ORIGINAL ARTICLE

Prevalence and distribution of recurrent aphthous stomatitis in 10-13 years old: observational study in elementary school

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ABSTRACT

Introduction: Recurrent aphthous stomatitis (RAS), better known as canker sore, is the most common soft tissue disease of the oral cavity and affects 5 to 66% of the world's population. RAS often begins in childhood and the age group of 10-14 years has the highest proportion of RAS in children. The purpose of this study was to determine the prevalence and distribution of RAS according to gender and age, clinical characteristics, ulcer location, and predisposing factors in 10 to 13 years old students. **Methods:** This observational study used cross-sectional design with total sampling method. The data were collected by oral cavity examination using direct observation with a mouth mirror and by filling out 10 closed questions questionnaires about predisposing factors of RAS. The data that had been obtained was tabulated and presented in tabular form using SPSS 16.0. **Results:** With a total sample size of 79 students from 10-13 years old, this study showed that the prevalence of RAS was found in 16 students (20,25%). The distribution of RAS based on gender was found to be higher in females (11,39%), while based on age, it was found that 11 years of age was the age that suffered the most RAS (10,13%). Based on clinical examination, all of the subjects were categorized as minor, mostly found at labial mucosa and tongue (31,25%). Based on questionnaires, the highest predisposing factor was due to trauma in 11 people (68,75%). **Conclusion:** In our study, among 10 to 13 year old students with RAS, females were mostly found at 11 years of age, detected with minor clinical characteristics. The labial mucosa and tongue, and trauma were the highest predisposing factors.

KEYWORDS
recurrent aphthous stomatitis, children, prevalence, distribution

INTRODUCTION

Recurrent aphthous stomatitis (RAS), also known as canker sore, is the most common soft tissue disease of the oral cavity.[1] RAS is characterized by recurrent ulcerative lesion that is round or oval in shape, well-demarcated, covered with white to grayish-yellow pseudomembranes, and surrounded by reddish edges.[2,3] Ulcers can occur as single or multiple ulcers with three clinical characteristics, such as minor, major, and herpetiform. The etiology of RAS is still unknown, but there are several predisposing factors that are thought to trigger the onset or RAS.[4]

RAS begins in childhood and affects up to 40% of the population.[5] The second decade of life, or age 10-19 years, is considered the peak period for the onset of RAS in children.[6] The frequency of recurrence and severity of RAS will increase until early adulthood and then gradually decrease entering age 20-29 years, or third decade of life.[7-9]

The prevalence of RAS affects 5 to 66% of the world's population, with an average of around 20%.[10,11] In Indonesia, the prevalence of RAS is 8,0%.[12] Jember Regency, which is one of the regencies in East Java Province, has a higher prevalence of RAS at 8,78% compared to the prevalence of RAS in East Jawa at 7,07% and the prevalence of RAS nationally.[13]

Arjasa is one of the sub-districts in Jember Regency, with the majority of the community having a low level of education, only elementary school graduates.[14] Each region has a different pattern of life, both in terms of the environment, family parenting, and dietary habit that can impact family.[15] The proportion of people in Jember who treat oral health problems is still relatively low.[13]

Previous research on RAS was usually only conducted on college student subjects, which corresponded to the peak age of RAS recurrence. Research on RAS that focused on the age of school children, which was the age of the onset of RAS, had rarely been done before. Riskesdas in 2018 showed that the highest proportion of RAS in children was in the age group of 10-14 years old at 8,3%, where the age group was on average the age children in 10 to 13 year old students of elementary school[12] According to data from the health profile of East Java Province in 2020, the ratio of dental and oral health services for elementary school children or equivalent in Jember Regency ranked lower.[13] Candijati 01 elementary school is a school located closest to the tobacco agro-industry

area with the majority of parents working as tobacco farm laborers. In the case of Candijati 01 students, many carious and sharp teeth were found, so the incidence of RAS was higher because the oral mucosa was often scratched or bitten by these sharp teeth. Research on the relationship between the prevalence of RAS and predisposing factors in the tobacco agro-industry area had never been carried out in Jember, so researchers wanted to conduct research related to this matter. The aim of this study was to describe the prevalence and distribution of RAS in children in 10 to 13- year-old students of Elementary School.

METHODS

This type of research is descriptive observational. Descriptive observational research is research designed to see a comprehensive picture of the phenomena that occur in a particular population and carried out without intervening in the research subject.[16]

The research was conducted at Candijati 01 Elementary School in Arjasa Jember in September to December 2022. The population of this study were students of 10-13 years old at Candijati 01 Elementary School in the 2022/2023 school year, totaling 79 students, which was categorized based on the presence or absence of RAS and the distribution of RAS based on gender and age, clinical characteristics, ulcer location and predisposing factors. The study was conducted in weekly increments, where each examination visit was only conducted in one class. The sampling technique used in this study was total sampling, or all population units were taken as sample units. The reason for taking total sampling was because the population was less than 100.[17] Students who were willing to participate in the study by filling out informed consent forms and questionnaires and who were present during the examination were taken as research subjects.

