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ORIGINAL ARTICLE

Prevalence of oral lesions in 13- to 16-year-old students in Duzce, Turkey

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OBJECTIVE: The aim of this study was to determine the prevalence of oral lesions in 13- to 16-year-old students.
METHODS: A cross-sectional survey was carried out on students in Duzce, a province in the western Black Sea region of Turkey. A total of 993 children aged between 13 and 16 from eight secondary schools were examined. Oral lesions with recurrent behavior, if observed, were recorded at the time of examination. Venous blood samples were obtained for detecting hemoglobin levels.
RESULTS: Two hundred sixty adolescents (26.2%) were diagnosed with at least one oral mucosal lesion at the time of the examination. Thirteen different mucosal alterations were diagnosed, and the most common lesions were angular cheilitis (9%), linea alba (5.3%), and aphthous ulceration (3.6%). The correlation between occurrence of mucosal lesions and sex was not statistically significant ($P > 0.05$). Statistical evaluation of the data revealed a significant relationship only between the presence of angular cheilitis and anemia ($P < 0.05$).
CONCLUSION: This study is the first epidemiologic study of oral mucosal lesions in adolescents in Turkey. Angular cheilitis was the only oral mucosal lesion that had a significant correlation with anemia.
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Keywords: adolescents; oral mucosal lesions; prevalence; oral lesions

Introduction

Epidemiologic studies have demonstrated a wide variability in prevalence rates of oral lesions in different populations. It has been reported that diseases of the oral mucosa may affect 25–50% of individuals, depending on the population studied (Andreasen *et al*, 1986).

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As the variability is quite high, there is a need of data concerning the prevalence rates of oral mucosal lesions in specific populations to develop a rational oral health policy.

Adolescents are at the crossroads between childhood and adulthood, and it is unclear whether the pattern of oral diseases in this group resembles that of children or that of adults. To date, little epidemiologic research has been conducted into oral mucosal disorders in adolescents (Sawyer *et al*, 1984; Sedano *et al*, 1989; Kleinman *et al*, 1991, 1994; ; Tomar *et al*, 1997; Shulman, 2004a,b, 2005). From Turkey, there are only few studies regarding the prevalence of oral lesions and none of them were conducted on adolescents (Avcu and Kanli, 2003; Avcu *et al*, 2005; Mumcu *et al*, 2005).

The aim of the present study was to investigate the prevalence of oral lesions in 13- to 16-year olds living in Duzce, and a possible correlation between the occurrence of these lesions and sex. As anemia is one of the possible predisposing factors to oral mucosal lesions (Wray *et al*, 1978), we also aimed to investigate the relationship between oral mucosal lesions and anemia.

Material and methods

Study population

Duzce, a Turkish province located in the western Black Sea region, is made up of different ethnic groups. Socioeconomic and living conditions in Duzce apparently deteriorated following two earthquakes in 1999 spanning 3 months – reflected at the time of the study which was conducted in May 2002.

A total of 993 children aged between 13 and 16 from Duzce comprised the study population. The number of schoolchildren was 11 200 at the time of the study according to the data obtained from the Directorate of Education. Sample size was calculated on an expected oral lesion prevalence rate of 25% (Andreasen *et al*, 1986; Bessa *et al*, 2004), $d = 0.05$ at a confidence level of 99%, and the calculated study population was 1031 with Epi-info 6.0 (statcalc). Permission was obtained from the Directorate of Education and informed consent was obtained from all subjects. Multistage sampling was used

in the selection of the study sample. Duzce was separated into seven regions according to the local administration. A total of eight schools, two from the city center and one from each peripheral region were randomly selected. Sample size was stratified by sex, and school population by region. In the first stage, the number of students from each school was obtained according to the proportion of 13- to 16-year olds of that region and in the second stage according to male/female ratio. Mouth mirrors, disposable retractors, and natural and/or artificial light were used to examine the participants. As there was no institutional review board at the time of the survey, the rules of Declaration of Helsinki were followed. Exclusion criteria were refusal, absence on the day of examination, and failure to return consent forms.

Data collection

Diagnostic charts were used to record personal data and the oral lesions. All examinations and diagnoses were carried out by the same authors from the Department of Dermatology. All dermatologists received a standard training for detecting oral lesions before starting this study. Intra- and inter-examiner calibration at the beginning of the study was performed. In case of difference, final diagnosis was made out in consensus. The diagnosis was merely based on examinations and histopathologic confirmation of lesions was not used in this survey. Periodontal and gingival diseases were not included in the survey.

