

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.

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19 **Author's contributions-** AJ, MAM, SAM and TMC conceived the study. Data was collected by

20 MAM, SAM and TMC and analysis of the data was done by AJ. MAM, SAM and TMC wrote the

21 first draft and researched the manuscript. The final draft of the article was written by MAM and

22 AJ did the critical review of the article. All authors approved the final version of the manuscript.

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

25 **Abstract**

26 **Background**

27 Recurrent aphthous stomatitis (RAS) is one of the most common oral mucosal diseases affecting
28 an approximate 25% of the world's population. Some common etiological factors are genetics,
29 nutritional deficiencies, stress and immune dysfunction. There is currently no specific
30 medication to treat the condition but RAS tends to heal by itself within a week or two. We aimed
31 to explore about the prevalence and related risk factors of recurrent aphthous ulcers among
32 college students aged 18-30 years who had been affected within the preceding six months prior
33 to the study duration.

34 **Methods**

35 A questionnaire survey was conducted among 681 students from four colleges in Mangalore,
36 Karnataka, India after obtaining the approval for the same from the respective colleges.
37 Consenting participants returned a survey containing various questions. The collected data was
38 then analyzed using descriptive statistics. The study was approved by the Institutional Ethics
39 Committee.

40 **Results**

41 Of the total 681 participants, 322 (47.2%) were affected with RAS in the past six months which
42 included 131 (40.6%) males and 191 (59.3%) females. Single mouth ulcers were the most
43 common presentation seen among the study participants (74.2%). Factors showing statistically
44 significant association were - family history of RAS ($P \leq 0.001$), known diabetics ($P \leq 0.001$),
45 history of smoking ($P \leq 0.001$), oral trauma ($P \leq 0.001$), history of wearing braces/dentures
46 ($P \leq 0.001$) as well as those using toothpastes containing sodium lauryl sulphate ($P \leq 0.001$), stress
47 and lack of sleep ($P \leq 0.001$). The most common form of medication used were topical agents
48 (43.1%) ($P \leq 0.001$).

49 **Conclusions**

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

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

56 **Introduction**

57 Recurrent Aphthous Ulcer (RAU) or recurrent aphthous stomatitis or more commonly known as
58 mouth ulcers affects an approximate 25% of the world's population [1]. Studies have reported the
59 prevalence of RAS in the United States and United Kingdom to be about 20% of the population
60 [2]. With a variety of factors contributing to the cause of RAS neither a specific risk factor, nor a
61 treatment has been discovered.

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

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

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

86 **Materials and Methods**

87 A cross-sectional descriptive study was carried out in Mangalore, Karnataka among individuals
88 aged 18-30 years who have or have not been affected with RAS. Four institutions comprising of
89 a medical college, dental college, and two other degree colleges were selected as the study
90 setting. The study was conducted from March 1st, 2019 to May 30th, 2019. The sample size of
91 681 was calculated by taking 20% relative precision, 95% confidence, 15% prevalence [2] and
92 20% non-response. The participants were chosen on the basis of a non-random sampling.
93 Individuals who have or have not been affected with mouth ulcers and those who had complete
94 questionnaires were included in the study. Incomplete questionnaires and those who did not
95 accept the informed consent was excluded from the study. The study protocol was submitted to
96 the Institutional Ethics Committee of Kasturba Medical College (Manipal Academy of Higher
97 Education), Mangalore (IEC KMC MLR 02-1963). After obtaining the approval of the ethics
98 committee, approval was taken from the Heads of the respective colleges. After obtaining the
99 approval of the colleges, data collection was done using the structured proforma through online
100 google forms. An informed consent form was obtained from every individual. The data was
101 entered into MS Excel and was tabulated. Data was analyzed using descriptive statistics. A
102 statistical package SPSS version 25.0 was used to do the analysis. $P < 0.05$ was considered to be
103 significant.

104 **Results**

105 Of the total 681 participants that participated in the study, 268 (39.4%) of the participants were
106 male and 413 (60.6%) of the participants were female, giving a male to female ratio of 2:3. The

107 prevalence of RAS among individuals affected in the past six months prior to the study period
108 was 47.2%.

