

# JIDMR

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## Abstract

The study aimed to analyze dental caries and its contributing factors in 12-year-old school children living in Jakarta. This was a cross-sectional study. Multistage cluster proportional to random sampling was conducted to select children of 12 years of age. Out of 1346 public and private Junior High Schools in Jakarta, 24 were included in the study. One examiner measured dental caries status throughout the study. The Decayed, Missing, and Filled Teeth (DMFT) index was used to record the prevalence of dental caries based on the World Health Organization (WHO) criteria. Parents were given self-administered oral health questionnaires to fill in. A total of 487 children participated in the study. The DMFT mean (SD) score was 1.7 (2.2). The prevalence of dental caries was 23%. Dental caries was significantly related to gender, dental erosion, and mother's education. Dental caries in 12-year-old school children living in Jakarta was high. Further severe clinical implications should be considered.

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## Introduction

Dental caries is a disease resulting from a destructive and progressive pathologic process that is marked by the demineralization of hard tooth tissue caused by acid, as a result of carbohydrate fermentation by dental plaque bacterial.<sup>1</sup> Dental caries is a common oral health problem found in both children and adults in developed and developing countries.<sup>2</sup> This finding is supported by epidemiological data reported by Bagran et al (2009) that showed an increase in dental caries prevalence in children in both developed and developing countries.<sup>3</sup> Data in Brazil (2010) showed the prevalence of dental caries in 12-year-old children was 44% with mean DMFT (Decayed, Missing, and Filled Teeth) 2.1, while in Jordania (2014) and Nepal (2013) it was 46% and 41% with mean DMFT 1.1 and 0.8 respectively.<sup>2,4,5</sup>

Although dental caries in children shows a high prevalence, the global trend has been decreasing, for example in Brazil in 2003 the prevalence was 69% with mean DMFT 2.8, while in 2010 the prevalence decreased to 44% with mean DMFT also decreased, to 2.1.<sup>1,2</sup>

In Indonesia, the prevalence of dental caries between 2001 and 2007 showed an increase from 77% to 81%, but the latest data from 2013 showed that the prevalence of active caries in 12-year-old children had decreased to 43% with active caries experience at 50%.<sup>6,7</sup> The prevalence of active caries and caries experience of 12-year-old children in Jakarta was 35% and 49% with DMFT 1.4 and DT score 0.9.<sup>8</sup> This means that in every child there was at least one tooth with dental caries. The oral health status of 12-year-old children is a main indicator in measurement criteria of various oral diseases. As described by the WHO, this age group is chosen to be an international and global indicator for comparisons between countries and to see disease trends by surveys.<sup>9</sup> The measurement for dental caries status in 12-year-old children is carried out on this age group because usually the mixed dentition period has already ended and all the permanent teeth, except the third molars,

have erupted by this age. This age group is usually used for epidemiological studies also because of their tendency to be more cooperative. Another reason is because this age group is easily identified, and it is convenient to do a follow up because they are still in the school system so it is possible to reach them and to get optimum sample homogeneity. Thus, the 12-year-old age group is suitable for determination of dental caries status in permanent teeth. The study aims to analyze dental caries in 12-year-old school children living in Jakarta. With the high prevalence of dental caries and its multifactorial etiology, it is important to determine the contributing factors to the dental caries status of 12-year-old school children in Jakarta, and the association of those factors to dental caries, in order to provide evidence-based data.