Clinical criteria for oral soft tissue lesions were based on World Health Organization (1980) recommendations. Recurrent herpetic lesions and aphthous stomatitis were recorded only if observed at the time of the examination.

Additionally, venous blood samples obtained from all subjects (except students who refused to give blood sample) were used for complete blood count ($n = 973$). Anemia was defined as hemoglobin levels < 12 g dl^{-1} in girls and < 13 g dl^{-1} in boys, regardless of its etiology.

Statistical analysis

Statistical analysis was performed using the software Epi-info version 6.0 to evaluate any significant difference between adolescents with and without oral lesions with respect to sex and anemia. Confidence intervals were calculated and the chi-square test was used for analytic assessment. $P < 0.05$ was considered statistically significant.

Results

Of the 993 adolescents included in the study, 534 (53.8%) were boys and 459 (46.2%) were girls. The mean age was 14.2 years with a standard deviation of 0.81. Distribution of participants according to sex and number of total oral lesions is shown in Table 1.

Two hundred sixty adolescents (26.2%) were diagnosed with at least one oral mucosal lesion at the time of the examination. The prevalence rates of oral mucosal lesions in boys and girls were 26.2% and 26.1%, respectively. There were 28 (2.8%) adolescents with two or more oral mucosal alterations at the same time. The correlation between occurrence of any type of mucosal lesions and gender was not statistically significant ($P > 0.05$) (Table 1).

Table 1 Participants' distribution by sex and number of total oral lesions

Oral lesion	*Boys, n (%)*	*Girls, n (%)*	*Total, n (%)*	χ^2	*P*
Present	140 (26.2)	120 (26.1)	260 (26.2)	0.001	0.519
Absent	394 (73.8)	339 (73.9)	733 (73.8)		
Total *n*	534 (53.8)	459 (46.2)	993 (100)		
Total lesion *n*	159 (29.8)	129 (28.1)	288 (29)		

Thirteen different mucosal lesions were diagnosed, of which the most common were angular cheilitis (9%), linea alba (5.3%), aphthous ulceration (3.6%), herpes labialis (2.9%), and fissured tongue (2.8%). The prevalence rates of the different oral lesions observed are presented in Table 2.

Evaluation of the distribution of oral mucosal lesions according to sex revealed linea alba and herpes labialis to be more common in boys, unlike oral aphthous ulcers and angular cheilitis which were found to be more common in girls. However, these data were not statically significant ($P > 0.05$) (Table 2).

Venous blood samples were obtained from 973 students. Two hundred twenty-seven subjects (23.3%) were anemic. Anemia was a significant factor only in adolescents with angular cheilitis ($P < 0.05$). Statistical analysis of the data regarding the occurrence of other oral mucosal lesions and anemia failed to show significant correlation ($P > 0.05$) (Table 3).

Discussion

The frequency of children presenting with oral mucosal alterations in the present study was 26.2% and the most prevalent oral mucosal lesions were angular cheilitis (9%), linea alba (5.3%), aphthous stomatitis (3.6%), and herpes labialis (2.9%) (Table 2). Even though the prevalence rates of linea alba and aphthous ulcerations were higher in boys and girls, respectively, the difference was insignificant ($P > 0.05$) for other lesions with respect to sex.

The marked variation in the prevalence of oral mucosal lesions in the literature may be the result of differences in geographic settings, socio-demographic characteristics of the population studied, methodology, and clinical diagnostic criteria. Although a prevalence rate of 27% was reported from Brazil (Bessa *et al*, 2004), only 4% of 5- to 17-year-old US schoolchildren had one or more oral mucosal lesions at the time of examination (Kleinman *et al*, 1994). In a survey based on record reviews, only 2.3% of children aged 0–5 years were found to have oral mucosal lesions (Bezera and Costa, 2000). Results of the Third National Health and Nutritional Examination Survey, 1988–1994 (NHANES III) showed a point prevalence of 10.26% of oral mucosal lesions in 2- to 17-year olds in the USA

Table 2 The prevalence rates of the different oral lesions and correlation between sex