109 Of the total 681 participants in this study, 322 (47.2%) suffered from RAS in the past six months
110 of which 131 (40.6%) were males and 191 (59.3%) were females which was significant (Table
111 1). Each participant was given the option to choose multiple responses to help establish the
112 pattern and anatomical location of the ulcers among participants that were affected by it. Of the
113 total 322 individuals that have been affected by RAS in the past six months, 239 (74.2%)
114 reported single mouth ulcers, 25 (7.7%) reported the presence of a cluster of ulcers and 58 (18%)
115 reported a combination of both which was significant (Table 2). The preeminent anatomical
116 locations of the ulcers were found to be on the inner surface of the lips with a prevalence of
117 78.2% followed by the inner surface of the cheeks with a prevalence of 58.6% and on the dorsal
118 surface of the tongue giving a prevalence of 27.6% which was also significant (Table 2).

119 A total of 254 (37.2%) participants reported a family history of recurrent aphthous stomatitis of
120 which 190 (59%) suffered from RAS in the past six months while 51 (18.5%) participants who
121 had a family history of RAS did not suffer from RAS in the past six months which was
122 significant (Table 3). Out of 28 diabetic patients who participated in the study, 24 participants
123 were affected with RAS in the past six months (Table 3). Of a total 176 participants who were
124 active smokers, 118 (36.6%) were affected with RAS in the past six months. From the total study
125 population of 322 affected with RAS in the past six months, 111 (34.4%) participants who
126 stopped smoking still suffered from RAS during the past six months which was significant
127 (Table 3). There was a total of 142 individuals who stopped smoking of which 111 were affected
128 with RAS which was also very significant (Table 3).

129 Out of a total of 251 (36.8%) participants reported a history of wearing braces/dentures, 156
130 (48.4%) participants who had reported a history of wearing dentures/braces suffered from RAS
131 (Table 4). It was also discovered that 224 (69.5%) suffered from RAS in the past six months due
132 to trauma of the oral mucosa which was significant (Table 4). A total of 272 (84.4%) participants
133 who actively used toothpastes containing sodium lauryl sulphate were affected with RAS in the
134 past six months which was also very significant (Table 4).

135 It was also observed that 199 (61.8%) participants who suffered from RAS, slept for five to six
136 hours and 94 (29.1%) participants who were affected with RAS slept for seven to eight hours

137 daily which was highly significant (Table 4). Among the participants who were affected with
138 RAS in the past six months, 126 (39.1%) participants reported that they suffered from RAS
139 during stressful periods of their life which was also significant (Table 4).

140 Of the total 191 female participants who were affected with RAS in the past six months, 58
141 (18%) female participants reported that they were affected with aphthous stomatitis specifically
142 during menstruation which was significant (Table 4).

143 Pineapples (29.1%) were the most common fruit to be foremost cause for the formation of ulcers
144 followed by lemons (14.9%) and oranges (10.2%) but this was not statistically significant (Table
145 5). However, it was also reported that 38.5% of the participants attributed spicy food to be the
146 fundamental cause for the formation of ulcers followed by chocolates (9.0%) and almonds
147 (5.2%) (Table 5). Due to the consumption of beverages, 54 (16.7%) participants accredited
148 coffee to be a major cause in the formation of ulcers followed by pineapple juice and orange
149 juice which was reported by 37 (11.4%) and 35 (10.8%) participants respectively (Table 5).

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

158 It was reported that when affected with aphthous ulcers, 139 (43.1%) individuals used topical
159 agents such as triamcinolone acetonide, fluocinolone acetonide, clobetasol propionate, topical
160 diclofenac and topical lidocaine (Table 7). Vitamin supplements were reported to be used by 65
161 (20.1%) participants while 51 (15.8%) participants resorted to home remedies (Table 7). Oral
162 medications such as hydrocortisone buccal tablets and prednisolone tablets were used by 30
163 (9.3%) participants (Table 7). Mouth washing agents such as chlorhexidine gluconate was used
164 by 42 (13%) participants. It was also reported that 89 (27.6%) participants did not take any sort
165 of medication (Table 7)

