The respondents answered seven questions on a self-reported online questionnaire set up using Google Forms. Chi-square analyses were conducted to determine any correlation between RAS predisposing factors and the gender and year of study of the students.

Results The highest predisposing factors for RAS in undergraduate dental students were local trauma (77.7%) followed by stress (71.3%) and nutritional deficiencies (41.5%). Stress correlated strongly with the year of study ($p = 0.015$). There was no correlation between gender and RAS predisposing factors ($p > 0.05$).

Conclusion There was a correlation between stress, one of the predisposing factors for RAS, and the year of study, but there was no correlation between gender and RAS predisposing factors including local trauma, stress, nutritional deficiency, genetics, allergies, and systemic diseases.

Keywords

- ▶ human health
- ▶ recurrent aphthous stomatitis
- ▶ stress
- ▶ trauma

Introduction

The prevalence of recurrent aphthous stomatitis (RAS) worldwide among the general population is 20%.¹ A study conducted on undergraduate dental students in the United States found that the prevalence of RAS was as high as 36.5%,² and similar research on dental students from India found it was 55%.³ These data indicate that RAS is one of

the most common oral diseases among undergraduate dental students. The occurrence of RAS may interfere with physical functions such as speaking, chewing, and swallowing. In addition, the pain caused by RAS may affect the nutritional status of the individual due to the reduced intake of food, and this will have an impact on their quality of life, especially among undergraduate dental students.⁴

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One publication stated that undergraduate dental students may experience RAS due to the existence of several predisposing factors.⁵ Many communities, but particularly students, have a high prevalence of RAS and this may be caused by predisposing factors including local trauma, stress, nutritional deficiencies, genetics, food allergies, and other systemic diseases such as *Crohn's disease*.⁶

Gum and dental health play an important role in maintaining the condition of the entire oral cavity and directly affect general health. However, oral health is often neglected even though the underlying causes of common diseases may originate in oral health. Oral disease is one of the most common human health problems and it is often neglected because it progresses slowly with no direct effect on mortality, so health planners may not consider it a major problem.⁷

Recurrent ulceration of the oral mucosa is termed RAS. These lesions are often painful; this is patients' most common complaint.⁸ This pathological condition of the oral cavity displays clinical symptoms of painful, small, white, shallow, round, or oval ulcers, recurring after intervals of between several days and 2 to 3 months. These lesions can appear singly or in clusters. However, the lesions generally heal within 7 to 14 days.^{9,10} Any part of the oral cavity can be affected by RAS including the buccal and labial mucosa, tongue, and palate.⁸ The main RAS predisposing factor present in undergraduate dental students is the high level of stress caused by academic pressure and anxiety. Their busy schedule and the obligation to fulfill the academic requirements of their studies reduce their time for relaxation, and the nutritional quality of their diet is also poor.^{5,9,11}

Stress factors and lack of sufficient quality of nutritional intake may contribute to dietary deficiencies in students. Genetic influences, allergic reactions to food, or systemic diseases may also trigger RAS.¹²

There is no research providing an overview of the RAS predisposing factors affecting undergraduate dental students in Indonesia, specifically in Surabaya. The aim of this research is to provide an overview of the prevalence of RAS predisposing factors in undergraduate dental students.

Material and Method

Study Design and Participants

A cross-sectional analytical study using simple random sampling was conducted. The respondents were second, third-, and fourth-year bachelor dental medicine students in the Faculty of Dental Medicine at Airlangga University, which has a total population of 497 students. The minimum number of respondents needed for this study, according to Lemeshow equation (1997), was 80. However, we obtained 156 responses, so this was sufficient.

Questionnaire Format

This research used a self-reported questionnaire conducted online using the Google Forms platform during the period October–November 2020. The questionnaire consisted of seven questions divided into two groups relating to the experience of RAS and RAS predisposing factors. Each ques-

tion had two possible responses of yes or no. The questions used in the questionnaire were assessed for their validity and reliability.

Statistical Analysis

The data obtained from the respondents were presented as percentages. They were then cross-tabulated, and *chi-square* tests with a significance level of $p < 0.05$ were conducted using SPSS 20 (*Statistical Package for the Social Sciences 20*) software.

