

# Prevalence and risk factors of recurrent aphthous stomatitis among college students at Mangalore, India

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**Background:** Recurrent aphthous stomatitis (RAS) is one of the most common oral mucosal diseases affecting an approximate 25% of the world's population. Some common etiological factors are genetics, nutritional deficiencies, stress and immune dysfunction. There is currently no specific medication to treat the condition but RAS tends to heal by itself within a week or two. We aimed to explore about the prevalence and related risk factors of recurrent aphthous ulcers among college students aged 18-30 years who had been affected within the preceding six months prior to the study duration. **Methods:** A questionnaire survey was conducted among 681 students from four colleges in Mangalore, Karnataka, India after obtaining the approval for the same from the respective colleges. Consenting participants returned a survey containing various questions. The collected data was then analyzed using descriptive statistics. The study was approved by the Institutional Ethics Committee. **Results:** Of the total 681 participants, 322 (47.2%) were affected with RAS in the past six months which included 131 (40.6%) males and 191 (59.3%) females. Single mouth ulcers were the most common presentation seen among the study participants (74.2%). Factors showing statistically significant association were - family history of RAS ( $P < 0.001$ ), known diabetics ( $P < 0.001$ ), history of smoking ( $P < 0.001$ ), oral trauma ( $P < 0.001$ ), history of wearing braces/dentures ( $P < 0.001$ ) as well as those using toothpastes containing sodium lauryl sulphate ( $P < 0.001$ ), stress and lack of sleep ( $P < 0.001$ ). The most common form of medication used were topical agents (43.1%) ( $P < 0.001$ ). **Conclusions:** There was a statistically significant association between the occurrence of RAS and family history of RAS, diabetes, smoking, history of braces/dentures, oral trauma, sodium lauryl sulphate toothpastes, lack of sleep, stress, menstruation, consumption of particular foods and beverages. Further research is needed in this field to truly understand the prevalence and risk factors of RAS and to help in discovering a treatment modality for this condition.

1 **Prevalence and risk factors of recurrent aphthous stomatitis among college students at**  
2 **Mangalore, India**

3 **Abstract**

4 **Background**

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6 an approximate 25% of the world's population. Some common etiological factors are genetics,  
7 nutritional deficiencies, stress and immune dysfunction. There is currently no specific  
8 medication to treat the condition but RAS tends to heal by itself within a week or two. We aimed  
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12 **Methods**

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18 **Results**

19 Of the total 681 participants, 322 (47.2%) were affected with RAS in the past six months which  
20 included 131 (40.6%) males and 191 (59.3%) females. Single mouth ulcers were the most  
21 common presentation seen among the study participants (74.2%). Factors showing statistically  
22 significant association were - family history of RAS ( $P \leq 0.001$ ), known diabetics ( $P \leq 0.001$ ),  
23 history of smoking ( $P \leq 0.001$ ), oral trauma ( $P \leq 0.001$ ), history of wearing braces/dentures  
24 ( $P \leq 0.001$ ) as well as those using toothpastes containing sodium lauryl sulphate ( $P \leq 0.001$ ), stress  
25 and lack of sleep ( $P \leq 0.001$ ). The most common form of medication used were topical agents  
26 (43.1%) ( $P \leq 0.001$ ).

27 **Conclusions**

28 There was a statistically significant association between the occurrence of RAS and family  
29 history of RAS, diabetes, smoking, history of braces/dentures, oral trauma, sodium lauryl  
30 sulphate toothpastes, lack of sleep, stress, menstruation, consumption of particular foods and  
31 beverages. Further research is needed in this field to truly understand the prevalence and risk  
32 factors of RAS and to help in discovering a treatment modality for this condition.

33 Key Words: Aphthous Ulcer, Mouth Ulcer, college students, Prevalence, Risk factors

### 34 **Introduction**

35 Recurrent Aphthous Ulcer (RAU) or recurrent aphthous stomatitis or more commonly known as  
36 mouth ulcers affects an approximate 25% of the world's population [1]. Studies have reported the  
37 prevalence of RAS in the United States and United Kingdom to be about 20% of the population  
38 [2]. With a variety of factors contributing to the cause of RAS neither a specific risk factor, nor a  
39 treatment has been discovered.

