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## Oral mucosa lesions and risk habits: a cross-sectional study in North Serbia student population

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Epidemiological studies have established a wide variation in the prevalence of oral lesions in different population. Officially oral mucosa diseases can occur in 25-50% of cases, depending on the population to which the survey was conducted. We examined the relationship between oral mucosal lesions, tongue pH level, gingivitis, oral hygiene, and oral health behaviors in students' population.

**METHODS:** The study was conducted among 100 dental and medical final year students with age ranges of 23-26 years at the University of Novi Sad, School of Medicine. Information about the habits and the presence of the oral mucosa lesions (OML) were collected by interview and clinical examination. Tongue pH level, gingival and approximal plaque-space index (API) was measured. Association between variables was tested with univariate and multivariate analysis.

**RESULTS:** Lesions of the oral mucosa were found in 61.0% of the students. Analysis showed relationship between oral hygiene accessories and tongue lesions ( $P < 0.010$ ), male students who do not consume alcohol or tea and gingivitis ( $P < 0.050$ ). It was determined that coffee consumption has a significant effect on tongue pH level ( $P < 0.050$ ) and prevalence of melanin pigmentation ( $P < 0.010$ ). Students who consume tea showed significantly more often appearance of fissured tongue ( $P < 0.050$ ) and leukoedema of buccal mucosa ( $P < 0.050$ ). Significant association regarding gender was found in prevalence of tongue impressions ( $P < 0.050$ ), paleness of the oral mucosa ( $P < 0.010$ ) and recurrent aphthous ulcers ( $P < 0.050$ ), along with acid tongue pH and oral hygiene level.

**CONCLUSION:** According to the results, there is a high prevalence of oral mucosal lesions, as well as the existence of the association between some oral mucosal lesions, gender, harmful habits and oral hygiene accessories.

**KEYWORDS:** Oral Mucosa Lesions, Tongue Diseases, Gingivitis, Oral Hygiene, Students Population, Oral Health Behavior

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Epidemiological studies have established a wide variation in the prevalence of the oral mucosa lesions (OML) in different populations. Officially oral mucosa diseases can occur in 25-50% of cases, depending on which population survey was conducted.<sup>1</sup> According to the studies conducted on adult population the prevalence of oral lesions in Germany by Reichart,<sup>2</sup> was 66.1% of cases, by Garcia-Pola Vallejo et al.<sup>3</sup> in Spain 51.2%, and

Mumcu et al.<sup>4</sup> and Avcu and Kanli<sup>5</sup> in Turkey 41.7% of cases. Tongue lesions are considered to be a represent of oral as well as general health.<sup>6</sup> Recent epidemiological studies have shown that tongue lesions prevail among other oral lesions, and also that prevalence of tongue lesions vary in different parts of the world.<sup>7-11</sup>

Avcu and Kanli<sup>5</sup> have reported the prevalence of tongue lesions among the general population in 52.2% of cases while

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38.3% among the population age between 20-29 years. This study also showed higher prevalence of hairy, furred and fissured tongue among smokers, patients with low level of oral hygiene, as well as the patients who consume tea. The prevalence of tongue lesions in Scandinavian studies is 21.5%.<sup>12,13</sup> The Jordan study showed that the prevalence of geographic fissured and furred tongue is 23.7%.<sup>14</sup>

Hairy tongue is most frequent among young Finns (8.4%), and a possible cause for these statistic might be low level of oral hygiene or imbalance in oral microflora.<sup>12</sup> Fissured tongue, geographic tongue, tongue papillae atrophy and glossitis rhomboidea were found in 18.5% of cases in Hungarian population.<sup>15</sup> The differences in prevalence of tongue lesions might be a result of the different race, gender, age, as well as diagnostic and methodology differences that exist in various studies.<sup>9,12,15,16</sup> Considering the fact that epidemiological studies have established a wide variation in the prevalence of OML, the need for evaluating the prevalence in certain population groups is imposed, in order to obtain guidelines for planning health policies. The aim of this study was to determine the prevalence of OML, tongue pH level, gingivitis and oral hygiene among students population and examine their relationship with gender, harmful habits and use of oral hygiene accessories (dental floss, mouthwash).