## Materials and methods

This was a cross-sectional study with a comparative and multivariate analysis to determine the association of dental caries status and its contributing factors in 12-year-old school children in Jakarta. The protocol has been approved by Ethical Committee of the Faculty of Dentistry, University of Indonesia. The population was 12-year-old school children from Junior High Schools in Jakarta, who were healthy, not undergoing orthodontic treatment, cooperative and willing to be study subjects, also whose parents were willing to give their informed consent. Multistage cluster proportional to size random sampling was conducted to select children of 12 years of age from 24 out of the 1346 Junior High Schools in Jakarta, both public and private. Based on descriptive study sample number determination, the sample number that should be included in this study was 323 and added to by 20% to prevent drop outs. Thus, the minimum sample number in this study was 404 children, but during the course of the study a total of 487 students were included. The children were clinically examined by one examiner throughout the study at their school health center in an indoor setting, under light from a portable head lamp with ball-ended WHO CPI probe and mirrors. The DMFT index was used to record dental caries on 28 teeth, based on the WHO criteria. During the survey, the examiner carried out duplication for examination in 43 children, based on the WHO recommendations for the

intra-examiner reliability test. The Kappa score obtained was 0.93.

Parents were given self-administered oral health questionnaires consisting of four parts including: 1) Child's personal data (age, gender) 2) Dietary habits (frequency of acidic/sour beverages and fruit juice drinks, supplementary vitamin C consumption, chewing gum, etc), 3) Frequency of tooth brushing, and 4) Parents' knowledge of oral health. The questionnaire was adapted from Oral Health Questionnaires by Zhang et al, 2014. Prior to the study translation and back translation was carried out, followed by face and content validity with expert opinions performed in the Jakarta population. Pretesting of the questionnaire was conducted on 30 children as a convenience sample. Data analysis was performed by using SPSS v.20. A univariate analysis was conducted to determine the frequency and proportion of variables in the study. Non-parametric tests were used to analyze bivariate dependent variables (dental caries) and some independent variables in the study.

## Results

Among the 487 subjects, the gender ratio was dominated by females (n=278, 57.1%). Children's dental caries experience in DMFT was  $1.7 \pm 2.2$  (median=1, min-max=0-15), while the overall mean of the DT score (untreated dental caries) was  $1.6 \pm 2.1$ . Female subjects had a higher DMFT compared to male subjects: the scores were  $1.8 \pm 2.2$  and  $1.5 \pm 2.1$  respectively with  $p=0.040$ . There was also a higher DT score of female subjects compared to the DT score of male subjects: the scores were  $1.8 \pm 2.2$  and  $1.5 \pm 2.0$ , with  $p=0.075$ .

The proportion of children with a dental caries experience (DMFT>0) was 63% (n=306) and the proportion of dental caries severity, based on WHO criteria (DMFT>1.2), was 39% (n=192). Among 306 children with a dental caries experience, 13.1% (n=64) of them had a DMFT score of more than 3. This is classified by the WHO as a high dental caries experience. The proportion of children with dental caries (DT>0) was 61%. Among 487 subjects, only 1% (n=5) had one missing tooth that had been extracted because of dental caries. There were 3.7% (n=18) of subjects with fillings/tooth restoration; among 18 subjects there were 2.9% (n=14) children with one filling, 0.6% (n=3) children with

two fillings, and 0.2% (n=1) children with three fillings. Multivariate analysis using the Regression Binary Logistic test with  $p < 0.25$  results indicated that the prevalence of dental caries is significantly associated with gender, dental erosion experience, and mother's education (Table 2).

