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Dental erosion in 12-year-old school children living in Jakarta

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Abstract. This study assesses the dental erosion status of 12-year-old Indonesian children and studies the determinants of dental erosion of these children. The survey was performed in 2016 with ethics approval. A multistage cluster proportional to size random sampling method was adopted to select 12-year-old children in 24 primary schools in Jakarta. The parents were asked to complete a self-administered questionnaire concerning their children's diet and oral health habits. The children were examined by a single calibrated examiner. Detection of dental erosion followed basic erosive wear examination (BEWE) criteria. A total of 487 children participated in the survey. Most children (88%) had at least some signs of erosion (BEWE > 0), with dentin being involved in 50% of the cases (BEWE = 2). Dental erosion was significantly related to gender, the frequencies of citric tea consumption, parent's dental knowledge, father's education, and dental caries (OR = 3.148). The 12-year-old Indonesian school children who lived in Jakarta had signs of erosion, although severe erosion was not found. Screening programs should be provided to identify risk groups so early preventive measures can be taken.

1. Introduction

Dental erosion is a common condition that occurs all over the world. It became a topic of concern at the end of the 20th century, also becoming of interest to clinical dental practice and dental public health [1,2]. Epidemiological surveys in various countries showed a high prevalence of dental erosion in children [2,3]. The prevalence of dental erosion was found in 68% of school children in Australia in 2007, whereas in Sweden the figure was 75%, similar to the high prevalence of dental erosion in 12-year-old school children in Libya, which amounts to 90% [4-6]. An increased prevalence of dental erosion was also seen in the UK between 2000 and 2002, increasing by 45% in 2000 and 2001 and by 60% in 2002 [2]. Dental erosion is defined as the condition of tooth surface loss or enamel demineralization caused by chemical processes that do not involve bacterial activity [1,7]. Early symptoms of tooth erosion are characterized by white spots on the enamel surface that are round, smooth, and shiny under a microscope, and subsequently dissolve enamel layer by layer [7,8]. Further stages of dental erosion will result in more enamel loss, the tooth surface becoming more slippery and shiny with the rounded surfaces of the teeth becoming flat [9]. It can have an impact on aesthetics, chewing ability, and dentinal hypersensitivity, all of which may lead to complicated treatment and



high treatment costs if advanced erosion occurs [10]. Dental treatment for dental erosion can be very complex and challenging and early diagnosis is so very important.

Dental erosion is a multifactorial condition. Its etiology is related to sources that contain acid, either intrinsic or extrinsic, which affect teeth [11,12], and is modified by factors that affect the vulnerability of teeth such as para-functional habits (behavioral factors), saliva and tooth structure (biological factors), and pH and buffer capacity (chemical factors). Socio-economic factors, education, knowledge, and public health also are factors that influence the occurrence of dental erosion. With knowledge of the above conditions, dental erosion can be prevented as early as possible, for example, by diagnosing the risk factors for dental erosion [11,13,14]. The oral health status of 12-years-old school children become the main indicator measurement criteria in a variety of oral diseases. According to the WHO, this age group has become an global indicator for making comparisons between countries and monitoring trends of the disease through surveys [15]. Dental erosion status is measured in this age group because all permanent teeth, except the third molar, have erupted by this age [2,16]. This group is also commonly used because children of this age tend to be more cooperative in epidemiological studies; the age group is also easily identifiable and it is easy to ensure a subsequent visit because they are still in the school system. Thus, the scope of monitoring is clear, and a good or optimal homogeneous sample can be achieved [2,16]. This is the ideal age group for making measurements and assessing the status of dental erosion in permanent teeth.

Jakarta is the capital city of Indonesia and is a metropolitan city that has a large and varied population. Dietary habits become one risk factor for dental erosion—for example, drinking soft drinks, tea containing fruit (citric tea), which is made either individually or in packs, or acidic fruit juice [1,17,18]. These habits have started to appear in the school environment, exposing 12-years-old school children to dental erosion [17]. The ease of access to food and drinks that contain acid in the school cafeteria or the minimarkets in Jakarta can also increase the risk of dental erosion. In Indonesia, and Jakarta in particular, concern is focused on dental caries and oral diseases; little attention is paid to dental erosion, thus limiting the available data. Research regarding risk factors for dental erosion in Indonesia is limited to only one factor, despite the multi factorial nature of the disease. Thus, there is no research that examines those risk factors of dental erosion that are also associated with dental caries. Based upon the background described above, this study assesses the dental erosion status of 12-year-old Indonesian children, particularly in Jakarta, and studies the determinants of dental erosion for these children.