166 **Discussion**

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

175 In the present study conducted among individuals between the ages of 18-30 years in Mangalore,
176 Karnataka, females constituted a larger proportion of the total study population affected with
177 RAS in the past six months. Similar results have been reported in studies conducted in the
178 northern and southern parts of India. In a study conducted by Mathew et al, it was reported that
179 the prevalence of RAS was 2.1% in southern India [14]. In another study conducted by Patil et al,
180 it was reported that the prevalence of RAS in northern India was found to be 21.7% [15]. A study
181 held in Maharashtra reported that only 72 patients among 71,851 patients were clinically
182 diagnosed with aphthous stomatitis reporting a prevalence of 0.1% [16]. These statistics indicates
183 that the prevalence of RAS varies among the general population of India. Certain
184 epidemiological studies have reported that the prevalence of aphthous stomatitis among the adult
185 population in the United States and Canada was 46.4% to 69.4% [17]. The reported prevalence of
186 aphthous stomatitis in Europe was 36% to 37% [17]. A study held in Sweden reported that the
187 prevalence of aphthous stomatitis in Sweden was 0.5% to 2% [18].

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

193 The inner surface of the lips was the preeminent location for the occurrence of aphthous
194 stomatitis (78.2%) followed by inner surface of the cheeks (58.6%) and lastly on the dorsal
195 surface of the tongue (27.6%). In a study held in Rio by Salomao et al it was reported that the

196 most common anatomical location for the occurrence of RAS was the tongue followed by the
197 buccal mucosa ^[17]. In this study, it was also discovered that the most common form of
198 presentation was single mouth ulcers (74.2%) followed by a cluster of ulcers (7.7%) and lastly a
199 combination of both (18%).

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

207 The presence of oral mucosal lesions such as RAS has been frequently diagnosed in patients with
208 diabetes mellitus. The actual prevalence is rarely discussed in clinical studies. In a study by
209 Miguel et al, the investigators identified a high prevalence of RAS among diabetic patients
210 (78.4%) ^[20]. In this study a total of 28 diabetic patients had participated of which 24 were
211 affected with RAS in the past six months which was statistically significant ($P \leq 0.001$). These
212 results go on to highlight the importance for both physicians as well as dentists to closely
213 monitor diabetic patients for oral mucosal lesions.

214 The results of this study showed a significant occurrence of aphthous ulcers in smokers and in
215 former smokers. A total of 176 individuals who participated in the study were active smokers of
216 which 118 (67%) were affected with RAS in the past six months which was significant
217 ($P \leq 0.001$) and a total of 142 individuals were former smokers of which 111 (78.1%) participants
218 were affected with RAS in the past six months which was also significant ($P \leq 0.001$). Our results
219 are in line with the theory that aphthous ulcers are common in smokers as tobacco causes injury
220 or chronic irritation to the oral mucosa ^[21]. The results in this study about former smokers being
221 affected with RAS are in line with previous studies that have reported that aphthous ulcers are
222 common in former smokers with a possibility that certain former smokers have a chance to
223 develop severe laceration ^[22]. Studies have debated that the use of tobacco especially smoking
224 has a “protective effect” on aphthous ulceration. It has been suggested that smokers have an
225 increased keratinization of the oral mucosa and this keratinization provides a protects the oral

226 mucosa against trauma and bacterial penetration [23]. It is possible that one of the absorbed
227 constituents that promotes keratinization may be hyperkeratosis. Although hyperkeratosis may
228 be a premalignant condition, it is possible that it prevents aphthous ulcers through a local
229 protective effect on the oral mucosa [24]. In addition to this, it is not clear whether it is the
230 nicotine presence in the tobacco that induces the protective effect or whether it is the presence of
231 one of the other constituents [25]. The theory that nicotine is the protective factor, is supported by
232 a recent report that aphthous ulcers were prevented among nonsmokers with recurrent aphthous
233 ulcers while they used nicotine gum [26].