Variable (N)	DMFT>1.2 (n)	DMFT>1.2 (%)	p-value
<b>Number of subjects</b> (487)	192	39%	
<b>Gender*</b> (487)			0.431
Female (278)	121	63%	
Male (209)	71	37%	
<b>Frequency of softdrink consumption*</b> (487)			0.998
At least once in 2 days (41)	19	10%	
Less than once in 2 days (446)	173	90%	
<b>Frequency of citrus tea consumption*</b> (487)			0.752
At least once in 2 days (173)	75	39%	
Less than once in 2 days (314)	117	61%	
<b>Frequency of fruit juice consumption*</b> (487)			0.489
At least once in 2 days (131)	51	27%	
Less than once in 2 days (356)	141	73%	
<b>Frequency of gum chewing*</b> (487)			0.474
At least once in 2 days (84)	40	21%	
Less than once in 2 days (403)	152	79%	
<b>Frequency of vitamin C supplement consumption*</b> (487)			0.821
At least once in 2 days (57)	21	11%	
Less than once in 2 days (430)	171	89%	
<b>Frequency of tooth brushing*</b> (487)			0.204
At least once a day (57)	18	9%	
Twice or more a day (430)	174	91%	
<b>Child's main caregiver*</b> (487)			0.877
Parents (454)	18	9%	
Others (33)	10	5%	
<b>Parents' knowledge**</b> (487)			0.485
Low (41)	20	11%	
Fair (377)	154	80%	
High (69)	18	10%	
<b>Dental erosion*</b> (487)			0.988
Yes (430)	162	84%	
No (57)	30	16%	
<b>Father's education level**</b> (487)			0.646
< High school (141)	71	37%	
High school (242)	91	47%	
> High school (104)	30	16%	
<b>Mother's education level**</b> (487)			0.999
< High school (169)	83	43%	
High school (226)	83	43%	
> High school (92)	26	14%	
<b>Digestion disorders*</b> (487)			0.966
Yes (123)	45	23%	
No (364)	147	77%	
<b>Daily sweet meals consumption*</b> (487)			0.298
Yes (229)	95	49%	
No (258)	97	51%	
<b>Visit to dentist within the last 12 months*</b> (487)			0.478
Yes (95)	160	83%	
No (392)	32	17%	

**Table 1.** Prevalence of dental caries, dental caries experience, and variables in the study (p-values were tested using the Mann Whitney U-test (\*) and Kruskal Wallis test (\*\*);  $p < 0.05$

Variables	DMFT > 1.2		B	OR	95% CI	p-value
	n	%				
Gender						
Female	185	67	-0.502	0.605	0.412-0.889	0.011
Male*	121	58				
Dental erosion						
Yes	266	62	0.670	1.953	1.100-3.469	0.022
No*	40	70				
Mother's education						
< High school	113	63	-0.895	0.409	0.235-0.710	0.003
High school	143	69	-0.385	0.680	0.399-1.161	0.001
> High school*	50	63				

**Table 2.** Association of dental caries prevalence and variables in study (p-values were tested using Regression Binary Logistic with  $p < 0.25$ )\*reference

## Discussion

An epidemiological study is important for the determination of the pattern and needs of a certain disease. Thus evidence-based information can be achieved and used for health program planning and evaluation.<sup>10</sup> In an epidemiological study, 12 year old children are commonly used because this age group is more cooperative and is managed within a school environment, therefore it is easier to do a follow up with the help of school teachers.<sup>11</sup> As the capital of Indonesia, Jakarta is suitable for the pilot study, which can be referred to by other cities in Indonesia. The method of multistage cluster proportional to size random sampling was used in this study because it is suitable for use in Jakarta. The total population of Jakarta is contained in five districts, each one of them divided into 8-10 subdistricts. Schools in this study were chosen randomly in each subdistrict from a total number of 1346 schools, both public and private. Of these, 24 were included in this study with 10-41 students from each school as study subjects (based on district proportions). School data were accessed via the Jakarta Education Authorities website, thus their validity is guaranteed.

During the examinations, the examiner did duplications on the same day to test the measurement reliability, which was tested using the Kappa test. In one day of examination, the result obtained from one out of every ten subjects was duplicated, with the assumption that the examiner cannot recall the first examination of each duplicated subject. In total there were 43 duplications out of 487 subjects, which was 9% of total subjects. This is in accordance with WHO guidelines, which require the duplication of 5-10% of the total subjects and a minimum of 25



subjects.<sup>9</sup> The Kappa score obtained in this study was 0.93, showing very good reliability of the examiner.