40 Various factors such as gender, body mass index (BMI), age, family history, wearing dental  
41 braces, gastrointestinal diseases, times of brushing, bedtime at night, are some of the factors that  
42 contribute to RAS [3]. It has also been suggested that the occurrence of recurrent aphthous  
43 stomatitis can result from oral trauma or even from the consumption of acidic foods and  
44 carbonated drinks [4]. Mouth ulcers lasting more than 3 weeks could be suggestive of mouth  
45 tumors leading to orofacial pain and soreness [5]. RAS has been reported to affect the patient's  
46 lifestyle quality, however, studies have reported that RAS did not cause anxiety or depression  
47 among patients [6]. Stress was found out to be one of the main etiological factors of RAS [7].  
48 Tobacco users were found to have a less likely chance of being affected with RAS than non-  
49 tobacco users [8]. It was hypothesized that patients suffering from recurrent aphthous stomatitis  
50 were having vitamin B1, vitamin C, iron and or calcium deficiencies [9]. There has not yet been  
51 any correlation established between RAS and its genetic factor [10]. Several local, systemic,  
52 immunologic, allergic, and microbial factors as well as immunosuppressive drugs have been  
53 proposed as causative agents [11]. A study conducted in Tamil Nadu, India shows that the main  
54 cause of RAS could be systemic factors, food allergy or even due to immunopathogenesis. The  
55 study also showed that 17% of the population were affected with Minor RAS [12].

56 RAS usually heals itself within one week or two. There are no medications yet discovered that  
57 will help cure RAS completely but local anesthetics such as topical gels, creams, ointments,  
58 mouth wash can be used. It was also found out that taking vitamin supplements will help prevent  
59 and cure RAS [13].

60 This is the only study done in Karnataka, India which was designed to investigate the prevalence  
61 of RAS among college students aged 18-30 years in the Indian population and to assess the  
62 independent risk factors associated with RAS. Through this study, we aim to contribute towards  
63 research into the topic of aphthous stomatitis.

#### 64 **Materials and Methods**

65 A cross-sectional descriptive study was carried out in Mangalore, Karnataka among individuals  
66 aged 18-30 years who have or have not been affected with RAS. Four institutions comprising of  
67 a medical college, dental college, and two other degree colleges were selected as the study  
68 setting. The study was conducted from March 1<sup>st</sup>, 2019 to May 30<sup>th</sup>, 2019. The sample size of  
69 681 was calculated by taking 20% relative precision, 95% confidence, 15% prevalence [2] and  
70 20% non-response. The participants were chosen on the basis of a non-random sampling.  
71 Individuals who have or have not been affected with mouth ulcers and those who had complete  
72 questionnaires were included in the study. Incomplete questionnaires and those who did not  
73 accept the informed consent was excluded from the study. The study protocol was submitted to  
74 the Institutional Ethics Committee of Kasturba Medical College (Manipal Academy of Higher  
75 Education), Mangalore (IEC KMC MLR 02-1963). After obtaining the approval of the ethics  
76 committee, approval was taken from the Heads of the respective colleges. After obtaining the  
77 approval of the colleges, data collection was done using the structured survey questionnaire  
78 through online Google Forms. An informed consent form was obtained from every individual. In  
79 the first section of the questionnaire, demographic data of the participants was recorded. In  
80 subsequent section, participants were asked about whether they had a history of being affected  
81 by aphthous stomatitis ever and/or within the past six months, family history of aphthous  
82 stomatitis and about the location and pattern of the aphthous ulcers. Participants were also asked  
83 certain questions about their lifestyle like dietary choices, smoking habits, sleeping habits, and  
84 brushing habits. In addition to this, participants were also asked about the history of dental

85 braces usage, history of diabetes, nutritional deficiencies, systemic diseases and about the  
86 treatment they sought for the aphthous stomatitis.

### 87 **Data Analysis**

88 The data were entered into MS Excel and tabulated. Data were analyzed using descriptive  
89 statistics. A statistical package SPSS version 25.0 was used to do the analysis. Chi-square test  
90 was used to analyze the association between the occurrence of recurrent aphthous stomatitis in  
91 the participants and family history of aphthous stomatitis, history of diabetes, and smoking  
92 habits. In addition to this, Chi-square test was also used to analyze an association between the  
93 occurrence of aphthous stomatitis among the participants and history of dentures, oral trauma,  
94 type of toothpaste used, sleep habits, stress, menstruation, and dietary habits.  $P < 0.05$  was  
95 considered to be statistically significant.