234 Trauma such as sharp food, dental procedures, braces/dentures, traumatic tooth brushing, etc.
235 have been suggested as one of the common causes of aphthous ulcers [27]. Similarly, in this study
236 it was observed that there was a significant association of RAS occurrence with oral trauma and
237 in those individuals with a history of braces/dentures ($P \leq 0.001$). Certain studies have reported
238 that individuals who use toothpaste's containing sodium lauryl sulphate are more susceptible to
239 aphthous ulcers [28]. Our results are in line with these studies showing that 272 participants of a
240 total 560 participants who used toothpastes containing sodium lauryl sulphate were affected with
241 RAS in the past six months which was significant ($P=0.006$).

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

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

252 According to the results in the current study, 29.1% of the participant's reported pineapples as
253 the foremost cause for the formation of ulcers followed by lemons (14.9%) and oranges (10.2%)
254 ($P=0.083$) (Table 5). It has been suggested by certain authors that glycosides in the pineapple
255 stimulates the oral mucosa and the presence of protease leads to allergic reactions in some people

256 [33]. Many studies have reported spicy food as one of the most common causes for the occurrence
257 of aphthous ulcers. Spicy foods result in a temporary shortage of free moisture in the mouth due
258 to high calories [34]. Reduction of saliva in the mouth fails in protection of oral mucosa. Our
259 findings are in line with this theory as spicy food was reported as the most common type of food
260 associated with the occurrence of RAS which was statistically significant ($P \leq 0.001$) (Table 5).
261 Following the consumption of coffee, 16.7% of the participants reported that they were affected
262 by ulcers followed by pineapple juice (11.4%) and orange juice (10.8%) ($P = 0.004$) (Table 5).
263 Coffee contains a substance called theobromine which is sensitive to the oral region. The habits
264 of sweet and acidic intake can lead to changes in pH of the mouth. It is reported that stomatitis is
265 more likely to occur when pH in the mouth is abnormal [35]. It was also discovered in this study
266 that 50.3% of the participants who drank carbonated drinks one-two times a week were affected
267 with RAS in the past six months followed by 10.5% of the participants who consumed
268 carbonated beverages three-four times a week which was very significant ($P = 0.002$) (Table 6). A
269 study held by Qian Du et al, showed similar results that frequent consumption of carbonated
270 beverages was an independent risk factor for RAS. It was observed that the prevalence of RAS
271 was higher in individuals who were frequent consumers of carbonated beverages [36]. Carbonated
272 drinks soften the enamel surface leading to extremely rough, porous, and alveolate
273 demineralization, which then causes the wear of soft tissues in the mouth [37]. There was no
274 association found between RAS and frequent consumers of tea, milk and coffee.

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

279 **Conclusion**

280 The prevalence of aphthous ulcers within six months preceding study was found to be 47.2%
281 among college students at Mangalore. There was a statistically significant association between
282 the occurrence of RAS and family history of RAS, diabetes, smoking, history of braces/dentures,
283 oral trauma, sodium lauryl sulphate toothpastes, lack of sleep, stress, menstruation, consumption
284 of particular foods and beverages. This research would add on to the current evidence and
285 probably help in the prevention of ulceration. Further research is needed in this field to truly

286 understand the prevalence and risk factors of RAS and to help in discovering a treatment
287 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									χ^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 ²	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 ²	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 ²	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 ²	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 ²	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 ²	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 ²	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 ²	P Value
	N	%	N	%	N	%	N	%		

Less than 5 Hours	24	7.4	19	6.9	1	1.1	44	6.4	98.422	≤ 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		
Stress	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X ²	P Value
	N	%	N	%	N	%	N	%	64.207	≤ 0.001
Yes	126	39.1	51	18.5	6	7.1	183	26.8		
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		
Menstruation	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X ²	P Value
	N	%	N	%	N	%	N	%	58.621	≤ 0.001
Yes	58	18.0	16	4.9	0	0	74	10.8		
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 ²	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 ²
	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 ²
	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 ²	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 ²	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 ²	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		
Consumption of milk	Affected by RAS in the past six months									
	Yes		No		Not Applicable		Total		X ²	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 ²	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