## Methods

The research was conducted in one hundred dental and medical final year students at Dental clinic of Vojvodina, School of Medicine, Serbia. Among approximately 400 final year students, we randomly selected each fourth student to be included in the study. The data were collected using a combination of clinical oral examination and standardized interview. The information about purpose and protocol of the research were given to the students in a written form.

Once they had become familiar with the procedure, they gave consent. The principles of ethics and the Declaration of Helsinki were respected. Using questionnaire made for purpose of this study, a following data were collected: gender, date of birth, usage of oral hygiene accessories, presence of harmful habits such as smoking cigarettes, drinking alcohol, consuming tea and coffee, as well as its duration and frequency. Smokers (smoking yes) were defined as those who have smoked 100 cigarettes in their lifetime and currently smoke cigarettes every day (daily) or some days (nondaily).<sup>17</sup>

Having an alcohol intake (alcohol yes) was defined as those who drank 1 units of alcohol per day.<sup>18</sup> One unit of alcohol correspond to 10 ml (8-10 g) of pure alcohol. The oral examination was performed in a dental unit, using two plain mouth mirrors under artificial light. The OML was defined as any abnormal change in color or surface aspect or swelling or loss of integrity of the oral mucosal surface.<sup>13</sup>

OML was diagnosed in accordance with World Health Organization (WHO) criteria<sup>19</sup> and Burket's oral medicine textbook.<sup>7</sup> A summarized description of the capital clinical features of each condition was given using the International Classification of Diseases to Dentistry and Stomatology (ICD-DA) classification in the manual.<sup>20</sup> Paleness of the oral mucosa was considered only clinically, without analysis that confirmed anemia. Recurrent aphthous stomatitis was recorded if observed at the time of examination. Melanin pigmentation (only physiological and associated with smoking) were observed. Among tongue lesions we recorded fissured tongue (a tongue with fissures on the dorsum), glossitis rhomboidea (red, depapillated, rhomboidal area in the midline dorsum of tongue), glossitis geographic (areas of atrophic filiform papillae, surrounded by regenerating, healthy papillae), tongue papillae atrophy (localized or generalized depapillated area on dorsal surface of the

tongue), and tongue impression (without congenital macroglossia).

Findings that represent variations in morphology and appearance of healthy oral mucosa (leukoedema, linea alba and Fordyce spots) were also recorded and analyzed separately. Tongue pH level was measured using standard paper pH indicators with sensitivity 0.5 (Neutralit, Merck, Darmstadt, Germany). During the whole process of measuring, pH indicator was placed on dorsal surface of the tongue and gently pressed with mirror for 10 s, and the value of tongue pH was read by comparing color change in regard to standardized scale. Tongue pH values from 6.5 to 7.0 were considered as normal.<sup>21</sup>

According to the measured pH value, subjects were classified into two groups: group with acid pH value (pH < 6.5) and group with normal and alkaline pH value (pH ≥ 6.5). Loe and Silness gingival index,<sup>22</sup> which is based on the assessment of color, shape, and bleeding of the gingiva, was used for evaluation of gingival health. The gingiva of mesial, distal, vestibular and oral side of every tooth has been observed. It has been evaluated only the presence or absence of inflammatory lesion of gingival tissues (gingivitis).

Approximal plaque-space index (API)<sup>23</sup> was obtained for estimating the level of oral hygiene. Before measuring API students needed to wash their mouth out in order to remove materia alba and remains of food. A dental probe was used for detection of the dental plaque. The interdental spaces were observed in first and third quadrant from the oral surface of the tooth while in second and fourth quadrant from the buccal surface of the tooth. It has been evaluated only the presence or absence of dental plaque. API represents the percentage value, and it was calculated according to the formula:

$$API = \frac{\text{The sum of positive plaque findings}}{\text{The total number of ID spaces}} \times 100$$

According to the measured percentage value subjects were classified into two groups: good oral hygiene (API ≤ 30%) and poor oral hygiene (API > 30%).