Results

Respondents' Recurrent Aphthous Stomatitis History

Most of the respondents in this study were female (78.9%). Regarding the age distribution of the respondents, 1 respondent (0.6%) was 17 years old, 8 respondents (5.1%) were 18 years old, 38 respondents (23.5%) were 19 years old, 61 respondents (39.0%) were 20 years old, 37 respondents (23.7%) were 21 years old, 10 respondents (6.4%) were 22 years old, and 1 respondent (0.6%) was 23 years old. Regarding the distribution of years of study, 55 respondents (35.3%) were fourth-year, 47 (30.1%) were third-year, and 54 (34.6%) were second-year students. Among the total respondents (156 students), 94 respondents (60.0%) had a history of RAS (► **Table 1**).

Characteristic of the Respondents with Recurrent Aphthous Stomatitis History

Among the total respondents who had a history of RAS (94 respondents), 69 (73.0%) were female. Regarding the age distribution, RAS was commonly found among individuals in their 20s (37.2%). For the other individuals with a history of RAS, 1 respondent (1.1%) was 17 years old, 6 respondents (6.4%) were 18 years old, and 23 respondents (24.5%) were 19 years old. Regarding the years of study, 35 respondents (37.2%) were in their fourth year, 28 (29.7%) in their third year, and 31 (32.9%) in their second year (► **Table 2**).

Distribution of Predisposing Factors for Recurrent Aphthous Stomatitis

The most reported predisposing factors among the respondents who had a history of RAS were local trauma for 73 respondents (77.7%), followed by stress factors for 63 respondents (71.3%), nutritional deficiencies for 39 (41.5%), genetic tendencies for 34 (36.2%), allergies for 24 (25.5%), and systemic conditions for 18 (19.1%) (► **Table 3**).

Distribution of Recurrent Aphthous Stomatitis Predisposing Factors Based on Gender

Regarding gender, the most common predisposing factors in females were local trauma for 54 respondents (73.0%), followed by stress for 49 (73.0%), nutritional deficiencies for 41 (76.0%), and genetic tendencies for 26 (60.0%), while the most common predisposing factors in males were allergies for 20 respondents (51.0%) and systemic conditions for 22 (60.0%) (► **Table 4**).

Table 1 Distribution of gender and year of study and the history of RAS

Characteristics	n	(%)
Gender		
Male	33	21.15%
Female	123	78.85%
Age		
17 y	1	0.60%
18 y	8	5.12%
19 y	38	24.35%
20 y	61	39.00%
21 y	37	23.71%
22 y	10	6.41%
23 y	1	0.60%
Year of study		
Fourth year	55	35.25%
Third year	47	30.12%
Second year	54	34.61%
RAS history		
Yes	94	(60.00%)
No	62	(40.00%)

Abbreviation: RAS, recurrent aphthous stomatitis.

Distribution of Recurrent Aphthous Stomatitis Predisposing Factors Depending on the Year of Study

Local trauma as a predisposing factor of RAS was more commonly found in fourth-year dental students compared with those in a different year of study with 27 respondents (37.0%) reporting this. In addition, stress and nutritional deficiencies as RAS predisposing factors were also more commonly found in fourth-year students as reported by 32 respondents (48.0%) and 25 respondents (65.0%), respective-

Table 2 The distribution of the total of respondents who have RAS history based on gender, age, and year of study

	Total	(%)
Gender		
Male	25	26.60%
Female	69	73.40%
Age		
17 y	1	1.10%
18 y	6	6.40%
19 y	23	24.50%
20 y	35	3.20%
21 y	22	23.40%
22 y	6	6.40%
23 y	1	1.10%
Year of study		
Fourth year	35	37.20%
Third year	28	29.70%
Second year	31	32.90%

Abbreviation: RAS, recurrent aphthous stomatitis.

ly. Meanwhile, genetic tendencies as RAS predisposing factors were commonly found in second-year students with 14 respondents (36.0%) reporting this. Allergies as RAS predisposing factors were found equally across all years of study with nine respondents (33.3%), and systemic conditions as RAS predisposing factors were found in seven respondents (38.8%) in their second year of study (► Table 5).