### 96 **Results**

97 Of the total 681 participants that participated in the study, 268 (39.4%) of the participants were  
98 male and 413 (60.6%) of the participants were female, giving a male to female ratio of 2:3. The  
99 prevalence of RAS among individuals affected in the past six months prior to the study period  
100 was 47.2%.

101 Of the total 681 participants in this study, 322 (47.2%) suffered from RAS in the past six months  
102 of which 131 (40.6%) were males and 191 (59.3%) were females which was significant (Table  
103 1). Each participant was given the option to choose multiple responses to help establish the  
104 pattern and anatomical location of the ulcers among participants that were affected by it. Of the  
105 total 322 individuals that have been affected by RAS in the past six months, 239 (74.2%)  
106 reported single mouth ulcers, 25 (7.7%) reported the presence of a cluster of ulcers and 58 (18%)  
107 reported a combination of both which was significant (Table 2). The preeminent anatomical  
108 locations of the ulcers were found to be on the inner surface of the lips with a prevalence of  
109 78.2% followed by the inner surface of the cheeks with a prevalence of 58.6% and on the dorsal  
110 surface of the tongue giving a prevalence of 27.6% which was also significant (Table 2).

111 A total of 254 (37.2%) participants reported a family history of recurrent aphthous stomatitis of  
112 which 190 (59%) suffered from RAS in the past six months while 51 (18.5%) participants who  
113 had a family history of RAS did not suffer from RAS in the past six months which was

114 significant (Table 3). Out of 28 diabetic patients who participated in the study, 24 participants  
115 were affected with RAS in the past six months (Table 3). Of a total 176 participants who were  
116 active smokers, 118 (36.6%) were affected with RAS in the past six months. From the total study  
117 population of 322 affected with RAS in the past six months, 111 (34.4%) participants who  
118 stopped smoking still suffered from RAS during the past six months which was significant  
119 (Table 3). There was a total of 142 individuals who stopped smoking of which 111 were affected  
120 with RAS which was also very significant (Table 3).

121 Out of a total of 251 (36.8%) participants reported a history of wearing braces/dentures, 156  
122 (48.4%) participants who had reported a history of wearing dentures/braces suffered from RAS  
123 (Table 4). It was also discovered that 224 (69.5%) suffered from RAS in the past six months due  
124 to trauma of the oral mucosa which was significant (Table 4). A total of 272 (84.4%) participants  
125 who actively used toothpastes containing sodium lauryl sulphate were affected with RAS in the  
126 past six months which was also very significant (Table 4).

127 It was also observed that 199 (61.8%) participants who suffered from RAS, slept for five to six  
128 hours and 94 (29.1%) participants who were affected with RAS slept for seven to eight hours  
129 daily which was highly significant (Table 4). Among the participants who were affected with  
130 RAS in the past six months, 126 (39.1%) participants reported that they suffered from RAS  
131 during stressful periods of their life which was also significant (Table 4).

132 Of the total 191 female participants who were affected with RAS in the past six months, 58  
133 (18%) female participants reported that they were affected with aphthous stomatitis specifically  
134 during menstruation which was significant (Table 4).

135 Pineapples (29.1%) were the most common fruit to be foremost cause for the formation of ulcers  
136 followed by lemons (14.9%) and oranges (10.2%) but this was not statistically significant (Table  
137 5). However, it was also reported that 38.5% of the participants attributed spicy food to be the  
138 fundamental cause for the formation of ulcers followed by chocolates (9.0%) and almonds  
139 (5.2%) (Table 5). Due to the consumption of beverages, 54 (16.7%) participants accredited  
140 coffee to be a major cause in the formation of ulcers followed by pineapple juice and orange  
141 juice which was reported by 37 (11.4%) and 35 (10.8%) participants respectively (Table 5).

142 It was observed that a total of 424 participants consumed carbonated beverages frequently. Of  
143 the total 322 participants who were affected with RAS in the past six months, 162 (50.3%)  
144 participants who consumed carbonated beverages one-two times every week were affected with  
145 RAS followed by 34 (10.5%) participants who drank carbonated beverages three-four times  
146 every week and 31 (9.6%) participants who consumed carbonated beverages daily which was  
147 highly significant (Table 6). There was no significant relation between individuals who were  
148 frequent consumers of coffee (Table 6), tea (Table 6) and milk (Table 6) with the recurrence of  
149 aphthous stomatitis.