	Boys (n = 534)		*Girls (n = 459)*		*Total (n = 993)*			
Oral lesions	*n (%)*	*95% CI*	*n (%)*	*95% CI*	*n (%)*	*95% CI*	χ^2	*P*
Angular cheilitis	44 (8.2)	5.9–10.5	45 (9.8)	7.1–12.5	89 (9.0)	7.3–10.7	0.74	0.38
Linea alba	35 (6.6)	4.5–8.7	18 (3.9)	2.2–5.6	53 (5.3)	4.0–6.6	3.39	0.06
Aphthous ulcers	14 (2.6)	1.3–3.9	22 (4.8)	2.9–6.7	36 (3.6)	2.5–4.7	3.33	0.06
Herpes labialis	18 (3.4)	1.9–4.9	11 (2.4)	1.0–3.8	29 (2.9)	1.9–3.9	0.83	0.36
Fissured tongue	16 (3.0)	1.6–4.4	12 (2.6)	1.2–4.0	28 (2.8)	1.8–3.8	0.13	0.71
Geographic tongue	3 (2.4)	1.2–2.6	10 (2.2)	0.9–3.5	23 (2.3)	1.4–3.2	0.07	0.78
Fordyce spots	9 (1.7)	0.7–2.7	3 (0.7)	0.00–1.46	12 (1.2)	0.6–1.8	2.20	0.13
Strawberry tongue	1 (0.2)	0.02–0.57	4 (0.9)	0.00–1.76	5 (0.5)	0.07–0.93	2.31	0.14
Melanotic macule	3 (0.6)	0.00–1.25	1 (0.2)	0.00–0.60	4 (0.4)	0.01–0.79	0.73	0.37
Mucocele	2 (0.4)	0.00–0.93	1 (0.2)	0.00–0.60	3 (0.3)	0.00–0.64	0.20	0.55
Ectopic lingual tonsil	1 (0.2)	0.01–0.57	1 (0.2)	0.00–0.60	2 (0.2)	0.00–0.47	–	–
Leukoplakia	1 (0.2)	0.01–0.57	1 (0.2)	0.00–0.60	2 (0.2)	0.00–0.47	–	–
Oral candidiasis	1 (0.2)	0.01–0.57	0 (0.0)	–	1 (0.1)	0.00–0.29	–	–
Focal epithelial hyperplasia	1 (0.2)	0.01–0.57	0 (0.0)	–	1 (0.1)	0.00–0.29	–	–

Table 3 Anemia *vs* oral lesion

	Anemia, n (%)			
	Present	*Absent*	χ^2	*P*
Angular cheilitis	28 (31.8)	60 (68.2)	3.89	0.048
Linea alba	12 (23.1)	41 (76.9)	0.00	0.97
Aphthous ulcers	6 (17.1)	29 (82.9)	0.78	0.37
Herpes labialis	6 (20.7)	23 (79.3)	0.12	0.73
Fissured tongue	4 (14.3)	24 (85.7)	1.32	0.25
Geographic tongue	5 (22.7)	17 (77.3)	0.00	0.95
Fordyce spots	3 (25.0)	9 (75.0)	0.01	0.89

(Shulman, 2005). A randomized study found a prevalence rate of 51.19% in adults aged over 30 years in Spain (Garcia-Pola *et al*, 2002). In a study performed in Turkey, a prevalence rate of 41.7% was found in a population with a wide age range (Mumcu *et al*, 2005). Another Turkish study reported a 52.2% prevalence rate of tongue lesions in dental outpatients (Avcu and Kanli, 2003). The difference between prevalence rates in our study and others reported from Turkey may be attributed to the diversity of the studied populations. Moreover, studies performed in different countries indicated that the prevalence rate of oral mucosal lesions increases with age (Reichart, 2000; Bessa *et al*, 2004). Although this finding correlated with those in the literature, this study is unique in that it was performed only in adolescents.

Among the studies about the prevalence of oral lesions we picked up the one from Brazil (Bessa *et al*, 2004) which is thought to be more similar to Turkey than those countries with higher socioeconomic levels. The sample of our study was designed according to the expected frequency of total oral lesions of 25% which was the finding of this study from Brazil. Angular cheilitis, linea alba, aphthous stomatitis and herpes labialis were the most common oral lesions. However, given that the prevalence rates of some specific lesions are low, a calculated rate lower than 2.3% with a confidence level of 80% makes the power of the sample size insufficient. Accordingly the results for strawberry tongue, melanotic mucocele, ectopic lingual tonsil, leukoplakia, oral candidiasis, and focal epithelial hyperplasia should be interpreted carefully (Table 2). As the study was underpowered in this respect, we could not prove the relationship between anemia, sex and oral mucosal lesions.

The prevalence rate for angular cheilitis was high (9%) in our study. Garcia-Pola Vallejo *et al* (2002) reported a 2.9% prevalence rate in adults, which increased with denture usage (7.9%) and slightly with age. In a study performed in South African preschoolers, angular cheilitis was the most commonly observed oral mucosal alteration with a prevalence rate of 15.1% (Arendorf and van der Ross, 1996). A previous cross-sectional study from Turkey revealed a rate as low as 0.4% for angular cheilitis in elderly denture wearers (Mumcu *et al*, 2005). As none of our patients wore any form of prosthesis, the cause for this lesion was most likely anemia which was found in 31.8% of angular cheilitis patients. The significant correlation between the presence of anemia and angular cheilitis may help explain such a difference.

