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Research Article

Title

Erosive tooth wear among adults in Lithuania: a cross-sectional national oral health study

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Short Title: Prevalence of erosions in Lithuania

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Abstract

Introduction. Erosive tooth wear has a multifactorial origin, where multiple risks contribute to its initiation and subsequent progression. The prevalence of tooth wear varies among countries; therefore, national studies are needed to examine the prevalence of this condition and its associated determinants.

Materials and methods. A sample of this national study included a total of 1397 adults (response rate of 52%). Severity and number of teeth with erosive tooth wear, caries experience (D_3MFS), and fluorosis were assessed clinically. A self-reported questionnaire inquired about socio-demographics, oral health behaviour, diet, and general health. Fluoride levels in drinking water at the recruitment areas were also recorded. Data were analyzed by bivariate and multivariate methods.

Results. The prevalence of erosive tooth wear in enamel and dentin combined was 59% among 35–44-year-old, 75% among 45–54-year-old, 70% among 55–64-year-old and 66% among 65–74-year-old males. The prevalence among females in the respective age groups was 44%, 60%, 63%, and 59%. Erosive tooth wear in enamel associated with a lower fluoride level (≤ 1 ppm) in the drinking water (OR 2.1, 95% CI 1.1–4.2). Erosive tooth wear in dentin positively associated with male gender (OR 1.7, 95% CI 1.1–2.5), peri-urban/rural residency (OR 1.6, 95% CI 1.1–2.4), older age (OR 1.6, 95% CI 1.3–1.9), presence of reflux (OR 3.3, 95% CI 1.0–10.9), and negatively with higher D_3MFS scores (OR 0.7, 95% CI 0.5–0.9).

Conclusions. The prevalence of erosive tooth wear in enamel and dentin was relatively high in Lithuania; the erosive tooth wear in enamel and dentin combined was 52% among 35–44-year-olds, 68% among 45–54-year-olds, 67% among 55–64-year-olds, and 63% among 65–74-year-olds. Lower fluoride level in drinking water was associated with erosive tooth wear in enamel. Male gender, residency in peri-urban/rural areas, older age, and presence of acid reflux were

associated with higher odds, while higher D_3MFS scores were associated with lower odds for erosive tooth wear in dentin. These results can be used to plan dental public health prevention.

Introduction

Erosive tooth wear, which is defined as softening of tooth hard tissues due to extrinsic and intrinsic acids with a subsequent loss of mineral structure due to mechanical forces, is often called a 21st-century challenge [Lussi and Ganss, 2014]. Approximately one-third of the population in industrialized countries presents with dental erosive tooth wear; additionally, this condition seems to be rising, with prevalence rates in different countries varying from 3% to 100% [Bartlett et al., 2013; Isaksson et al., 2014; Jaeggi and Lussi, 2014; Van't Spijker et al., 2009].

Erosive tooth wear has a multifactorial etiology that usually co-exists with other types of tooth wear [Shellis and Addy, 2014]. Consumption of acidic foods and beverages [Bartlett et al., 2011], intensive tooth brushing [Bardolia et al., 2010; Savage et al., 2018], acid reflux and recurrent vomiting [Bartlett et al., 2013], and socio-demographic variables like residing in a rural area [Bartlett et al., 2013] were associated with a higher prevalence of erosive tooth wear [Lussi and Ganss, 2014], while fluorides may have a preventive effect against erosive tooth wear [Lussi et al., 2019]. Products containing titanium or stannous fluorides are reported to be the most effective in the prevention of erosive tooth wear by making the tooth surfaces more resistant to acids [Huysmans et al., 2014]. However, fluorides seem to be less beneficial in preventing erosive tooth wear than dental caries, as for preventing erosive tooth wear the fluoride concentration needs to be higher or its application more frequent [Magalhães et al., 2011]. An epidemiological study demonstrated that fluoridated water was associated with a lower prevalence of erosive tooth wear [Bardsley et al., 2004].

One previous Lithuanian study examined regular swimmers and found the 25% prevalence of dental erosive tooth wear among 12–17-year-olds, and 50% among 18–25-year-old individuals [Zebrauskas et al., 2014]. There were no previous national Lithuanian studies that examined the prevalence of erosive tooth wear in middle-aged and older adults.

Therefore, the present study aimed to examine the prevalence of erosive tooth wear and its potential determinants in a representative Lithuanian sample of the general adult population.