Commercial statistical program SPSS for Windows (version 17, SPSS Inc., Chicago, IL, USA) was used for statistical analysis of data. Attributive features were shown as absolute and relative numbers while numerical features through mean value and measures of variability. Univariate analysis were done by chi-square test and Student's t-test to calculate statistically significant between the observed variables. Direct binary logistic regression with presence of tongue lesions (presence = 1, absence = 0); tongue pH level (pH < 6.5 = 1, pH ≥ 6.5 = 0); gingivitis (presence = 1, absence = 0); and oral hygiene level (API > 30% = 1, API ≤ 30% = 0) was used to calculate odds ratios (OR) with 95% confidence intervals for various predictors. Value of P < 0.05 was considered as statistically significant.

## Results

The average age of the students was 24.76 ± 1.40 years. One hundred students were examined (43 male and 57 females). There was 76.0% of students who drinks alcohol, on a daily base 67.0% consume coffee, 70.0% tea, and 32.0% of the students smoke cigarettes. Mean tongue pH level was 6.72 ± 0.49 and acid pH (< 6.5) was confirmed in 28.0% of students. Data about oral hygiene are partially uniform: all of the students visited the dentist in less than 1 year, they are brushing their teeth twice a day, and 80.0% of students are using oral hygiene accessories. Soft toothbrush uses 33.0% of the students, and the remaining 67.0% uses a toothbrush medium hardness. Mean API was 46.89 ± 28.28%, and poor oral hygiene was found in 30.0% of subjects.

OML were found in 61.0% of the students and variation of healthy oral mucosa in 37.0% of students. All of the male students had at least one while only 20.0% of female students

had no OML. There were 16 OML diagnosed, of which the most common were impressions of teeth on the edge of the tongue (55.0%), followed by fissured tongue (41.0%), than exfoliative cheilitis (33.0%) and white lesions due to the bad habit of chronic cheek and lip biting (morsicatio buccarum) (33.0%). Among variation of healthy oral mucosa line alba has the highest prevalence (58.0%) (Table 1).

Statistically significant relationship between the prevalence of OML and gender was found in paleness of oral mucosa ( $P = 0.004$ ), recurrent aphthous ulcers ( $P = 0.013$ ), tongue impressions ( $P = 0.037$ ) and acid pH tongue level (0.041), respectively. Coffee consumption showed a significant difference in the prevalence of melanin pigmentation ( $P = 0.035$ ) and mean tongue pH level ( $P = 0.039$ ), respectively. It was also found a significant link between regular tea consumption and leukoedema on the buccal mucosa ( $P = 0.029$ ). Drinking tea also showed a significant effect on the prevalence of the fissured tongue ( $P = 0.049$ ). Smoking showed a significant association

( $P = 0.031$ ) with the morsicatio buccarum, where the lesion occurs in 50.0% of the smokers (Table 2).

**Table 1.** The prevalence of oral mucosal lesion

Oral mucosal lesion	n
Existence of at least one lesion	61
Paleness of oral mucosa	8
Petechiae	14
Morsicatio buccarum	33
Cheilitis exfoliativa	33
Gingivitis	12
Recurrent aphthous ulcers	6
Mucocele	3
Melanin pigmentation	8
Tongue	
Without lesion	45
One lesion	34
Few lesion	21
Fissured tongue	41
Glossitis rhomboidea	3
Glossitis geographica	15
Tongue impressions	55
Tongue papillae atrophy	7
Variation of healthy oral mucosa	
Existence of at least one variation	37
Linea alba	58
Leukoedema	14
St. Fordyce	26

**Table 2.** Association of the gender and harmful habits with the oral mucosal lesions, mucosal variation and tongue pH level

Variable	Gender		Smoking		Alcohol		Coffee		Tea	
	Male	Female	Yes	No	Yes	No	Yes	No	Yes	No
Paleness of oral mucosa (n)	0	8	0	8	5	3	4	4	5	3
P	0.004		0.104		0.617		0.500		0.751	
Morsicatio buccarum (n)	13	20	21	12	23	10	23	10	23	10
P	0.805		0.031		0.431		0.876		0.889	
Leukoedema (n)	6	8	6	8	11	3	12	2	6	8
P	0.775		0.302		0.917		0.194		0.029	
Melanin pigmentation (n)	4	4	4	4	7	1	8	0	6	2
P	0.453		0.221		0.529		0.035		0.919	
Recurrent aphthous ulcers (n)	6	0	3	3	4	2	2	4	5	1
P	0.013		0.397		0.585		0.144		0.467	
Fissured tongue (n)	21	20	14	27	30	11	23	18	33	8
P	0.173		0.705		0.585		0.086		0.049	
Tongue impressions (n)	18	37	14	41	39	16	37	18	37	18
P	0.037		0.123		0.186		0.950		0.515	
Tongue pH level (mean)	6.72	6.61	6.50	6.74	6.64	6.71	6.57	6.85	6.64	6.70
Tongue pH < 6.5 (n)	7	21	9	19	21	7	23	5	19	9
Mean (P)	0.527		0.326		0.746		0.039		0.755	
Frequency (P)	0.041		0.985		0.884		0.076		0.771	