Besides permits from National and Political Unity Agency, the Health Office, the Education Office, and the relevant schools, the instruments used were informed consent forms, examination sheets that consisted of 7 indicators (the history of RAS before, how many RAS appear in the oral mucosa, the Size of RAS, The Frequency of RAS, The Onset and Duration of RAS and the region of appearance of RAS), questionnaire sheets (consisted of 10 closed questions covering hereditary predisposing factors, trauma, stress, nutritional deficiencies, and hormonal changes), disposable dental kits, and stationery. Subjects who had given informed consent were then examined for the presence or absence of RAS lesions and interviewed about circumstances that were thought to be predisposing factors for RAS. Based on the questionnaire, the answers from the subjects were to be grouped according to the category of predisposing factors. Then data tabulation was carried out to determine the distribution of predisposing factors. The percentages were calculated and presented in the form of tables and graphs. Data collection was carried out by 2 researchers who had equated perceptions. Data had been calibrated and reviewed in a double blind and analysed using SPSS 16.0.

RESULTS

Table 1. RAS distribution based on gender and age

Age (years)	Male n (%)		Female n (%)		Total n (%)	
	RAS	Normal	RAS	Normal	RAS	Normal
9	0 (0)	1 (1.27)	1 (1.27)	3 (3.80)	1 (1.27)	4 (5.06)
10	2 (2.53)	12 (15.19)	3 (3.80)	11 (13.92)	5 (6.33)	23 (29.11)
11	4 (5.06)	7 (8.86)	4 (5.06)	9 (11.39)	8 (10.13)	16 (20.25)
12	1 (1.27)	11 (13.92)	1 (1.27)	8 (10.13)	2 (2.53)	19 (24.05)
13	0 (0)	0 (0)	0 (0)	1 (1.27)	0 (0)	1 (1.27)
Total	7 (8.86)	31 (39.24)	9 (11.4)	32 (40.51)	16 (20.26)	63 (79.75)

Note: n=79

Table 1 shows the gender and age distribution of subjects who experienced RAS. Based on gender. the highest subjects who experienced RAS were 9 females (11.39%). For distribution based on age. RAS was experienced by 8 students aged 11 years (10.13%).

Table 2. RAS distribution based on clinical characteristics

RAS classification	Male n (%)	Female n (%)	Total n (%)
Minor RAS	7 (43.75)	9 (56.25)	16 (100)
Major RAS	0 (0)	0 (0)	0 (0)
Herpetiform RAS	0 (0)	0 (0)	0 (0)
Total	7 (43.75)	9 (56.25)	16 (100)

Note: n=16

Table 2 shows the clinical characteristics of the study subjects who experienced RAS. All 16 subjects were suspected of having RAS with a minor type. with the highest were 9 females (56.25%). There were no subjects with major RAS or herpetiform RAS.

Table 3. RAS distribution based on ulcer location

Ulcer location	Male n (%)	Female n (%)
Labial mucosa	2 (12.5)	3 (18.75)
Buccal mucosa	1 (6.25)	2 (12.5)
Tongue	3 (18.75)	2 (12.55)
Floor of the mouth	0 (0)	1 (6.25)
Soft palate	0 (0)	0 (0)
Oropharyngeal mucosa	0 (0)	0 (0)
Gingiva	1 (6.25)	1 (6.25)
Total	7 (43.75)	9 (56.25)

Note: n=16

Table 3 shows the distribution of subjects with RAS based on ulcer location. Labial mucosa and tongue were the most common locations for RAS, with 5 people (31.25%) each. No ulcer was found on the soft palate or oropharyngeal mucosa.

Table 4. RAS distribution based on predisposing factors

Predisposing factors	Male n (%)	Female n (%)	Total n (%)
Genetic	2 (12.5)	4 (25)	6 (37.5)
Trauma	4 (25)	7 (43.75)	11 (68.75)
Stress	1 (6.25)	4 (25)	5 (31.25)
Nutritional deficiencies	3 (18.75)	4 (25)	7 (43.75)
Hormonal changes	0 (0)	0 (0)	0 (0)

Note: n=16

Table 4 shows the distribution of subjects who experienced RAS based on predisposing factors. The results showed that subjects can experience RAS that is not only triggered by one predisposing factor. The highest predisposing factor was due to trauma in 11 people (68.75%). There were no subjects who claimed to experience RAS due to hormonal changes.