Material and methods

Study design and participants

The current cross-sectional study, conducted as part of Lithuanian National Oral Health Survey included a stratified random sample of 35–74–year–olds and was carried out in the five largest Lithuanian cities and 10 randomly selected peri-urban/rural areas, in one of each of the 10 Lithuanian counties. The necessary minimum sample size was calculated to be around 300 for each age group. The following age groups were chosen based on the World Health Organization (WHO) recommendations 35–44, 45–54, 55–64, 65–74 years old subjects. Due to a planned stratified random sampling, the calculated number of participants was multiplied by a design effect of 1.5 [Naing L et al., 2006], and as we expected a 50% recruitment rate [Skudutyte et al., 2000]; the sample size was increased to 900 subjects per age group. In total, 1397 (462 males and 935 females) agreed to participate, resulting in a 52% response rate.

Questionnaire

Participants completed the WHO Oral Health Questionnaire for Adults [World Health Organization, 2013]. Besides, information about the presence of systematic diseases and dry mouth was also collected. The questionnaire was translated from English to an official Lithuanian language and two minority languages; Russian and Polish (and then back to English) by two independent individuals. Any inconsistencies were discussed and subsequently revised. The questionnaire was piloted in 10 adults who were not included in the main study.

Several potential determinants of tooth wear (presented in the supplementary material) were selected based on the proposed erosive tooth wear model [Lussi and Ganss, 2014]. Socio-demographic characteristics included age, education, and residency. Oral health behaviours

included tooth brushing frequency and the use of fluoridated toothpaste. The diet assessment included the consumption of fruits, juices, and soft drinks. General health had two assessments: the presence of reflux and dry mouth. The fluoride levels in drinking water at the recruitment areas were recorded based on the information provided by the water suppliers.

Clinical examination

Participants were clinically examined in the dental operatories of public health care institutions. The severity of erosive tooth wear and the number of teeth affected by this condition were evaluated based on the diagnostic criteria suggested by Lussi [Lussi, 1996] employing the WHO index [World Health Organization, 2013]. The diagnostic criteria for occlusal surfaces were rounded cusps, grooves, and restorations located above the adjacent tooth surface. The diagnostic criteria for facial and oral surfaces were concavities or flattened convex areas, the width of the defect exceeding the depth, intact enamel along the gingival margin and undulating borders. For differential diagnosis of attrition, the occlusion has been checked for corresponding features of opposing teeth. The diagnosis of erosive tooth wear was confirmed by the history of reflux and/or acidic diet. If there was a doubt that wear was not of erosive origin, for example, there was no history of reflux and/or acidic diet, such tooth was not considered as having signs of erosive tooth wear. All teeth, including third molars, were examined, erosive tooth wear was recorded at a subject level assigning a participant the most severe score detected. A score of '0' was allocated if there was no indication of erosive tooth wear, '1' if at least one tooth on any surface showed signs of erosive tooth wear in enamel, '2' if at least one tooth on any surface showed the signs of erosive tooth wear in dentin, and '3' if at least one tooth had erosion in dentin with pulp involvement. Subsequently, erosive tooth wear was dichotomized using two cut-off points: in enamel (erosive tooth wear in enamel versus no signs of erosive tooth wear) or in dentin (erosive tooth wear in dentin and dentin with pulp involvement versus no signs of erosive tooth wear). For each participant, the total number of teeth with signs of erosive tooth

wear of any severity was recorded. Subsequently, this variable was dichotomized and used as an outcome in a binary logistic regression analysis. A score of '1' was allocated if a participant had none or one tooth with signs of erosive tooth wear and '2' if a participant had two or more teeth with signs of erosive tooth wear. The rationale for such threshold was chosen as erosive tooth wear could affect more than one tooth per subject.

One trained and calibrated examiner (IS) assisted by a dental assistant assessed teeth for erosive tooth wear. The intra-examiner reliability was evaluated by examining 10 patients twice, with a two-week interval between the two evaluations. For the severity (categorical scale), the intra-examiner agreement rendered a Cohen's kappa of 0.84, and for the number of teeth affected by erosion (numerical scale), the intra-class correlation coefficient was 0.95. These levels of intra-examiner agreement were considered satisfactory. Using the WHO criteria, caries experience (D_3MFS) and fluorosis were recorded for each participant by the same examiner and subsequently categorized for statistical analyses: D_3MFS cut-off point was score 77, the mean value in the study sample. For D_3, M, and F surfaces, the intra-class correlation coefficient was 1.00, 0.99, and 1.00, respectively. These levels of the intra examiner agreement were considered satisfactory.