**Table 3.** Association of the gender, harmful habits and oral hygiene accessories with the presence of gingivitis, oral hygiene level, and tongue lesions

Variable	Gender		Smoking		Alcohol		Tea		Oral hygiene accessories	
	Male	Female	Yes	No	Yes	No	Yes	No	Yes	No
Gingivitis (n)	9	3	3	9	5	7	4	8	7	5
P	0.028		0.584		0.009		0.009		0.106	
Mean API (%)	42.6	51.6	40.5	51.1	46.8	50.7	47.3	48.7	47.2	49.9
API > 30% (n)	20	10	13	17	22	8	18	12	26	4
P (Significant) mean	0.127		0.078		0.554		0.847		0.702	
P (Significant) frequency	0.004		0.175		0.878		0.234		0.413	
Tongue lesions (n)	25	30	18	37	40	15	37	18	16	39
P	0.971		0.766		0.063		0.197		0.003	

API: Approximal plaque-space index

**Table 4.** Logistic regression analysis of possible risk indicators for gingivitis, poor oral hygiene level, tongue lesions, and acid tongue pH level

Variable	Gender	No alcohol	No tea	No oral hygiene accessories
Gingivitis OR (95% CI)	16.39 (2.04-125)*	16.13 (2.49-100)	6.02 (1.24-29.41)	7.81 (1.28-47.62)
P	0.008	0.004	0.026	0.026
API > 30% [OR (95% CI)]	3.76 (1.44-9.87)*			
P	0.007			
Tongue lesions [OR (95% CI)]				4.05 (1.20-13.70)
P				0.025
Tongue pH < 6.5 [OR (95% CI)]	3.10 (1.10-8.74)**			
P	0.033			

\*Male gender; \*\*Female gender; API: Approximal plaque-space index; OR: Odds ratio; CI: Confidence interval

Gingivitis showed significant relationship with gender ( $P = 0.028$ ), students who do not drink tea ( $P = 0.021$ ) and alcohol ( $P = 0.031$ ), respectively. Usage of oral hygiene accessories were significantly associated with tongue lesions ( $P = 0.003$ ), where lesions occur in 80% of cases within the students who do not use it. Poor oral hygiene was found in male students ( $P = 0.004$ ) and borderline difference ( $P = 0.078$ ) between smoking and mean API values (Table 3).

The results of logistic regression analysis indicate that male gender was significant predictor for gingivitis occurrence (OR = 16.39) and poor oral hygiene (OR = 3.76), while female gender predicted acid pH level of tongue mucosa (OR = 3.10). Students who do not use alcohol, tea, and oral hygiene accessories, independently were significantly associated with gingivitis (OR = 16.13, 6.02 and 7.81), respectively. Furthermore, students who used oral hygiene

accessories on a daily base have four times less chance to get some tongue lesions. Data are shown in table 4.

### Discussion

The frequency of OML in this study was 61.0%. Meanwhile the prevalence of oral lesions in studies from Brazil<sup>24</sup> is 27.0%, and the results of research conducted in U.S. showed that only 4.0% of school children had one or more lesions of the oral mucosa at the time of examination.<sup>7</sup> Randomized study showed that the prevalence of oral lesions is 51.2% among adults over 30 years in Spain.<sup>3</sup> In a study conducted in Turkey, the prevalence was 41.7% in a wide range of age population.<sup>4</sup>

Differences and the high prevalence of oral lesions in our study, compared to the above-mentioned studies, can be attributed to differences in the studied populations and sample size. Thus, this prevalence could not be considered as representative because our sample represents only one subgroup of the

student population between 23 and 26 years old. It has been also found that the prevalence of oral lesions increases with age.<sup>2</sup>