DISCUSSION

Based on Table 1. the prevalence of RAS was found to be 20.26%. This finding supports the theory that the prevalence rate of RAS in the world population ranges from 5 to 66%, with an average of about 20%.[11] Table 1 also reveals that the subjects affected by RAS in this study were fewer than the subjects who were not affected by RAS. The results of this study are in accordance with research by Sulistiani et al.,[10] which showed that patients with RAS who came to RSGM University of Jember in 2014 were 14% of the total patient visits. RAS prevalence rates might vary depending on the study and population studied, the diagnostic criteria used, and environmental factors.[18,19]

Table 1 also shows that the distribution of RAS by gender was more prevalent in females, with 9 subjects (11.39%) compared to 7 male subjects (8.86%). Based on this study, the difference in the number of patients with RAS between male and female was not significant because the number of subjects was too small. However, literally in females, a high percentage of RAS is often associated with hormonal imbalances during the menstrual cycle, especially during the luteal phase. Estrogen hormone promotes the overall maturation of oral mucosa epithelial cells, resulting in an increase in superficial epithelial cells.[20] The number of epithelial cells increases when progesterone hormone levels are high. A decrease in these two hormones can impair oral mucosal resistance, leading to RAS. The results of this study are in accordance with research by Sulistiani et al.,[10] that showed 70% of patients with RAS that visited RSGM University of Jember were women.

The theory of hormonal imbalance in the menstrual cycle is not relevant to explain the reason for the results of this study, as only two of the nine female subjects with RAS had experienced menstruation. The average girl in Indonesia starts menstruating at the age of 13, while the majority of subjects in this study were under 13 years old.[21] Another factor that may explain the increased prevalence rate among women is stress. Women experience more stress than men because they are more sensitive to environmental changes and more prone to anxiety.[22] Stress in school-aged children is due to separation from one's peer group, experiencing body injuries and pain, and loss of control.[23]

Table 1 also explains the distribution of RAS by age, showing that the age most affected by RAS is the 11 year olds for as many as 8 subjects (10.13%). This finding supports the theory that the initial peak period of the emergence of RAS in children occurs in the second decade of life, between the ages of 10 and 19 years.[6] Studies showed a trend of low prevalence of RAS in the first decade or age 0-9 years, then increasing in the second and third decades.[24]

Table 2 shows that all subjects (100.00%) experienced RAS with a minor type. This result is in accordance with the theory stating that the most common characteristic in children is minor RAS, reaching 75-85%. The excess percentage in the results of this study could be caused by changes in the population, period, region, and research methodology used.[10] Major RAS usually occurs after

puberty and can last for the rest of a person's life. Herpetiform RAS first appear in the second decade of life, or age 10-19 years.[25]

Table 3 shows the distribution of RAS that appear in various parts of the oral cavity. The most RAS were found in the labial mucosa and tongue, in as many as 5 subjects (31.25%) each. This finding supports the theory that RAS. especially minor characteristics, are more often found in non-keratinized mucosa, such as the labial mucosa, buccal mucosa, and lateral tongue.[1] This is also confirmed by the results of the study, which showed that all subjects experienced minor RAS, so most of the affected locations were non-keratinized mucosa, These include the buccal mucosa, labial mucosa, soft palate, floor of the mouth, ventral tongue. Non-keratinized oral mucosa is more susceptible to damage than keratinized mucosa due to its thinner stratum corneum layer.[10] In addition, non-keratinized oral mucosa has an epithelial structure with a surface layer that is not resistant to abrasion and is not firmly bound to the lamina propria, so ulcer formation becomes easier.[18]

Table 4 shows that the factors experienced by the subjects in this study were not only caused by one cause. These results support the theory that predisposing factors for RAS are multifactorial.[21] The most predisposing factor experienced in this study was the trauma factor as many as 11 subjects (68.75%). Furthermore, 7 subjects (43.75%) experienced nutritional deficiency factors, 6 subjects (37.50%) experienced genetic factors, and 5 subjects (31.25%) experienced stress factors. None of the subjects complained of the appearance of RAS as a result of hormonal changes.