Statistical analyses

Statistical package for the social sciences (SPSS) version 26.0 (IBM SPSS, Armonk, NY.) was used for all statistical analyses. The prevalence was calculated using descriptive statistics. The chi-square test, likelihood ratio, and the independent-sample t-test were used to identify gender-related differences for each age group. Univariable and multivariable binary logistic regressions were used to assess the associations between erosive tooth wear and its potential determinants. Three binary logistic regression models were constructed; the first one with the outcome being erosive tooth wear in enamel versus no signs of erosive tooth wear, the second one with the outcome of erosive tooth wear in dentin versus no signs of erosive tooth wear, and

the third one with the outcome being two or more teeth with signs of erosive tooth wear versus none or one tooth with signs of dental erosion. For all models, Hosmer and Lemeshow goodness-of-fit tests rendered $p > 0.050$. The assumption of no multicollinearity (tolerance, VIF statistics) was not violated in any of the models [Field, 2009]. The model summaries were indicated by Nagelkerke R^2 [Field, 2009]. The statistical significance for both bivariate and multivariable tests was set at $p < 0.050$ and odds ratios are presented with 95% confidence intervals (CI).

Results

Data included information about 1397 participants, of which 462 (33%) were males, and 935 (67%) were females. In younger age groups (35–44, 45–54, 55–64 yrs.), females were more educated than males (Table 1). In the two youngest age groups (35–44 yrs and 45–54 yrs.), more males resided in urban areas, while in the age group of 55–44 yrs., more females resided in the areas with fluoride level in drinking water > 1ppm (Table 1). In all age groups, males reported less frequent tooth brushing. In the three youngest age groups, males consumed fruits and soft drinks more frequently than females (Table 1). The overall mean (SD) D_3MFS score was 77.4 (36.9), and only in the oldest age group more females than males had a higher than average D_3MFS score (Table 1). Signs of fluorosis were detected in 2% of participants (N=21) and the presence of fluorosis did not associate significantly with higher levels of fluoride in the drinking water (*data not shown*).

The prevalence of erosive tooth wear in enamel and dentin combined was 59% among 35–44-year-old, 75% among 45–54-year-old, 70% among 55–64-year-old and 66% among 65–74-year-old males (Table 1). The prevalence among females, in the respective age groups, was 44%, 60%, 63%, and 59% (Table 1). The prevalence of erosive tooth wear in enamel and dentin combined differed significantly between males and females only in the two youngest age groups

(Table 1). In different age groups, the range of erosive tooth wear in enamel was 5–29% among males and 11–27% among females, while in dentin, it was 30–63% among males and 19–48% among females (Table 1). The prevalence of erosive tooth wear in dentin was statistically significantly higher in males compared to females in the three youngest age groups (Table 1). Males in the age groups of 35–44 yrs., 45–54 yrs. and 65–74 yrs. had a significantly higher mean number of teeth with signs of erosive tooth wear than females of similar ages (Table 1). According to univariable and multivariable binary logistic regression analysis, only one variable, namely the fluoride level in drinking water ≤1 ppm associated with higher odds of erosive tooth wear in enamel (OR 2.1, 95% CI 1.1–4.2) (Table 2). Also, participants in the two youngest age groups, residing in areas with ≤1 ppm fluoride level in drinking water were twice as likely to have more teeth (two or more versus none or one) affected by erosive tooth wear (OR 2.2, 95% CI 1.2–4.4) (*data not shown*). Male gender (OR 1.7, 95% CI 1.1–2.5), residency in peri-urban/rural areas (OR 1.6, 95% CI 1.1–2.4), older age (OR 1.6, 95% CI 1.3–1.9) and self-reported acid reflux (OR 3.3, 95% CI 1.0–10.9) associated with higher odds, while higher than average D_3MFS score (OR 0.7, 95% CI 0.5–0.9) associated with lower odds for erosive tooth wear in dentin (Table 2). More teeth (two or more versus none or one) with signs of erosive tooth wear positively associated with residency in peri-urban/rural areas (OR 1.6, 95% CI 1.1–2.3) and older age (OR 1.3, 95% CI 1.1–1.5), and negatively with higher D_3MFS score (OR 0.7, 95% CI 0.5–0.9).