Relationship between Gender and Predisposing Factors for Recurrent Aphthous Stomatitis

The chi-square test was used to check for correlation between gender and RAS predisposing factors. The results

Table 3 Distribution of RAS predisposing factor among students with RAS history

	Trauma local	Stress	Nutritional deficiencies	Genetic	Allergies	Systemic
Yes	73 (77.70%)	67 (71.30%)	39 (41.50%)	34 (36.20%)	24 (25.50%)	18 (19.10%)
No	21 (22.30%)	27 (28.70%)	55 (58.50%)	60 (63.80%)	70 (74.50%)	76 (80.90%)

Abbreviation: RAS, recurrent aphthous stomatitis.

Table 4 Distribution of RAS predisposing factors based on gender

	Trauma local		Stress		Nutritional deficiencies		Genetic		Allergies		Systemic	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Male	20	5	18	7	13	15	17	17	20	20	22	22
Female	54	12	49	20	41	26	26	43	19	50	15	54

Abbreviation: RAS, recurrent aphthous stomatitis.

Table 5 Distribution of RAS predisposing factors based on the year of study

	Trauma local		Stress		Nutritional deficiencies		Genetic		Allergies		Systemic	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Fourth year	27	8	32	4	25	9	11	24	9	26	6	28
Third year	21	7	17	10	17	11	9	18	9	21	5	24
Second year	25	6	18	13	13	19	14	18	9	24	7	28

Abbreviation: RAS, recurrent aphthous stomatitis.

Table 6 Chi-square test result based on the distribution of RAS predisposing factors and gender

Gender	Trauma local	Stress	Nutritional deficiencies	Genetic	Allergies	Systemic
t	0.054	0.009	0.088	0.257	0.548	1.124
df	1	1	1	1	1	1
p	0.816	0.926	0.766	0.613	0.459	0.289

Abbreviation: RAS, recurrent aphthous stomatitis.

Table 7 Chi-square test result based on the distribution of RAS predisposing factors and the year of study

Year of study	Trauma local	Stress	Nutritional deficiencies	Genetic	Allergies	Systemic
t	0.279	8.425	5.970	0.790	0.269	0.357
df	2	2	2	2	2	2
p	0.870	0.015	0.051	0.674	0.874	0.837

Abbreviation: RAS, recurrent aphthous stomatitis.

showed that there was no correlation between gender and predisposing factors including local trauma ($p=0.816$), stress ($p=0.926$), nutritional deficiencies ($p=0.766$), genetic tendencies ($p=0.613$), allergies ($p=0.459$) and systemic conditions ($p=0.289$) ($p>0.05$) (► **Table 6**).

Relationship between the Year of Study and Predisposing Factors for Recurrent Aphthous Stomatitis

The chi-square test was used to check for correlation between gender and RAS predisposing factors. The results showed that there was a correlation between year of study and stress as an RAS predisposing factor ($p=0.015$), but there was no correlation between year of study and local trauma, nutritional deficiencies, genetic tendencies, allergies, or systemic conditions ($p=0.870$, $p=0.051$, $p=0.674$, $p=0.874$ and $p=0.837$, respectively) (► **Table 7**).

Discussion

The prevalence of RAS in this study was evaluated for students on the bachelor dental medicine students course starting in 2017, 2018, and 2019 and found to be 60.0%. The prevalence was quite high and was in agreement with research conducted by Darmanta, who used a questionnaire with students in the bachelor dental medicine students course in Indonesia and found the prevalence of RAS to be 68.2%.¹³ The criteria for diagnosing RAS in their study were based on the history of repeated thrush with an occurrence

of at least twice in the last 2 years. The recurrence of RAS could be two to four times a year or once every two to three months.¹⁰

Of the students who had experienced RAS, 69 (73.4%) were female. The number of students who experienced RAS in their fourth year of study was 35 (37.2%), in their third year of study 28 (29.7%), and in their 2019 second year of study 31 (32.9%). Respondents who experienced RAS accompanied by predisposing factors and were students of the bachelor dental medicine students course were diagnosed using subjective examinations. In this study, there were more female respondents, 69 (73.4%), to the online questionnaire than males.