150 It was reported that when affected with aphthous ulcers, 139 (43.1%) individuals used topical  
151 agents such as triamcinolone acetonide, fluocinolone acetonide, clobetasol propionate, topical  
152 diclofenac and topical lidocaine (Table 7). Vitamin supplements were reported to be used by 65  
153 (20.1%) participants while 51 (15.8%) participants resorted to home remedies (Table 7). Oral  
154 medications such as hydrocortisone buccal tablets and prednisolone tablets were used by 30  
155 (9.3%) participants (Table 7). Mouth washing agents such as chlorhexidine gluconate was used  
156 by 42 (13%) participants. It was also reported that 89 (27.6%) participants did not take any sort  
157 of medication (Table 7)

## 158 **Discussion**

159 Recurrent aphthous stomatitis proves to be challenge to physicians all around the world due to its  
160 difficulty in diagnosis and treatment. RAS continues to be a topic of research in the fields of  
161 medicine, otorhinolaryngology, dermatology and oral surgery. Studies from all around the world  
162 emphasize on the fact that it is important for the professionals of the medical world to detect the  
163 clinical aspects of this condition because every patient is treated differently. RAS remains a  
164 common problem faced by college students with various factors such as stress, lack of sleep,  
165 consumption of beverages, and smoking contributing to its cause. To our knowledge, this is the  
166 first study of its kind among college students in Karnataka, India.

167 In the present study conducted among individuals between the ages of 18-30 years in Mangalore,  
168 Karnataka, females constituted a larger proportion of the total study population affected with  
169 RAS in the past six months. Similar results have been reported in studies conducted in the  
170 northern and southern parts of India. In a study conducted by Mathew et al, it was reported that  
171 the prevalence of RAS was 2.1% in southern India <sup>[14]</sup>. In another study conducted by Patil et al,

172 it was reported that the prevalence of RAS in northern India was found to be 21.7% [15]. A study  
173 held in Maharashtra reported that only 72 patients among 71,851 patients were clinically  
174 diagnosed with aphthous stomatitis reporting a prevalence of 0.1% [16]. These statistics indicates  
175 that the prevalence of RAS varies among the general population of India. Certain  
176 epidemiological studies have reported that the prevalence of aphthous stomatitis among the adult  
177 population in the United States and Canada was 46.4% to 69.4% [17]. The reported prevalence of  
178 aphthous stomatitis in Europe was 36% to 37% [17]. A study held in Sweden reported that the  
179 prevalence of aphthous stomatitis in Sweden was 0.5% to 2% [18].

180 In our study, the prevalence of RAS was more common among the female participants. In the  
181 study conducted by Patil et al it has been reported that there was a higher prevalence among  
182 females (56.3%) than in males (43.7%) [15]. It has been suggested by some authors that hormonal  
183 factors could be responsible for the higher prevalence of RAS among females [19]. On the  
184 contrary, only a few studies have reported a higher prevalence of RAS among males [20].

185 The inner surface of the lips was the preeminent location for the occurrence of aphthous  
186 stomatitis (78.2%) followed by inner surface of the cheeks (58.6%) and lastly on the dorsal  
187 surface of the tongue (27.6%). In a study held in Rio by Salomao et al it was reported that the  
188 most common anatomical location for the occurrence of RAS was the tongue followed by the  
189 buccal mucosa [17]. In this study, it was also discovered that the most common form of  
190 presentation was single mouth ulcers (74.2%) followed by a cluster of ulcers (7.7%) and lastly a  
191 combination of both (18%).

192 Earlier study by Ship found that RAS had a definite tendency to occur along family lines and that  
193 the probability of a sibling developing RAS was influenced by the parents RAS status [18]. The  
194 results in our study have proved the same, 59.0% of the individuals who were affected with RAS  
195 six months prior to the study period reported a family history of recurrent aphthous stomatitis  
196 which was statistically significant ( $P \leq 0.001$ ). More recent investigations have detected  
197 associations between RAS and specific HLA subtypes, which indicates that RAS in certain  
198 individuals may have a genetic basis [19].