Discussion

This is the first national Lithuanian study examining the prevalence and potential determinants of erosive tooth wear among middle-aged and older adults. The combined prevalence of erosive tooth wear in enamel and dentin was 52% among 35–44-year-olds, 68% among 45–54-year-olds, 67% among 55–64-year-olds, and 63% among 65–74-year-olds. These prevalence rates

in adult Lithuanians were higher compared to the prevalence reported in a systematic review published a decade ago; that reported prevalence around 5% for 35-year-old adults and around 15% for 64-year-old participants [Van't Spijker et al., 2009]. The prevalence observed in the current study was also higher when compared to the one (29%) reported for younger adults (18–35 years old) from seven selected European countries and based on the Basic Erosive Wear Examination (BEWE) index [Bartlett et al., 2013].

However, the prevalence of erosive tooth wear that we observed was lower compared to 18–30-years-old in the United Kingdom, where all participants had signs of erosive tooth wear in the enamel and 77% had at least one surface with exposed dentine using the Exact Tooth Wear Index (ETWI) [Bartlett et al., 2011; Fares et al., 2009]; 35–74-year-olds in China, where the prevalence was 68% among 35–49-year-olds and 100% among 50–74-year-olds based on the BEWE [Wei et al., 2016]; and 46-year-olds in Finland with 75% prevalence recorded using the BEWE [Alaraudanjoki et al., 2016].

It has been cautioned that the prevalence of erosive tooth wear depends on the measurement used [Salas et al., 2015]; therefore, the results of the current study, which used the WHO recommended classification system for erosive tooth wear detection [World Health Organization, 2013] may not be directly comparable to other studies using the BEWE or other indices. For example, the BEWE is not primarily based on dentin involvement, as it has been shown that the measurement "involvement of dentin" is poorly reproducible [Holbrook and Ganss, 2008], while the ETWI examines signs of erosive tooth wear in enamel and dentin separately [Fares et al., 2009]. Furthermore, the direct comparison of our study to other studies may also be limited due to age-related differences and different teeth and/or surfaces examined.

The response rate among adults in the present study was 52%; therefore, self-selection bias may not be ruled out. Two-thirds of our participants were females, which does not accurately represent the Lithuanian national gender-based distribution in 2018, where women constituted

55% of all permanent inhabitants in Lithuania [Official Statistics Portal, 2019]. Therefore, the over-representation of females in the present study should be taken into consideration for the generalizability of our findings at the national level. On the other hand, a large sample size covering a country-wide geographical area strengthens the generalizability of our results.

In Lithuania, some regions, especially in the western part of the country, consume drinking water with a naturally elevated content of fluorides. The beneficial effect of fluoridated water on dental caries among adults has been demonstrated [Griffin et al., 2007], and the proposed mechanism of beneficial effect was attributed to frequent topical exposure of low fluoride concentration [Machiulskiene et al., 2009]. However, not much is known about the effect of fluoridated water on erosive tooth wear. In the present study, in the two youngest age groups, ≤ 1 ppm fluoride level in drinking water was associated with higher odds for more teeth affected by erosive tooth wear. In addition, our participants were twice as likely to have erosive tooth wear in enamel if the fluoride level in drinking water was ≤ 1 ppm. This finding related to adults is in line with the previous epidemiological study in North West England, where children in non-fluoridated areas had higher odds for erosive tooth wear compared to children from fluoridated areas [Bardsley et al., 2004]. It has been demonstrated that meals prepared with the fluoridated water increased fluoride concentration in saliva [Lima et al., 2019]. This may benefit against erosive tooth wear. More studies are needed to confirm our findings, to examine the mechanism on fluoridated water on erosive tooth wear, and to establish the threshold for the concentration of fluorides in the drinking water that efficiently prevents both erosive tooth wear and caries without increasing the risk of dental fluorosis.

