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RESEARCH ARTICLE

Gender Inequalities in Caries Experience among Primary School-Children: A Cross-sectional Study in a Rural Area of Indonesia

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Abstract

Objectives: Dental caries is known as one of the most prevalent chronic diseases among school-children, especially those with lower socioeconomic status and higher sugar consumption. The purpose of the study is to compare caries prevalence between female and male school-children aged 11-13 years, adjusting for socioeconomic status. Methods: A cross-sectional study was carried out in a rural area of Sleman, Indonesia, to estimate the effect of gender, parental education and family income. A sample of 1,144 children at fifth grade was selected from 45 elementary schools in Sleman, Indonesia. Information concerning paternal education, demographic data of the school-children and family income were obtained from parents or guardians of the children. Caries status (DMF-T) of the schoolchildren was examined according to WHO dental health survey guidelines. Results: The results of the study showed that female students had on average 0.39 higher DMF-T than male students (p=0.001) and 28% less odds for caries-free status (p=0.009) adjusting for paternal education and family income. University education of fathers was associated with 0.53 lower DMF-T compared to the lowest education category and 79% increases in odds for caries-free status. There is no difference in restorative index between male and female students reflecting similar experience in dental care. Conclusions: Female school-children aged 11-13 years were consistently at a greater risk for dental caries adjusting for parental education, an issue for further research and school-based oral health promotion program.

Keywords: *Dental caries, Gender, School-children, Paternal education, Family income.*

Introduction

Dental caries has been one of the most widespread diseases in the world population [1, 2, 3]. Social gradients were known to exist in oral health status among school-children [4, 5, 6]. Lower socioeconomic status is usually associated with a higher risk of caries, depending on the prevalence of sugar consumption [7, 8] and oral hygiene practices [9]. Parental education is correlated with caries level in children; those with lower or no caries experience usually come from families with higher parental education [10].

Children from low income families face poorer oral health with higher caries level [11] and lack of oral health services especially with regard to untreated caries [12]. Gender differences in caries status remain elusive [13]. Females approaching adolescence or older show higher caries prevalence compared to males [14, 15, 16], while young female children have lower or equal level of caries in comparison to young males [17]. Genetic and hormonal factors are complicated issues to address in an attempt to prevent caries incidence [18]. Social factors may explain variability in dental caries experience by girls and boys [19].

A cross-sectional survey was carried out to identify demographic and socioeconomic determinants of oral health among school-children in rural Java, Indonesia. The purpose of this study is to examine gender differences in caries level, taking into account socioeconomic gradients. The results of the study may improve targeting individuals for caries prevention.

Subjects and Methods

Study Design

A cross-sectional survey was carried out among children aged 11-13 years, attending public primary schools in Sleman District, Yogyakarta Province, representing rural areas of Java, Indonesia. A cluster random sampling obtained 1,144 children at fifth grade of 45 selected schools.

Data Collection

Data on age, gender, parental education, and household expenditure were provided by parents of the subjects who filled written forms indicating informed consent. Dental caries was measured as DMF-T using methods developed by WHO [20]. Decayed, missing (due to caries) and filled teeth index is one of the most frequently used measures of caries prevalence in the population. A caries free individual is defined as DMF-T equals to zero. Informed consent was given by parents or guardians of the subjects. Ethical clearance to carry out the study was granted by Ethical Committee of the Faculty of Dentistry, Gadjah Mada University, with an ethical approval letter number 00343/KKEP/FKG-UGM/EC/2015.

Data Analyses

Variations in the mean of DMF-T and proportion of no caries (DMFT=0) were detected by comparing DMF-T between boys and girls, controlling for different parental education and household expenditure levels. Restorative indexes (Filled / (Filled + Decayed) of subjects with at least one caries in females and males students [21] were compared and tested with non-parametric statistical methods (Kruskal-Wallis test for two independent samples). Multivariable models analyses were conducted using R (CRAN –R Project), an open source software, to identify the role of gender in caries experience.

Results

The findings of the study showed that the mean of DMF-T among the study subjects was 1.70 (95% confidence interval 1.60 – 1.81) and median 1.0. Proportion of caries-free children (DMF-T = 0) was 35.2%.

Gender and paternal education were significantly associated with DMF-T and proportion of caries-free individuals. Female students showed higher DMF-T level and less proportion with caries-free status. There were no significant differences in DMF-T and caries-free status among children with different levels of maternal education and household expenditure (Table 1). However, mothers with university education were 1.4 times more likely to have caries free children (p=0.06). Family income Rp 2,000,000 or more per month was associated with 1.2 times of caries free among the children (p=0.09).