199 The presence of oral mucosal lesions such as RAS has been frequently diagnosed in patients with  
200 diabetes mellitus. The actual prevalence is rarely discussed in clinical studies. In a study by  
201 Miguel et al, the investigators identified a high prevalence of RAS among diabetic patients

202 (78.4%)<sup>[20]</sup>. In this study a total of 28 diabetic patients had participated of which 24 were  
203 affected with RAS in the past six months which was statistically significant ( $P \leq 0.001$ ). These  
204 results go on to highlight the importance for both physicians as well as dentists to closely  
205 monitor diabetic patients for oral mucosal lesions.

206 The results of this study showed a significant occurrence of aphthous ulcers in smokers and in  
207 former smokers. A total of 176 individuals who participated in the study were active smokers of  
208 which 118 (67%) were affected with RAS in the past six months which was significant  
209 ( $P \leq 0.001$ ) and a total of 142 individuals were former smokers of which 111 (78.1%) participants  
210 were affected with RAS in the past six months which was also significant ( $P \leq 0.001$ ). Our results  
211 are in line with the theory that aphthous ulcers are common in smokers as tobacco causes injury  
212 or chronic irritation to the oral mucosa<sup>[21]</sup>. The results in this study about former smokers being  
213 affected with RAS are in line with previous studies that have reported that aphthous ulcers are  
214 common in former smokers with a possibility that certain former smokers have a chance to  
215 develop severe laceration<sup>[22]</sup>. Studies have debated that the use of tobacco especially smoking  
216 has a “protective effect” on aphthous ulceration. It has been suggested that smokers have an  
217 increased keratinization of the oral mucosa and this keratinization provides a protects the oral  
218 mucosa against trauma and bacterial penetration<sup>[23]</sup>. It is possible that one of the absorbed  
219 constituents that promotes keratinization may be hyperkeratosis. Although hyperkeratosis may  
220 be a premalignant condition, it is possible that it prevents aphthous ulcers through a local  
221 protective effect on the oral mucosa<sup>[24]</sup>. In addition to this, it is not clear whether it is the  
222 nicotine presence in the tobacco that induces the protective effect or whether it is the presence of  
223 one of the other constituents<sup>[25]</sup>. The theory that nicotine is the protective factor, is supported by  
224 a recent report that aphthous ulcers were prevented among nonsmokers with recurrent aphthous  
225 ulcers while they used nicotine gum<sup>[26]</sup>.

226 Trauma such as sharp food, dental procedures, braces/dentures, traumatic tooth brushing, etc.  
227 have been suggested as one of the common causes of aphthous ulcers<sup>[27]</sup>. Similarly, in this study  
228 it was observed that there was a significant association of RAS occurrence with oral trauma and  
229 in those individuals with a history of braces/dentures ( $P \leq 0.001$ ). Certain studies have reported  
230 that individuals who use toothpaste’s containing sodium lauryl sulphate are more susceptible to  
231 aphthous ulcers<sup>[28]</sup>. Our results are in line with these studies showing that 272 participants of a

232 total 560 participants who used toothpastes containing sodium lauryl sulphate were affected with  
233 RAS in the past six months which was significant ( $P=0.006$ ).

234 We believe that stress influences the duration of RAS rather than trigger it <sup>[29]</sup>. A total of 39.1%  
235 of the participants in our study reported that they were affected with RAS when they were faced  
236 with stress in their life ( $P\leq 0.001$ ). In this study, it was also observed that 223 (69.2%)  
237 participants who were affected with RAS in the past six months slept for less than six hours daily  
238 which was significant ( $P\leq 0.001$ ). A similar study by Ma et al reported that bedtime after 11pm  
239 was an independent risk factor for aphthous ulcer recurrence among college students <sup>[30]</sup>.

240 Certain studies have reported that there is a correlation between menstruation and aphthous  
241 ulcers <sup>[31]</sup> but there are also studies that state that there is not enough evidence to support this  
242 claim <sup>[32]</sup>. It was observed in our study that there was a statistically significant association  
243 between the occurrence of RAS and menstruation ( $P\leq 0.001$ ).

244 According to the results in the current study, 29.1% of the participant's reported pineapples as  
245 the foremost cause for the formation of ulcers followed by lemons (14.9%) and oranges (10.2%)  
246 ( $P=0.083$ ) (Table 5). It has been suggested by certain authors that glycosides in the pineapple  
247 stimulates the oral mucosa and the presence of protease leads to allergic reactions in some people  
248 <sup>[33]</sup>. Many studies have reported spicy food as one of the most common causes for the occurrence  
249 of aphthous ulcers. Spicy foods result in a temporary shortage of free moisture in the mouth due  
250 to high calories <sup>[34]</sup>. Reduction of saliva in the mouth fails in protection of oral mucosa. Our  
251 findings are in line with this theory as spicy food was reported as the most common type of food  
252 associated with the occurrence of RAS which was statistically significant ( $P\leq 0.001$ ) (Table 5).