In the current study, male gender increased odds for erosive tooth wear in dentin. However, available evidence regarding gender-related differences is inconsistent, as some studies reported higher prevalence among males [Alaraudanjoki et al., 2016; Bardolia et al., 2010; Fares et al., 2009], while others found no gender-related differences [Bartlett et al., 2013; Vered

et al., 2014]. The higher erosive tooth wear among males was explained by males consuming more carbonated drinks and having stronger biting forces [Bardsley et al., 2004; van der Glas et al., 1996]; this finding is in accordance with our study results, as we found that males consumed soft drinks more frequently than females. In addition to consuming acidic foods and knowing their intake frequency, the timing of consumption is also important, as it may predispose erosive tooth wear; however, we did not collect such data in the present study [O'Toole et al., 2017]. Another plausible explanation for erosive tooth wear might be bruxism, which is more prevalent among males than females [El Aidi et al., 2011]. However, we did not have information about this potential determinant in the present study.

The odds for erosive tooth wear in dentin and for having more teeth with signs of erosive tooth wear increased with older age. Previous studies reported a similar trend [Bardolia et al., 2010; Bartlett et al., 2013; Savage et al., 2018; Van't Spijker et al., 2009; Vered et al., 2014]. However, the increased prevalence of tooth wear observed in older age groups might also be related to other types of wear. Even though only one examiner collected the clinical data and the intra-examiner agreement was satisfactory, it is important to consider that it is difficult to distinguish between erosive tooth wear and other types of tooth wear, especially in older age [Alaraudanjoki et al., 2016].

Reflux is a well-known risk factor for erosive tooth wear [Li et al., 2017; Skalsky Jarkander et al., 2018], and in our study, participants who reported having reflux had more than three times higher odds of erosive tooth wear in dentin.

The residency was used as one of the socio-demographic variables and as a proxy for the socio-economic position since it was reported that those residing in rural Lithuanian areas had worse oral health [Skudutyte, 1999]. In the current study, residence in peri-urban/rural areas increased the odds for erosive tooth wear in dentin and for having more teeth with signs of this condition. This finding is in line with the previous study performed among young adults in seven European

countries, where residency in rural areas was associated with higher levels of erosive tooth wear [Bartlett et al., 2013]. The socio-economic position is commonly related to individual lifestyle, and erosive tooth wear is a multifactorial condition where lifestyle, including diet, may have a substantial impact. The authentic Lithuanian cuisine includes fermented cabbage and cucumbers, and it is still a substantial part of the Lithuanian diet, especially in peri-urban/rural areas. This particular aspect of diet may explain our finding, as frequent consumption of fermented vegetables was associated with erosive tooth wear [Shellis, 2015]. For example, a higher prevalence of erosive tooth wear was associated with a higher socioeconomic position in the Netherlands [van Rijkom et al., 2002], while it was associated with a lower socio-economic position in China and Finland [Alaraudanjoki et al., 2016; Wei et al., 2016]. Thus this may suggest that detrimental behaviours for erosive tooth wear may be dependent upon the socio-economic position and the direction of this association may also be country dependent.

Higher caries experience (D_3MFS scores) was associated with lower odds of erosive tooth wear in dentin. This finding is in line with several previous studies showing the opposite distribution between dental caries and erosive tooth wear [Jarvinen et al., 1991; O'Sullivan and Curzon, 2000]. The explanation may be the difference in etiology of both conditions, including diet, as it has been shown that sweetened beverages were associated with higher caries rates, while consumption of acidic snacks/beverages associated with erosive tooth wear [Moynihan and Kelly, 2014; Tschammler et al., 2019]. In addition, a vegetarian diet has been shown to decrease the risk for caries but to increase the risk for erosive tooth wear [Smits et al., 2020].

A relatively high erosive tooth wear among Lithuanian adults calls for a national preventive strategy. As up to date, the best approach against erosive tooth wear is to detect it early and address its associated risk factors. Based on the results of the present study, it is reasonable to design and deliver a dental health education program targeting common risk factors for erosive tooth wear and other oral health conditions.

In conclusion, erosive tooth wear in enamel and dentin was relatively high in Lithuania. The combined prevalence of erosive tooth wear in enamel and dentin was 52% among 35–44-year-olds, 68% among 45–54-year-olds, 67% among 55–64-year-olds, and 63% among 65–74-year-olds. Lower fluoride level in drinking water was associated with erosive tooth wear in enamel. Male gender, residency in peri-urban/rural areas, older age, and presence of acid reflux were associated with higher odds, while higher D_3MFS score was associated with lower odds for erosive tooth wear in dentin. These results can be used to plan dental public health prevention.