The results obtained agree with the current theory that RAS is more common in females than males.¹ This is also supported by Rodríguez-Archilla and Raissouni, whose statistical analysis shows that RAS is more common in females than males.¹⁴ In addition, the study conducted by Sulistiani et al also states that RAS is more common in females than males, with approximately 70.0% of RAS patients being female.¹⁵ The same was also revealed in Abdullah's research, which found that the majority of RAS patients were female (55.4%).¹⁶ A further study found that 65.0% of RAS patients were female.¹⁷

The high incidence of RAS among female respondents at the Faculty of Dental Medicine at Airlangga University could be caused by the change in the hormonal balance during the luteal phase of the menstrual cycle. The decrease in estrogen levels results in decreased blood supply to the peripheral

organs and disruption of the cell types in the oral cavity, slowing the keratinization process so that oral tissues become more susceptible to local irritation and can easily develop RAS.^{18,19}

There are two age categories: adolescents aged 11 to 19 years and adults aged 20 to 60 years.²⁰ Adolescence is a period of growth and development physically, psychologically, and intellectually. Adolescent students are an important target group for maintaining oral health and hygiene.²¹ RAS most often occurs in the second (10–19 years) and third (20–29 years) decades.²² This agrees with research that found that 37.2% of students aged 20 years had RAS. Meanwhile, Sulistiani et al found the highest prevalence in the third decade, which was 54.0%.¹⁵ In the third decade, the 20 to 29 age group, it is suspected that people are affected by RAS because they are just coming out of adolescence and many are students.^{15,23} Students can have RAS because they experience a large amount of stress, for example, during exams and due to the high demands of assignments at the Faculty of Dental Medicine, especially for final semester students. They may also have personal problems in addition to their studies.²⁴ This can cause students to develop psychological disorders, which can be a predisposing factor for physical symptoms including RAS.^{16,17}

The oral cavity is a point of entry into the body for microorganisms. This can be with food, drink, or any other material that enters the mouth.²⁵ The human body has a defense system to protect it from disease. Saliva in the oral cavity can protect it from microorganisms and the occurrence of lesions on the oral mucosa. The health of the oral cavity depends on the integrity of the mucosa, with a healthy epidermal layer and an intact mucosal epithelium that can prevent the entry of microorganisms.²⁶ The oral cavity is very susceptible to physical, chemical, and mechanical trauma. It is very important to maintain the health and hygiene of the oral cavity to prevent the occurrence of RAS lesions, also called recurrent canker sores, and other diseases.^{27,28}

Recurrent ulceration of the oral mucosa in the absence of other accompanying diseases is defined as RAS. Generally, RAS has early symptoms with sensations such as itching, burning, pain, and heat and they can be exacerbated by physical contact, especially when brushing teeth and eating or drinking.²⁹ Students often experience RAS.³⁰ Students have busy lecture schedules and other activities, so they may forget to maintain the health and hygiene of their oral cavities sufficiently.³⁰ This can contribute to the occurrence of RAS, due to several predisposing factors as examined here, including local trauma, stress, nutritional deficiencies, genetics, allergies, and systemic disorders of the gastrointestinal tract.

This study found that the most common cause of RAS was local trauma (77.7%). No correlation was found between local trauma and either gender or the years of study ($p = 0.870$ and $p = 0.816$, respectively). In this study, the questionnaire respondents were asked about local mechanical trauma due to accidentally poking the mucosa with the toothbrush when brushing their teeth. The question was based on similar research by Darmanta on dental student respondents

in Indonesia. They found that the prevalence of RAS due to trauma when brushing teeth was very high at 91.1%.¹³ Research by Shirzaiy and Sarbadani also found that RAS can be caused by toothbrush abrasions, but in their study, the prevalence of this was much lower at 6.1%.³¹

In the present study, local trauma due to toothbrush injury had the highest percentage among the predisposing factors for RAS at 77.7%. The respondents were students who had had RAS before, so, if there was repeated local trauma, it could cause tissue damage to the oral epithelium and then reach the stratum basalis and lamina propria when injured again. The non-keratinized oral mucosa is more susceptible to trauma, because the stratum corneum is thinner.¹⁵ If RAS occurs as a result of local trauma to the oral cavity, usually the loss of the epithelial layer in the soft tissues causes pain that affects the stomatognathic system.³²