253 Following the consumption of coffee, 16.7% of the participants reported that they were affected  
254 by ulcers followed by pineapple juice (11.4%) and orange juice (10.8%) ( $P=0.004$ ) (Table 5).

255 Coffee contains a substance called theobromine which is sensitive to the oral region. The habits  
256 of sweet and acidic intake can lead to changes in pH of the mouth. It is reported that stomatitis is  
257 more likely to occur when pH in the mouth is abnormal <sup>[35]</sup>. It was also discovered in this study  
258 that 50.3% of the participants who drank carbonated drinks one-two times a week were affected  
259 with RAS in the past six months followed by 10.5% of the participants who consumed  
260 carbonated beverages three-four times a week which was very significant ( $P=0.002$ ) (Table 6). A  
261 study held by Qian Du et al, showed similar results that frequent consumption of carbonated

262 beverages was an independent risk factor for RAS. It was observed that the prevalence of RAS  
263 was higher in individuals who were frequent consumers of carbonated beverages [36]. Carbonated  
264 drinks soften the enamel surface leading to extremely rough, porous, and alveolate  
265 demineralization, which then causes the wear of soft tissues in the mouth [37]. There was no  
266 association found between RAS and frequent consumers of tea, milk and coffee.

267 In this study it was reported that the most common treatment used was topical agents followed  
268 by vitamin supplements and home remedies (Table 7). It is commonly reported that the treatment  
269 for aphthous ulcers is symptomatic mainly with the use of topical agents. Systemic therapy  
270 should only be considered in patients with chronic aphthous stomatitis [38].

## 271 **Conclusion**

272 The prevalence of aphthous ulcers within six months preceding study was found to be 47.2%  
273 among college students at Mangalore. There was a statistically significant association between  
274 the occurrence of RAS and family history of RAS, diabetes, smoking, history of braces/dentures,  
275 oral trauma, sodium lauryl sulphate toothpastes, lack of sleep, stress, menstruation, consumption  
276 of particular foods and beverages. This research would add on to the current evidence and  
277 probably help in the prevention of ulceration. Further research is needed in this field to truly  
278 understand the prevalence and risk factors of RAS and to help in discovering a treatment  
279 modality for this condition.

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**Table 1** (on next page)

Table 1: Participants affected by recurrent aphthous stomatitis (RAS) in the past six months

Participants affected by recurrent aphthous stomatitis (RAS) in the past six months

1 **Table 1: Participants affected by recurrent aphthous stomatitis (RAS) in the past six**  
 2 **months**

Gender	Affected by RAS in the Past six months									$\chi^2$	P Value
	Yes		No		Not Applicable		Total				
	N	%	N	%	N	%	N	%			
Male	131	40.6	94	34.2	43	51.2	268	39.4	8.252	0.016	
Female	191	59.3	181	65.8	41	48.8	413	60.6			
Total	322	100.0	275	100.0	84	100.0	681	100.0			

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**Table 2** (on next page)

Table 2: Pattern and anatomical location of mouth ulcers present in participants in the past six months

1 **Table 2: Pattern and anatomical location of mouth ulcers present in participants in the past**  
 2 **six months**

Pattern of mouth ulcer in the past six months			
Pattern	N	%	P $\leq$ 0.001
Single mouth ulcers	239	74.2	
Clusters	25	7.7	
Both	58	18	
Anatomical location of mouth ulcer in the past six months			
Location	N	%	P $\leq$ 0.001
Dorsal surface of tongue	89	27.6	
Inner surface of lips	252	78.2	
Inner surface of cheeks	189	58.6	
Ventral surface of tongue	43	13.3	
Soft palate	13	4.0	

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**Table 3** (on next page)

Table 3: Role of family history of RAS, diabetes, smoking and cessation of smoking among individuals who were affected with RAS in the past six months

1 **Table 3: Role of family history of RAS, diabetes, smoking and cessation of smoking among**  
 2 **individuals who were affected with RAS in the past six months**