Statements

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Statement of Ethics

The study was approved by the Lithuanian Bioethical Committee (Nr.158200-17-920-426) and the personal data protection authority (Nr. 2R-4077). Participation was based on a signed informed consent.

Disclosure Statement

The authors have no conflicts of interest to declare.

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Author Contributions

LSM drafted the manuscript; JA substantively revised it. AP made a substantial contribution to the conception of this work. LSM, JA, AP, and IS contributed to the design of the study. IS

collected data and contributed to the preparation of the manuscript. LSM analyzed the data, and together with JA interpreted it.

All authors approved the final version of the manuscript and agreed to be personally accountable for their own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even parts in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Caries Res. 2020 Sep 16;54(3):283-291. doi: 10.1159/000509872.

Table 1. Characteristics of participants and erosive tooth wear distribution in different age groups stratified by gender.

Characteristics of participants	35–44 years		45–54 years		55–64 years		65-74 years	
	Males N=130 (100%)	Females N=224 (100%)	Males N=104 (100%)	Females N=207 (100%)	Males N=112 (100%)	Females N=250 (100%)	Males N=116 (100%)	Females N=254 (100%)
Outcome								
Erosive tooth wear (ETW)	130*	222	104*	206	112	249	115	253
No signs	*54 (41)*	*124 (56)*	*26 (25)*	*82 (40)*	*34 (30)*	*92 (37)*	*39 (34)*	*103 (41)*
In enamel	*37 (29)*	*56 (25)*	*27 (26)*	*56 (27)*	*8 (7)*	*47 (19)*	*6 (5)*	*27 (11)*
At least one lesion in dentin	*38 (29)**	*40 (18)*	*47 (45)**	*66 (32)*	*63 (56)**	*103 (41)*	*63 (55)*	*115 (45)*
At least one pulp involvement	*1 (1)*	*2 (1)*	*4 (4)*	*2 (1)*	*7 (7)*	*7 (3)*	*7 (6)*	*8 (3)*
Teeth with signs of ETW	1277**	1403	1213**	1677	1125	2208	1177**	1868
Mean (SD)	*16.6 (5.9)*	*14.3 (6.3)*	*15.6 (6.1)*	*13.5 (6.1)*	*14.4 (6.7)*	*13.9 (6.1)*	*10.2 (9.8)*	*7.4 (7.6)*
Median (range)	*17 (26)*	*14 (28)*	*15.5 (30)*	*14 (27)*	*15 (25)*	*14 (27)*	*10.5 (32)*	*6 (28)*
Socio-demographic characteristics								
Education	128*	217	99*	201	109*	241	111	239
Secondary school or less	*56 (44)*	*46 (21)*	*57 (58)*	*62 (31)*	*60 (55)*	*98 (41)*	*54 (49)*	*118 (49)*
College less than 4 years	*45 (35)*	*116 (54)*	*31 (31)*	*114 (57)*	*46 (42)*	*132 (55)*	*53 (48)*	*114 (48)*
College 4 years or more	*27 (21)*	*55 (25)*	*11 (11)*	*25 (12)*	*3 (3)*	*11 (4)*	*4 (3)*	*7 (3)*
Residency	130*	224	104*	207	112	250	116	253
Urban	*120 (92)*	*168 (75)*	*82 (79)*	*126 (61)*	*70 (62)*	*164 (66)*	*91 (78)*	*178 (70)*
Peri-urban/rural	*10 (8)*	*56 (25)*	*22 (21)*	*81 (39)*	*42 (38)*	*86 (34)*	*25 (22)*	*75 (30)*
Fluoride level in drinking water	130	224	104	207	112*	250	116	254
≤ 1 ppm	*121 (93)*	*198 (88)*	*95 (91)*	*181 (87)*	*100 (89)*	*201 (80)*	*96 (83)*	*204 (80)*
>1ppm	*9 (7)*	*26 (12)*	*9 (9)*	*26 (13)*	*12 (11)*	*49 (20)*	*20 (17)*	*50 (20)*
Oral health behaviour								
Tooth brushing frequency	129*	222	104*	204	111*	245	115*	250
Twice a day or more	*51 (40)*	*136 (61)*	*29 (28)*	*128 (63)*	*37 (33)*	*132 (54)*	*38 (33)*	*133 (53)*
Once a day or less	*78 (60)*	*86 (39)*	*75 (72)*	*76 (37)*	*74 (67)*	*113 (46)*	*77 (67)*	*117 (47)*
Using fluoridated toothpaste	82	163	65	148	70	138	74	136
Yes	*71 (87)*	*139 (85)*	*47 (72)*	*116 (78)*	*53 (76)*	*106 (77)*	*52 (70)*	*100 (74)*
No	*11 (13)*	*24 (15)*	*18 (28)*	*32 (22)*	*17 (24)*	*32 (23)*	*22 (30)*	*36 (26)*
Diet								
Fruits	128*	220	97*	197	106*	236	111	234
Once or more everyday	*28 (22)*	*96 (44)*	*35 (36)*	*108 (55)*	*37 (35)*	*151 (64)*	*59 (53)*	*141 (60)*
Several times a week or less	*100 (78)*	*124 (56)*	*62 (64)*	*89 (45)*	*69 (65)*	*85 (36)*	*52 (47)*	*93 (40)*
Juice	123	213	94	192	99	212	97	190
Once or more everyday	*11 (9)*	*13 (6)*	*11 (12)*	*10 (5)*	*8 (8)*	*27 (13)*	*16 (16)*	*30 (16)*
Several times a week or less	*112 (91)*	*200 (94)*	*83 (88)*	*182 (95)*	*91 (93)*	*185 (87)*	*81 (84)*	*160 (84)*
Soft drinks	122*	207	90*	189	95*	204	88	173
Once or more everyday	*17 (14)*	*13 (6)*	*14(16)*	*10 (5)*	*10 (11)*	*6 (3)*	*3 (3)*	*5 (3)*
Several times a week or less	*105 (86)*	*194 (94)*	*76 (84)*	*179 (95)*	*85 (89)*	*198 (97)*	*85 (97)*	*168 (97)*
Oral health								
D_3MFS	130	224	104	207	112	250	116*	254
≤ 77	*108 (83)*	*175 (78)*	*71 (68)*	*119 (57)*	*52 (46)*	*99 (40)*	*43 (37)*	*62 (24)*
>77	*22 (17)*	*49 (22)*	*33 (32)*	*88 (43)*	*60 (54)*	*151 (60)*	*73 (63)*	*192 (76)*
Fluorosis	130	223	104	207	112	248	116	253