Tongue lesion had 55.0% of students, of whom 34.0% had one and 21.0% more than one lesion. Research in Turkey showed that the prevalence of tongue lesions was 52.2%,<sup>15</sup> while Hungarian study among children found 35.1% of tongue lesions.<sup>25</sup> Chosack et al.<sup>1</sup> reported that the prevalence of lesions occurs in 1.9% of cases. The prevalence of tongue lesions in our study showed a significant association with the usage of oral hygiene accessories. There was the lack of information in literature regarding the impact of oral hygiene accessories on tongue lesions.

It is considered that fissured tongue is hereditary anomaly, although there are studies that show an association with aging and that the prevalence of fissured tongue increases with age.<sup>4,12,15,25</sup> Our study shows significantly higher prevalence of fissured tongue among students who consume tea. It was previously reported correlation between tongue lesions and consumption of black tea.<sup>5</sup> The most of studies that were investigating fissured tongue showed no difference related to the gender,<sup>5,12,13,15</sup> as it was found in our study while some authors reported a higher incidence in male.<sup>25,14</sup> The prevalence of tongue impressions in our study showed a significant difference related to gender, with predominance in females. Tongue impressions, macroglossia, and ankyloglossia are more common in people over 60 year's old.<sup>5</sup>

The occurrence of gingivitis higher frequency among the students who do not consume alcohol or tea can be explained by its possible antiseptic or antiphlogistic effect on the oral cavity, although it briefly reserves. There was no information about this relationship found in the literature. On contrary, Rooban et al.<sup>26</sup> found a correlation between gingival inflammation and long-term alcohol consumption, explaining that while the concentration of alcohol increases in the blood, the amount of stimulated saliva is decreasing

and also chemical composition of saliva changes by decreasing electrolyte and protein and thus its protective role. Male students who do not use oral hygiene accessories in our study showed a higher gingivitis prevalence and lower oral hygiene level.

The study among dental students in the Emirates, also showed higher prevalence of gingival inflammation in men caused by poorer level of oral hygiene and higher values of plaque index.<sup>27</sup> Associated with coffee consumption melanin pigmentation were found in 8.0% of students, and no data about this link were found. Because of small frequencies, these results cannot be considered as significant. The prevalence of these lesion shows differences among racial and ethnic groups, in Iran occurs in 4.0% of cases,<sup>28</sup> while in Turkey in 6.9% of cases.<sup>4</sup> It is a known fact that females are more affected by anemia, therefore, higher prevalence of paleness of oral mucosa in women compared to men is not surprising.

Leukoedema as a variation in the structure and appearance of the healthy oral mucosa occurs in 30.0% of students in our study who do not drink tea. Although it is well-known that the existence of such variation is associated with smoking.<sup>29</sup> Recurrent aphthous ulcers were found in 6.0% of students, with higher prevalence among men (13.9%), compared to women, who did not have any. The prevalence of recurrent aphthous stomatitis in the general population is 10-20%, with predominance among women.<sup>7</sup>

Relationship between coffee consumption and pH value of the tongue mucosa were significant in our study. Although mean pH value was considered as normal, we believe that decreasing the saliva and mucosa pH value showed a potential risk of changing the oral microflora, by growing more virulent types of microorganisms, which consequently might cause oral infection, gingivitis, periodontitis, and caries. In the present study, a borderline difference was found

between smoking and API values. Regarding this, smokers have significantly higher values of plaque index and gingival index, and a higher percentage of periodontitis, gingival recession, as well as larger apical displacement of the epithelial attachment level compared to non-smokers.<sup>30,31</sup>

### Conclusion

According to the results, there is a high prevalence of oral mucosal lesions among student population, as well as existence of relationship between some oral mucosal lesions, gender, tongue mucosa pH level, oral hygiene level, harmful habits, and oral

hygiene accessories.

Considering the fact that dentistry and medical students are health-educated people, therefore, it is their role to promote oral health and further motivate patients by avoiding harmful habits and also showing the positive effect of higher level of oral hygiene.

### Conflict of Interests

Authors have no conflict of interest.

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