Family history of RAS	Affected by RAS in the past six months								X <sup>2</sup>	P Value
	Yes		No		Not Applicable		Total			
	N	%	N	%	N	%	N	%		
Yes	190	59.0	51	18.5	13	15.4	254	37.2	123.33	≤0.001
No	132	39.7	224	81.4	71	84.5	427	62.7		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
Diabetes	Affected by RAS in the past six months								X <sup>2</sup>	P Value
	Yes		No		Not Applicable		Total			
	N	%	N	%	N	%	N	%		
Yes	24	7.4	3	1.0	1	1.1	28	4.1	31.442	≤0.001
No	298	92.5	272	98.9	83	98.8	653	95.8		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
Smokers	Affected by RAS in the past six months								X <sup>2</sup>	P Value
	Yes		No		Not Applicable		Total			
	N	%	N	%	N	%	N	%		
Yes	118	36.6	46	16.7	12	14.2	176	25.8	40.253	≤0.001
No	204	63.3	229	83.2	72	85.7	505	74.1		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
Smoking Cessation	Affected by RAS in the past six months								X <sup>2</sup>	P Value
	Yes		No		Not Applicable		Total			
	N	%	N	%	N	%	N	%		
Yes	111	34.4	29	10.5	2	2.3	142	20.8	96.14	≤0.001
No	13	4.0	35	12.7	4	4.7	52	7.6		

Not Applicable	198	6.1	211	76.7	78	92.8	487	71.5		
Total	322	100.0	275	100.0	84	100.0	681	100.0		

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**Table 4**(on next page)

Table 4: Role of Braces/Dentures history, oral trauma, use of toothpaste containing sodium lauryl sulphate, sleep, stress and menstruation among participants affected with RAS in the past 6 months

Role of Braces/Dentures history, oral trauma, use of toothpaste containing sodium lauryl sulphate, sleep, stress and menstruation among participants affected with RAS in the past 6 months

- 1 **Table 4: Role of Braces/Dentures history, oral trauma, use of toothpaste containing sodium**
- 2 **lauryl sulphate, sleep, stress and menstruation among participants affected with RAS in**
- 3 **the past 6 months**

History of braces/dentures	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		
Yes	156	48.4	82	29.8	13	15.4	251	36.8	40.940	≤0.001
No	166	51.5	193	70.1	71	84.5	430	63.1		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
Oral trauma	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		
Yes	224	69.5	131	47.6	9	10.7	364	53.4	221.54	≤0.001
No	98	30.4	144	52.3	75	89.2	317	46.5		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
Toothpaste containing sodium lauryl sulphate	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		
Yes	272	84.4	218	79.2	70	83.3	560	82.2	18.093	0.006
No	50	15.5	57	20.7	14	16.6	121	17.7		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
Sleep	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		

Less than 5 Hours	24	7.4	19	6.9	1	1.1	44	6.4	98.422	$\leq 0.001$
5 to 6 Hours	199	61.8	116	42.1	14	16.6	329	48.3		
7 to 8 Hours	94	29.1	126	45.8	53	63.0	273	40.0		
More than 8 Hours	5	1.5	14	5.0	16	19.0	35	5.1		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
<b>Stress</b>	<b>Affected by RAS in the past six months</b>									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		
Yes	126	39.1	51	18.5	6	7.1	183	26.8	64.207	$\leq 0.001$
No	196	60.8	224	81.4	78	92.8	498	73.1		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
<b>Menstruation</b>	<b>Affected by RAS in the past six months</b>									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		
Yes	58	18.0	16	4.9	0	0	74	10.8	58.621	$\leq 0.001$
No	133	41.3	165	51.2	41	48.8	439	64.4		
Not Applicable	131	40.6	94	29.1	43	51.1	168	24.6		
Total	322	100.0	275	100.0	84	100.0	681	100.0		

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**Table 5** (on next page)

Table 5: Dietary factors among participants affected with RAS in the past six months

This table lists the probable dietary factors among participants affected with RAS in the past six months as reported by themselves

1 **Table 5: Dietary factors among participants affected with RAS in the past six months**