2. Materials and Methods

The survey was performed in 2016 with ethics approval. The study design was a cross sectional study with comparative and multivariate analysis to determine the association of dental erosion status and its contributing factors in 12-year-old school children in Jakarta. Multistage cluster proportional to size random sampling was adopted to select 12-year-old children in 24 primary schools in Jakarta, both public and private. This study included 487 students as the sample. The population was made up of healthy children who were not undergoing orthodontic treatment, were willing and cooperative to be study subjects, and whose parents were also willing to sign the informed consent. The participating parents were asked to complete a self-administered questionnaire concerning their children's diet and oral health habits. The questionnaire was adapted from the oral health questionnaires by Zhang's study in 2014 [1], followed by face and content validity with expert opinion. Additionally, a convenience sample of thirty children was used to pretest the questionnaire.

The children were examined by a single calibrated examiner. The examination was conducted in a health center at each school in an indoor setting under light from a portable head lamp, and used a ball-ended WHO CPI probe and disposable mirror. Detection of dental erosion followed basic erosive wear examination (BEWE) criteria [19–21]. During the survey, the examiner duplicated examinations in 43 children based on WHO recommendations for an intra-examiner reliability test, and the Kappa score was 0.93 (almost perfect agreement). Data from the clinical examinations and questionnaires were recorded, edited, coded, and entered into computer software (Microsoft Access). The analysis

was performed using computer software SPSS Statistics v.20. Univariate analysis was conducted to determine the frequency and proportion of variables in this study. Non-parametric tests were used to analyze the bivariate of the dependent variable (dental erosion) with some independent variables in the study. Finally, multivariate analysis with binary logistic regression was conducted to determine that the relation was significant ($p < 0.25$) for all the independent variables on the dental erosion status with a backward procedure model.

3. Results and Discussion

3.1 Results

A total of 487 children participated in this survey, of whom 95 were in Central Jakarta, 79 in West Jakarta, 161 in East Jakarta, 67 in South Jakarta, and 85 in North Jakarta (Thousand Islands). The majority of the participants were girls ($n = 278$, 57%), and most participants were Muslim (89%, $n = 435$). The most common ethnicity of fathers was Java (35%, $n = 173$); the most common ethnicity of mothers was also Java (36%, $n = 179$). A total of 12% ($n = 59$) of children were free of dental erosion (BEWE cumulative score of all 6 = 6 sextant), meaning that most children (88%) had at least some sign of erosion (BEWE > 0). There were no children with severe erosion (score BEWE = 3), and as many as 139 (29%) children had 1 or 2 sextants with distinctive erosion (score BEWE = 2) of the 428 children (88%) who had a score BEWE = 2. The total BEWE score of 6 sextants for every child had a range of 6 to 12 with a mean value of 9.4 ± 2.1 . The BEWE mean of the scores (range 0–3) was 1.9 ± 0.3 .

After bivariate analysis, variables such as gender, parental knowledge, experience of caries, father and mother's education, and behavior regarding visits to the dentist was significantly associated with BEWE score ($p < 0.05$). Multivariate analysis using binary logistic regression with $p < 0.25$ showed that the experience of dental erosion had a significant association with gender, frequency of drinking citric tea, caries experience, parents' knowledge, and father's education (Table 1).

Table 1. Dental erosion relationship with all the variables

Variables	B	OR	95% CI	p-value
Gender				
Girl	-0.457	0.633	0.427–0.940	0.023
Boy*				
Frequency of drinking citric tea				
At least 1x/2 days	-0.493	0.611	0.401–0.931	0.022
Less than 1x/2 days*				
Parents knowledge				
Low	-1.262	0.283	0.117–0.686	0.005
Medium	-0.900	0.407	0.231–0.716	0.002
High*				
Caries/DMFT score				
>1.2	1.147	3.148	2.101–4.717	0.001
≤ 1.2 *				
Father's education				
<Senior high	0.909	2.481	1.385–4.444	0.001
Senior high				
>Senior high*	0.107	1.113	1.667–1.858	0.002