Stress was found to be the most common predisposing factor for RAS in fourth-year dental students. In the section of the questionnaire related to stress factors, there was a question asking students whether they had an average of <7 hours or >7 hours of sleep per night. Students are often sleep deprived.³³ The results obtained were around 47.7% for fourth-year dental students who had the highest stress levels compared with students in the second and third years. The results of this study agree with those of Lohitashwa et al who found that the percentage of students sleeping irregular hours and <7 hours was 58.0%.³⁴ The optimal amount of sleep for young people is more than 7 hours per night.³⁵ Years of study and stress factors ($p = 0.015 < 0.05$) both correlated significantly with RAS. This is a positive correlation because the higher the stress factor, the more likely the student is to experience RAS.³⁶

The stress could be caused by the students needing to adapt to online learning during this pandemic era, meaning that their hours of sleep became irregular.^{37,38} Reduced sleep can affect protein synthesis that is necessary to repair damaged cells³⁵ and keep them healthy.³⁹ Insufficient sleep causes fatigue resulting in increased stress and lack of concentration.³³ Stress also increases levels of the hormone cortisol, which makes lysis of the oral mucosa more likely. These predisposing factors could cause students with a history of RAS to relapse and experience RAS again.⁴⁰

Nutrition is very important for students, especially in their final semester. Adequately balanced diets will provide enough vitamins to prevent health problems such as RAS.⁴¹ Nutrients are obtained from fruit, vegetables, meat, fish, milk, and other foods. Consumption of vegetables and fruit is needed as a source of vitamins, minerals, and fiber. Some of the vitamins and minerals found in vegetables and fruit function as antioxidants, and these can reduce the occurrence of disease or prevent the occurrence of lesions.⁴²

Predisposing factors for RAS caused by nutritional deficiencies when there are insufficient vegetables, fruits, and other foods in the diet can result in RAS. In this study, only limited questions related to predisposing factors for nutritional deficiency were asked. Students were asked whether they consumed at least three servings of vegetables a day. The results showed that 41.5% of the students had nutritional

deficiencies. The p -value ($p = 0.766 > 0.05$) showed no significant relationship between gender and nutritional deficiency. There was also no significant relationship between students' years of study and nutritional deficiency ($p = 0.051 > 0.05$). According to some dietary advice, at least three servings of vegetables and two servings of fruit should be consumed per day.³⁶ Meanwhile, other advice recommends consuming five servings of fruit and vegetables per day.³⁵ Insufficient intake of vegetables and fruit can cause nutritional deficiencies of folic acid, vitamin B12, and other B vitamins, which can lead to RAS.⁴³ Nutritional deficiencies of iron, folic acid, and vitamin B12 are most common in patients with RAS.⁴⁴ Nutritional deficiency also causes a decrease in protein synthesis, reducing protein metabolism. Deficiencies of vitamins B1, B2, and B6 have been found in 28.0% of patients with RAS.⁴⁵

This is the first study to describe the distribution and frequency of RAS predisposing factors in dental students at the Faculty of Dental Medicine at Airlangga University in Indonesia. Knowledge of the age distribution and years of study related to predisposing factors for RAS can be used as evidence for further research into the management of RAS. This study has the limitation that the RAS was not confirmed objectively but only using a self-reported questionnaire.

Conclusion

There was a correlation between stress as one of the predisposing factors for RAS and the year of study, but there was no correlation between RAS predisposing factors and gender, local trauma, nutritional deficiency, genetics, allergies, and systemic diseases such as *Crohn's disease*.

Ethical Approval

This study has received an ethical clearance certificate from the Faculty of Dental Medicine Health Research Ethical Clearance Commission at Airlangga University under the registered number 344/HRECC.FODM/VII/2020 on 30th July, 2020.

Author Contributions

I.P.R. designed the study, conducted the experiment, analyzed and interpreted data, and wrote the original draft of the article. F.Y.M. designed the study, supervised, analyzed, interpreted data, and wrote the original draft of the article. M.D.C.S. designed the study, supervised, analyzed, interpreted data, and revised the final article. A.E.P. supervised and revised the final article. P.H.C. and N.F.S. revised the final article.

All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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Conflict of Interest

None declared.

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