Fruits	Affected by RAS in the past six months							X <sup>2</sup>	P Value
	Yes		No		Not Applicable				
	N	%	N	%	N	%			
Pineapple	96	29.1	53	19.2	1	1.1	80.189	0.083	
Apple	21	6.5	7	2.5	1	1.1			
Fig	15	4.6	7	2.5	0	0			
Lemon	48	14.9	15	5.4	1	1.1			
Orange	33	10.2	13	4.7	2	2.3			
Strawberry	10	3.1	6	2.1	0	0			
Banana	10	3.1	4	1.4	0	0			
NA/None	185	57.4	200	72.7	79	94.0			
Food	Affected by RAS in the past six months								X <sup>2</sup>
	Yes		No		Not Applicable				
	N	%	N	%	N	%			
Chocolate	29	9.0	8	2.9	0	0	107.010	≤0.001	
Cheese	16	4.9	5	1.8	0	0			
Peanut	16	4.9	3	1.0	0	0			
Almond	17	5.2	6	2.1	1	1.1			
Egg	15	4.6	10	3.6	0	0			
Spicy Food	124	38.5	52	18.9	2	2.3			
NA/None	157	48.7	200	72.7	81	96.4			
Beverages	Affected by RAS in the past six months								X <sup>2</sup>
	Yes		No		Not Applicable				
	N	%	N	%	N	%			

	N	%	N	%	N	%		
Coffee	54	16.7	25	9.0	0	0	90.971	0.004
Tea	22	6.8	7	2.5	0	0		
Milk	16	4.9	3	1.0	0	0		
Carbonated Drinks	31	9.6	8	2.9	1	1.1		
Orange Juice	35	10.8	5	1.8	0	0		
Pineapple Juice	37	11.4	37	13.4	2	2.3		
NA/None	190	59.0	219	79.6	1	1.1		

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**Table 6** (on next page)

Table 6: Relationship between RAS and frequency of consumption of beverages among participants affected in the past six months

This table depicts the relationship between RAS and frequency of consumption of beverages among participants affected in the past six months

1 **Table 6: Relationship between RAS and frequency of consumption of beverages among**  
 2 **participants affected in the past six months**

Consumption of carbonated beverages	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		
Nil	95	29.5	124	45.0	38	45.2	257	37.7	20.846	0.002
Daily	31	9.6	14	5.0	8	9.5	53	7.7		
1-2 times a week	162	50.3	112	40.7	29	34.5	303	44.4		
3-4 times a week	34	10.5	25	9.0	9	10.7	68	9.9		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
Consumption of coffee	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		
Nil	168	52.1	145	52.7	50	59.5	363	53.3	11.752	0.163
Daily	3	0.9	0	0	1	1.1	4	0.5		
1-2 times a week	139	43.1	122	44.3	31	36.9	292	42.8		
3-4 times a week	12	3.7	8	2.9	2	2.3	22	3.2		
Total	322	100.0	275	100.0	84	100.0	681	100.0		
Consumption of tea	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		
Nil	198	61.4	176	54.6	48	57.1	422	61.9	4.961	0.549
Daily	0	0	2	0.6	1	1.1	241	35.3		
1-2 times a week	117	36.3	92	28.5	32	38.0	15	2.2		
3-4 times a week	7	2.1	5	1.5	3	3.5	3	0.4		

Total	322	100.0	275	100.0	84	100.0	681	100.0		
<b>Consumption of milk</b>	<b>Affected by RAS in the past six months</b>									
	Yes		No		Not Applicable		Total		X <sup>2</sup>	P Value
	N	%	N	%	N	%	N	%		
Nil	138	42.8	110	40	36	42.8	284	41.7	5.269	0.728
Daily	3	0.9	6	2.1	2	2.3	11	1.6		
1-2 times a week	163	50.6	143	52	38	45.2	344	50.5		
3-4 times a week	18	5.5	16	5.8	8	9.5	42	6.1		
Total	322	100.0	275	100.0	84	100.0	681	100.0		

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**Table 7** (on next page)

Table 7: Various medications used for RAS by participants in the past six months

Medications used by participants in the past six months for relief from RAS are depicted in this table.

1 **Table 7: Various medications used for RAS by participants in the past six months**

Medication	Affected by RAS in the Past six months					
	Yes		No		X <sup>2</sup>	P Value
	N	%	N	%		
Topical Agents	139	43.1	49	17.8	168.486	≤0.001
Oral Medication	30	9.3	12	4.3		
Vitamin Supplements	65	20.1	29	10.5		
Mouth Wash	42	13.0	22	8.0		
Home Remedies	51	15.8	35	12.7		
NA/None	89	27.6	160	58.1		

2