3.2 Discussion

Oral health is an essential part of human health [22]. Epidemiological studies are essential to assess the patterns and needs of an illness, giving reliable information that is useful for the planning or evaluation of a health program [6,23]. As the capital of Indonesia, Jakarta was considered for a

preliminary study that could be used as a reference for other major cities in Indonesia. A multistage cluster proportional to size random sampling method was selected for this study. The total population in Jakarta inhabits six districts, each of which includes 8–10 sub-districts. Schools in this study were chosen randomly in each sub-district, with a total number of 1346 schools, both public and private. Twenty-four of these were included in this study, represented by 10–41 children from each school (based on district proportion). School data was accessed via the Jakarta Education Authorities website; thus, its validity is well guaranteed. Besides the validity of the data, measurements were conducted with duplication to ensure reliability. Duplication was conducted on the same day for one child in every ten who was examined, in accordance with the WHO. The result of this duplication formed the Kappa value, which was 0.93, indicating substantial agreement and the reliability of the examiner for dental erosion [24,25].

There is no definitive index or international standard for the measurement of dental erosion status, and there are several measuring devices that can be used [19,26–30]. In this study, BEWE was used because its scoring is easy and it has sensitivity and adequate specificity; thus, an epidemiological survey for dental erosion can be reach good and adequate data [19-21]. According to a previous study [1], BEWE as a measurement of dental erosion developed in 2007 following an international workshop on erosion indices, and it is a convenient index, although there is no agreement yet that BEWE is the best index [1]. The BEWE score in this study was measured by calculating the highest score from each sextant, resulting in an epidemiological survey that is considered fast, simple, and easy [15].

Study results revealed that almost all the 12-year-old school children living in Jakarta have dental erosion, with only 12% free from dental erosion with dentin involvement. This is similar to the results of a study conducted on 12-year-old school children living in Libya, wherein 90% of children were exposed to dental erosion [6]. This prevalence was higher when compared to another study conducted earlier in Hong Kong and southern China [1]. The difference may be attributed to geographical factors, socioeconomic factors, and eating habits. A study in Benghazi also found that gender was associated with dental erosion, with girls being more exposed to erosion than boys; this is also consistent with this study's results. This is possibly because in this study the participants were dominated by girls, who thus had more potential for having dental erosion than boys [6]. Another study reported increased an prevalence of dental erosion in boys compared to girls, but in this study found no statistically significant association between dental erosion and gender [31]. Consistent with previous studies, this study showed that dental erosion is associated with the frequency of drinking citric tea, and risk factors such as the consumption of acidic drinks—for example, drinks containing sour or acidic fruits was associated with dental erosion in 12-year-old school children in America [6,32]. Theories state that the extrinsic etiology of dental erosion is caused by exposure to acidic substance ($\text{pH} < 6.8$); thus, more frequent acidic substance exposure against the teeth will increase erosion of the teeth. Tea has a pH of approximately 4.2 (acidic). Fruits that contain citrus such as lemon, orange, and apples has a pH of 1.8-2.4, 2.8-4.0, and 2.9-3.5 respectively. Citric tea was proven to contribute to dental erosion and this proved to be statistically significant [6,32].

Parents' knowledge about oral health and their level of education were associated with dental erosion incidence [1]. A study in Norway also proved that lower parental education levels have a relationship to a higher incidence of dental erosion [33]. Knowledge and education levels of parents affect decisions about a child's dietary intake of acid and a child's teeth cleaning habits; thus, it was proved that less knowledge and a lack of education can increase the risk of dental erosion and increase the incidence of dental erosion [1,33]. Children with caries experience had a significantly higher BEWE score; in this study it was proven that dental caries potentially becomes a risk factor for dental caries. Several studies support these results [1,5,34]. This is possibly because both diseases are multifactorial and caused by an acidic condition, although the specific effect of acids is different. Studies in Sri Lanka reported that dietary habits can carry a significant risk to dental erosion and dental caries because acid drinks usually also have added sugar to make the beverage taste good to

consumers [17,35]. Some studies also show the opposite—that dental caries is not statistically associated with dental erosion [17].

4. Conclusion

In this study, many 12-year-old Indonesian school children who lived in Jakarta had signs of erosion, most of which had dentinal involvement. A high frequency of drinking citric tea, caries experience, lower levels of parental dental knowledge, lower father education, and being a girl were found to be positively associated with dental erosion. Screening programs can be provided to identify risk groups for early preventive measures, and this can strategically enhance the cost-effectiveness of dental treatment.

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