Study results revealed that the proportion of 12-year-old school children with dental caries experience (DMFT>0) was 63% with a mean DMFT of 1.7 and their dental caries status (DT>0) was 6%. Another study revealed similar numbers to this study, where the prevalence of dental caries was 56% with a mean DMFT of 1.8.<sup>12</sup> Meanwhile, a study in 2016 showed that the prevalence of dental caries experience among 12-year-old children in Jakarta and its satellites cities was 84%.<sup>12</sup> High prevalence of dental caries in Indonesia, especially in Jakarta, might be caused by the society's low utilisation of dentists, specifically by children. This study indicated that less than one-fifth of 12-year-old school children visited a dentist annually.

The result in this present study showed that there was an increase almost twice as high as in the survey done in Jakarta in 2013, which mentioned that active caries and caries experience in 12-year-old children were 35% and 49% respectively.<sup>8</sup> The increase could be caused by high sugar consumption, particularly in refined food, by children living in a metropolitan city such as Jakarta. A study in Peru in 2009 showed that, as the capital of the country, Peru had 12-year-old children with a high mean DMFT, which was  $3.9 \pm 3.7$ .<sup>13</sup>

The number of mean DMFT  $1.7 \pm 2.2$  shows that the caries experience of 12-year-old children in Jakarta is categorized as low in comparison to the WHO global standard, which is  $DMFT < 3$ .<sup>14</sup> Study results indicated that both DMFT and DT were higher in female children, which is in line with the results of a study of 12-year-old children in Hong Kong showing that caries experience was higher in female children. This may be caused by the order of eruption and permanent tooth growth and development in female children, which is earlier than in male children.<sup>15,16</sup> This was also supported by present study results that proved that the prevalence of dental caries was significantly associated with gender. The results of the multivariate analysis showed that prevalence of dental caries was significantly associated with the child's dental erosion. This finding is in line with the Hong Kong study that stated that dental erosion became more severe in children with caries experience.<sup>16</sup> Another study analyzed caries experience as

being associated with dental erosion in 12-year-old children and may be used as predictor of dental erosion in 14-year-old children.<sup>1</sup>

Mothers' education was significantly associated with dental caries, based on comparison test results, and was supported by multivariate analysis results that proved that the mothers' education may affect dental caries occurrence. This was in line with a previous study that showed that children whose mothers had a higher education level had fewer carious lesions on the tooth surfaces.<sup>17</sup> This may be caused by the possibility of mothers with high education levels having more access to knowledge about the risk of dental caries and therefore being more careful in choosing their children's diet and limiting sweet meals.

There are limitations in this study, such as its cross-sectional design, which caused the associated factors to have a weak correlation because the data were taken only on one occasion. Another limitation is its lack of sample size. The sample size was considered adequate if it had at least 600 subjects, as used in many other studies. It can be shown in this study that the data obtained had an abnormal distribution, so to make it normal the sample size should be expanded. Moreover, dental caries is a multifactorial disease, which makes it difficult to determine its association to various independent variables, and it is also modified by biological factors (such as tooth resistance towards acid, tooth structure, function of saliva, etc.). Cultural factors may also affect daily diets. Questions on the questionnaire should include more details, for instance in the questions about diet/ drinking habits regarding acidic beverages, not only the frequency should be asked about, but also the variety of beverages based on their acidity levels, and ways of drinking them, including the use of aids such as straws. The regularity intensity of drinking at night should also be asked about. Questions about tooth brushing habits should include not only frequency, but also the time period between acid exposure and tooth brushing.<sup>16,18</sup> There is also a need to add salivary function examination, because salivary flow and buffer capacity affect disease management. It also needs revision in question details such as in the question about digestion disorders, where parents can give appropriate answers as expected in this study.

## Conclusions

The dental caries experience of 12-year-old school children living in Jakarta showed that more than half (63%) were exposed to dental caries, and fewer than 3% were treated with fillings. Factors such as gender, the mother's education, and experience of dental erosion have a positive association with dental caries. Further severe clinical implications should be considered

## <sup>11</sup> Declaration of Interest

The authors report no conflict of interest.

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