Angular cheilitis is an acute or chronic inflammation of the skin and contiguous labial mucous membrane at the angles of the mouth. Most cases result from mechanical, infective, nutritional, or immune defects. Nutritional deficiencies such as riboflavin, folate, iron and general protein malnutrition may be causative factors for angular cheilitis (Scully, 2004). Wray and Dagg (1990) reported a 15% prevalence rate of angular cheilitis in patients with iron deficiency. One of the limitations of our study is the lack of investigation of those etiologic factors for angular cheilitis. However, only anemia, regardless of its etiology, was included in this study. A study from Argentina reported that angular cheilitis was more commonly observed in people of low socioeconomic status (Crivelli *et al*, 1988). The apparent low socioeconomic status due to the two earthquakes in Duzce might be a predisposing factor for angular cheilitis.

Linea alba is described as a slightly raised, usually bilateral whitish line traversing the corner of the mouth as far as the last molar tooth (Seoane Leston *et al*, 2002). In this study linea alba was the second most common lesion with a prevalence rate of 5.3%. Although some authors reported the prevalence of frictional lesions and cheek biting, we could not find any data in relation to linea alba. This may be because of different nomenclatures used for these lesions.

The prevalence of aphthous ulcerations was usually reported based on positive history because of the relapsing nature of the disease. As recall of the condition may differ, and it may be difficult for an adolescent to describe and identify such a condition, we only included cases with lesions diagnosed at the time of the examination and excluded subjective factors. A review of the literature revealed a prevalence of positive history of aphthous ulcerations ranging between 6% and 66% (Kleinman *et al*, 1991). Because of the different methodology, it was not surprising to have a point prevalence rate of 3.6% in our study. Moreover, the prevalence of aphthous ulcerations depends on populations. It was reported as 11.1% in outpatients in Malaysia (Axell *et al*, 1990), 1.6% in the 12–17 age group school children in the United States (Kleinman *et al*, 1994) and 2% in a Swedish adult population (Axell, 1975).

Although several factors were proposed as causative, attempts to elucidate the exact etiology of recurrent aphthous stomatitis have failed. Shulman (2004b), in his analysis of NHANES III data, reported a point prevalence rate of 1.51% in the USA in children and youths. Point prevalence increased significantly in the older age group and was almost eight times higher in the 12–17 (2.48%) than in 2–4 (0.32%) year groups. Data analysis do not support the association between recurrent aphthous stomatitis and gender, family income, cigarette smoking or smokeless tobacco use, vitamin deficiency hematologic factors such as ferritin, iron and hemoglobin, *Helicobacter pylori*, hepatitis C, and recurrent herpes labialis history. Although we used point prevalence rate in our study, our result is still higher than Shulman's, which may be attributed to the racial and ethnic differences of the studied groups (Shulman, 2004b). As Behçet's disease – another risk factor for aphthous ulcerations – prevalent in Turkey, we expected to find a relatively high prevalence of aphthous ulcerations (Idil *et al*, 2002). Taking these into consideration, our results based on the same methodology may be accepted as comparable to the data present in the literature.

We did not find any significant relationship between aphthous ulcerations and anemia ($P = 0.37$). The lack of data on smoking is a further limitation as cigarette smoking has been reported to protect against aphthous ulcers (Shulman, 2004b).

Data on the prevalence of herpes simplex vary in different geographic settings (Embil *et al*, 1975). The highest prevalence was observed in North America (close to 40%), followed by South America and Asia (under 20%). Data from Europe indicate that the incidence of recurrent labial herpes has decreased considerably, ranging from 0.6% (Salonen *et al*, 1990) to 1.3% (Garcia-Pola Vallejo *et al*, 2002). Once again, the methodology gains importance as Reichart (2000) showed a rate of 20% according to positive history, which decreased to as low as 1.4% when only the herpes lesions diagnosed at the time of the study were considered. Our result indicated a rate of 2.9% based on point prevalence and this is a slightly higher rate compared with the prevalence studies concerning herpes labialis in Europe, Brazil and USA which reported a range of 0.91–1.7% (Kleinman *et al*, 1994; Reichart, 2000; Garcia-Pola Vallejo *et al*, 2002; Bessa *et al*, 2004; Shulman, 2004a). Point prevalence rate of herpes labialis in youths and children in USA was 1.42 and race-ethnicity was found to be a risk factor for recurrent herpes labialis point prevalence, annual prevalence and HSV-1 seropositivity (Shulman, 2004a).