Yes	*5 (4)*	*8 (4)*	*2 (2)*	*3 (1)*	*1 (1)*	*0 (0)*	*2 (2)*	*0 (0)*
No	*125 (96)*	*215 (96)*	*102 (98)*	*204 (99)*	*111 (99)*	*248 (100)*	*114 (98)*	*253 (100)*
General health								
Reflux present	130	224	104	207	112	250	116	254
Yes	*3 (2)*	*5 (2)*	*0 (0)*	*6 (3)*	*2 (2)*	*11 (4)*	*1 (1)*	*7 (3)*
No	*127 (98)*	*219 (98)*	*104 (100)*	*201 (97)*	*110 (98)*	*239 (96)*	*115 (99)*	*247 (97)*
Dry mouth present	130	224	104	207	112	250	116*	254
Yes	*16 (12)*	*38 (17)*	*19 (18)*	*48 (23)*	*30 (27)*	*67 (27)*	*21 (18)*	*88 (35)*
No	*114 (88)*	*186 (83)*	*85 (82)*	*159 (77)*	*82 (73)*	*183 (73)*	*95 (82)*	*166 (65)*

*Significant difference between genders in respective age groups, chi-square test (likelihood ratio only for erosive tooth wear in enamel), $p < 0.05$
**Significant differences between genders in respective age groups, independent sample t-test, $p < 0.05$

Caries Res. 2020 Sep 16;54(3):283-291. doi: 10.1159/000509872.

Table 2. Association between erosive tooth wear (ETW) and number of teeth affected by ETW, and characteristics of participants according to univariable and multivariable binary logistic regression analyses.