Table 4 also shows a total of 6 subjects (37.50%) admitted that their family members, both parents and siblings, often experienced RAS. This finding supports the theory that genetic factors play a role in the development of RAS in approximately 24-46% of cases.[19] It is hypothesized that the early onset of RAS in children with a history of triggering RAS in their parents is related to an increased amount of HLA (Human Leukocyte Antigen). By stimulating mononuclear cells in the epithelium, HLA attacks the cells through a cytotoxic mechanism. However, this has only been demonstrated in certain ethnic groups.[26] Another hypothesis is that the inheritance of certain genes may alter genetic factors that are predisposing factors for RAS. A recent study by Bazrafshani et al. linked minor RAS to genetic factors related to immunologic function, including genes that regulate proinflammatory cytokines, namely IL-1β, IL-6, and IL-8. The risk of RAS increases with polymorphisms in genes, such as IL-1β, IL-6, TNF-α, and IFN-γ, which interfere with cytokine metabolism. These cytokines promote the proliferation and differentiation of CD8+ cytotoxic cells, which can cause the oral mucosa to rupture more easily.[27]

In this study, the most commonly identified predisposing factor for the emergence of RAS was trauma, with 11 subjects (68.75%) reporting that RAS occurred when they accidentally bit the oral mucosa or bumped while brushing their teeth. The high rate of trauma as a predisposing factor for RAS is related to the initial symptoms of trauma in the oral cavity, such as biting, which are immediately followed by ulcers in the area. The rapid transition from trauma-induced ulceration to RAS suggests that trauma plays a role in the onset of RAS.[28] Trauma from biting causes oral epithelial cells to produce keratin, a protein that causes hyperkeratotic lesions. Trauma can also induce edema, cell inflammation, and an increase in submucosal extracellular cells, all of which can lead to the formation of RAS.[29]

Table 4 shows the stress factor was experienced by 5 subjects (31.25%) as a predisposing factor for RAS. The results in this study align with the study conducted by Nurdiana et al, that showed 75.8% of subjects had moderate stress levels as predisposing factor for RAS.[30-32] Stress can create habits that can damage the oral mucosa, such as biting the lips and cheeks, which eventually causes RAS.[31] when a person experiences stress, the body will produce more cortisol. Cortisol stimulates protein catabolism, resulting in the easy rupture of oral mucosal tissues, which is thought to induce RAS.[27] Stress has also been shown to disrupt homeostasis, making tissues more susceptible to RAS ulcers. Stress reactions decrease the function of IgA, IgG, and neutrophils, making it easier for microorganisms to cause infection.[10]

Based on table 4, it also shows A total of 7 subjects (43.75%) admitted to experiencing RAS due to nutritional deficiencies. The result in this study has similarity with the study by Chiang et al, that found anemia, serum iron, vitamin B12, and folic acid deficiencies, and hyperhomocysteinemia in 20.9, 20.1, 4.8, 2.6, and 7.7% of 273 RAS patients.[33]

Nutritional deficiencies, especially hematic deficiencies such as iron, folic acid, and vitamin B12, are thought to play a role in the development of RAS. A study by Wray et al.,[21] found that 47 out of 330 patients with RAS had nutritional deficiencies consisting of 57% iron deficiency, 15% folic acid deficiency, 13% vitamin B12 deficiency, and the rest were combined deficiencies.[4] Folic acid deficiency changes the quality of immature cell membranes and causes atrophy of the oral mucosal tissue, so that the oral epithelium ruptures easily and causes ulcers. Iron and vitamin B12 deficiencies cause the structure of red blood cells to become disorganized, reducing their ability to supply oxygen, which will cause atrophy of the oral mucosa. The subjects in this study also admitted to experiencing RAS after consuming excessive amounts of snacks. There are studies that report a high prevalence of RAS in people who frequently consume sugary drinks, carbonated drinks, and fried foods. The intake of sweet and sour substances can produce changes in oral pH that can trigger the onset of RAS.[24]

No subjects reported RAS due to hormonal changes. This study contradicts previous research by Afifah et al, which showed results with 42.11% of SARs related to cycles of menstruation. A total of 11 people (57.89%) did not relate to menstruation.[20] The factor of hormonal changes was only studied in female subjects because it is related to the imbalance of estrogen and progesterone hormones during the menstrual cycle. A decrease in these two hormones can damage the resistance of the oral mucosa, which causes RAS.[27] However, the theory of hormonal imbalance in the menstrual cycle cannot be used to explain the relationship between hormonal changes and predisposing factors

for RAS in this study. Most of the subjects in this study had not experienced RAS due to their age. The average age of girls in Indonesia experiences the onset of menstruation at the age of 13 years.[22]

The limitation of this study is that there were not many subjects suffering from RAS, so the data presented were too little. Suggestions for future research are to increase the number of subjects and clarify the questionnaire to be able to explore more detailed information regarding the predisposing factors that cause RAS.

CONCLUSION

In our study, among 10 to 13-year-old students with RAS, females were mostly found at 11 years of age, detected with minor clinical characteristics. The labial mucosa and tongue, and trauma were the highest predisposing factors.

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