Similar to other oral mucosal lesions, the frequency of tongue lesions in children shows a wide variability. Although fissured tongue is thought to be hereditary, published studies show that its occurrence is influenced by age (Chosack *et al*, 1974; Kullaa-Mikkonen *et al*, 1982; Banoczy *et al*, 1993; Voros-Balog *et al*, 2003). In a survey conducted on Hungarian children, a prevalence rate of 29.2% was reported (Voros-Balog, 2003). This finding was higher than the results of most of the previous studies – 0.8% in Nigerian children (Sawyer *et al*, 1984), 11.4% in Jordanian adults (Darwazeh and Pillai, 1993), 2.0% in Argentinean school children (Crivelli *et al*, 1988), and 2.8% in 5- to 12-year-old Brazilian children (Bessa *et al*, 2004). In our study, we found a prevalence rate of 2.8%. In previous studies from Turkey conducted on dental outpatients with a wide age range (13–83), the prevalence rate of fissured tongue was 20% (Avcu and Kanli, 2003). On the other hand, in a cross-sectional study it was 3% in the 5–17 age group and increased with age (Mumcu *et al*, 2005). Although data on male or female predominance in fissured tongue are contradictory, the present study did not show any predominance for either sex (Kullaa-Mikkonen *et al*, 1982; Banoczy *et al*, 1993; Darwazeh and Pillai, 1993; Avcu and Kanli, 2003).

Benign migratory glossitis, or geographic tongue, is usually an asymptomatic inflammatory disorder of unknown etiology that affects the epithelium of the tongue. The prevalence of geographic tongue has been reported to vary between 0.3% and 14.4%, but most surveys show a range between 1.0% and 2.5% (Assimakopoulos *et al*, 2002), as in this survey which showed a rate of 2.3%. It appears to occur more commonly in children, and its frequency diminishes with age (Assimakopoulos *et al*, 2002). As our study group was composed of adolescents, our result was along expected lines. Differences in sampling, diagnosis, and type of examination may explain the wide range in the reported rates of geographic tongue. Some studies have shown that it is more common in women, whereas others reported similar rates regarding sex (Assimakopoulos *et al*, 2002). Statistical

analysis failed to show such a difference with respect to sex in the current survey.

Fordyce granules were reported to have a prevalence rate of 1.2% and no significant difference was encountered in both sexes. A prevalence rate of 0.96% was reported in Spanish preschool children (Garcia-Pola *et al*, 2002), 0.65% in 5- to 12-year-old Brazilian children (Bessa *et al*, 2004), 26.6% in Germans aged 35–44 years (Reichart, 2000), and 82.8% in a Swedish adult population (Axell, 1975). These studies demonstrate that the increase in prevalence with age is remarkable and our result (1.2% in adolescents) is in accordance with the literature. There are reports pointing out a huge variability in the prevalence of fordyce granules, attributed to racial differences. The function of these sebaceous glands is unknown, thus the explanation for very high results reported from some countries remains obscure.

Other lesions encountered in this survey are strawberry tongue (0.5%), melanotic macule (0.4%), mucocele (0.3%), ectopic lingual tonsil (0.2%), leukoplakia (0.2%), oral candidiasis (0.1%), and focal epithelial hyperplasia (0.1%) (Table 2). To our knowledge, there is no data on the prevalence rate of strawberry tongue, which is mostly associated with streptococcal upper respiratory infections.

Among oral mucosal lesions, aphthous stomatitis and angular cheilitis are especially known to be related to anemia, iron and vitamin deficiencies (Wray *et al*, 1978). In our study, only angular cheilitis was found to have a significant correlation with anemia. Lack of detailed investigation of anemia or other nutritional deficiencies that could have revealed an etiologic relationship between these factors and oral mucosal lesions was a limitation of our study.

Conclusion

This study is the first epidemiologic study in Turkey concerning oral mucosal lesions in adolescents. More than 26% of adolescents were found to have at least one oral mucosal lesion. Angular cheilitis, linea alba, and aphthous ulcerations were the most commonly encountered lesions in Turkish adolescents without any significant difference between boys and girls. Regarding anemia, the only statistically significant correlation was found with angular cheilitis. Investigation of possible etiologic factors other than anemia might strengthen our study. However, the power of the sample size was insufficient to make correlations between anemia and oral mucosal lesions.

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