Characteristic		Crude OR (95% CI) ETW in enamel[i]	Adjusted OR (95% CI) ETW in enamel N=447	Crude OR (95% CI) ETW in dentin[ii]	Adjusted OR (95% CI) ETW in dentin N=586	Crude OR (95% CI) Two or more teeth[iii]	Adjusted OR (95% CI) Two or more teeth N=738
Socio-demographic characteristics							
Gender	*Female*	1	1	1	1	1	1
	Male	1.1 (0.8–1.5)	0.7 (0.4–1.1)	1.8 (1.4–2.3)	1.7 (1.1–2.5)	1.5 (1.2–1.9)	1.3 (0.9–1.9)
Education	*College 4 years or more*	1	1	1	1	1	1
	College less than 4 years	0.9 (0.6–1.6)	1.0 (0.6–2.4)	1.3 (0.9–2.0)	0.9 (0.5–1.5)	1.1 (0.8–1.6)	0.9 (0.6–1.5)
	Secondary school or less	1.0 (0.6–1.4)	1.2 (0.6–2.4)	1.8 (1.1–2.7)	0.9 (0.5–1.6)	1.4 (0.9–2.0)	0.9 (0.5–1.6)
Residency	*Urban*	1	1	1	1	1	1
	Peri-urban/rural	1.6 (1.1–2.2)	1.6 (1.0–2.5)	1.9 (0.6–2.0)	1.6 (1.1–2.4)	1.8 (1.4–2.3)	1.6 (1.1–2.4)
Fluoride level in drinking water	*>1 ppm*	1	1	1	1	1	1
	≤1 ppm	1.8 (1.1–2.8)	2.1 (1.1–4.2)	1.1 (0.8–1.4)	1.1 (0.7–1.8)	1.2 (0.9–1.7)	1.3 (0.9–2.0)
Age per 10 years	*Continuous*	0.8 (0.7–0.9)	0.9 (0.7–1.1)	1.4 (1.3–1.5)	1.6 (1.3–1.9)	1.2 (1.1–1.2)	1.3 (1.1–1.5)
Oral health behaviour							
Tooth brushing frequency	*Twice a day or more*	1	1		1	1	1
	Once a day or less	0.8 (0.6–1.1)	0.8 (0.5–1.3)	0.8 (0.7–1.0)	1.1 (0.7–1.5)	0.8 (0.7–1.0)	1.0 (0.7–1.3)
Using fluoridated toothpaste	*Yes*	1	1		1	1	1
	No	1.0 (0.6–1.6)	0.9 (0.6–1.5)	1.2 (0.8–1.7)	0.9 (0.6–1.4)	1.2 (0.8–1.6)	1.0 (0.7–1.4)
Diet							
Fruits	*Several times/week or less*	1	1	1	1	1	1
	Once or more everyday	0.8 (0.6–1.1)	0.9 (0.6–1.3)	1.0 (0.8–1.3)	0.9 (0.6–1.3)	1.0 (0.8–1.2)	0.9 (0.7–1.3)
Juice	*Several times a week/less*	1	1		1	1	1
	Once or more everyday	0.9 (0.6–1.6)	1.2 (0.6–2.4)	1.1 (0.7–1.7)	1.0 (0.6–1.9)	1.1 (0.7–1.5)	1.0 (0.6–1.7)
Soft drinks	*Several times a week/less*	1	1		1	1	1
	Once or more everyday	1.2 (0.6–2.3)	1.0 (0.4–2.4)	1.3 (0.8–2.2)	1.7 (0.8–3.4)	1.3 (0.8–2.1)	1.4 (0.7–2.6)
Oral health							
D_3MFS	*77 or less*	1	1	1	1	1	1
	More than 77	0.6 (0.4–0.8)	0.8 (0.5–1.3)	0.9 (0.7–1.1)	0.7 (0.5–0.9)	0.8 (0.6–0.9)	0.7 (0.5–0.9)
General health							
Reflux	*No*	1	1	1	1	1	1
	Yes	1.5 (0.6–3.9)	2.0 (0.5–8.8)	1.7 (0.8–1.2)	3.3 (1.0–10.9)	1.7 (0.8–3.6)	2.7 (0.9–8.6)
Dry mouth	*No*	1	1	1	1	1	1

Yes	0.8 (0.6–1.1)	1.2 (0.7–1.9)	0.9 (0.7–1.2)	1.0 (0.7–1.6)	0.9 (0.7–1.1)	1.1 (0.8–1.6)
Model Summary						
Nagelkerke R^2		0.054		0.111		0.053

[i] Erosive tooth wear in enamel versus no signs of erosive tooth wear
[ii] Erosive tooth wear in dentine versus no signs of erosive tooth wear
[iii] Two or more teeth with signs of erosive tooth wear versus one or none teeth with signs of erosive tooth wear