Only 2.1% of female students and 1.7% of male students received restorative treatment in at least one carious lesion. Restorative index is higher in females, indicating that female students with caries received more restorative care. However the difference in restorative index was not statistically significant (p-value for Kruskal-Wallis test = 0.70).

Table 1: Differences in DMF-T and % caries free status according to gender, parental education and household expenditure (bivariate analyses) among primary school children in Sleman, Indonesia

	Means of DMF-T	Means differences (p-value)	% Caries-free	Odds Ratio (p-value)
Gender				
Female	1.90	0.39 (0.001)	31.4	0.717 (0.008)
Male	1.51	Ref	38.9	Ref
Paternal education				
University	1.36	-0.53 (0.004)	41.8	1.788 (0.002)
High school	1.70	-0.19 (0.349)	37.0	1.225 (0.232)
Junior high school or below	1.89	*Ref	28.7	Ref
Maternal education				
University	1.45	-0.27 (0.275)	39.6	1.409 (0.063)
High school	1.77	0.05 (0.999)	36.2	1.152 (0.413)
Junior high school or below	1.72	*Ref	31.7	Ref
Household expenditure				
Rp 2,000,000 or more	1.69	-0.02 (0.805)	38.1	1.239 (0.088)
Less than Rp 2,000,000	1.71	Ref	33.2	Ref

*Multiple comparisons of means (Bonferroni)

Multiple linear regressions (Table 2) and multiple logistic regressions (Table 3) of DMF-T of caries prevalence and caries free status respectively indicate that gender and paternal education are significant predictors of both caries indicators. The adjusted effect of university education of fathers on DMF-T was the strongest, followed by gender both on better DMF-T and higher caries-free status. Children with paternal education at high school level did not indicate statistiaclly significant difference in DMF-T and caries-free status compared to those with junior high school education or below.

Table 2: Multiple linear regression of gender, paternal education, maternal education and household expenditure on DMF-T among primary school-children in Sleman, Indonesia

	MODEL 1 Regression coefficients (p-value)	MODEL 2 Regression coefficients (p-value)	MODEL 3 Regression coefficients (p-value)
Gender			
Female	0.39 (0.001)	0.39 (0.001)	0.39 (0.001)
Male	0 (Ref)	0 (Ref)	0 (Ref)
Paternal education			
University	-0.66 (0.002)	-0.63 (0.003)	-0.53 (0.001)
High school	-0.28 (0.041)	-0.28 (0.045)	-0.18 (0.148)
Junior high school or below	0 (Ref)	0 (Ref)	0 (Ref)
Maternal education			
University	0.12 (0.558)	0.13 (0.516)	
High school	0.23 (0.097)	0.23 (0.096)	
Junior high school or below	0 (Ref)	0 (Ref)	
Household expenditure			
Rp 2,000,000 or more	-0.08 (0.492)		
Less than Rp 2,000,000	0 (Ref)		

Children of mothers attaining high-school education (without university level education) showed the highest DMF-T, with marginally statistical significance (p=0.097) compared to the lowest education category (junior high school or below). Interestingly, university education of mothers was not associated with lower DMF-T among their children, compared to the lowest education category.

Table 3: Multiple logistic regression of gender, paternal education, maternal education and household expenditure on caries-free status among primary school-children in Sleman, Java, Indonesia

	MODEL 1 Odds Ratio (p-value)	MODEL 2 Odds Ratio (p-value)	MODEL 3 Odds Ratio (p-value)
Gender			
Female	0.72 (0.008)	0.72 (0.008)	0.72 (0.009)
Male	1 (Ref)	1 (Ref)	1 (Ref)
Paternal education			
University	1.75 (0.023)	1.83 (0.012)	1.79 (0.002)
High school	1.22 (0.327)	1.27 (0.238)	1.24 (0.205)
Junior high school or below	1 (Ref)	1 (Ref)	1 (Ref)
Maternal education			
University	0.94 (0.771)	0.96 (0.850)	
High school	0.94 (0.802)	0.96 (0.874)	
Junior high school or below	1 (Ref)	1 (Ref)	
Household expenditure			
Rp 2,000,000 or more	0.871 (0.302)		
Less than Rp 2,000,000	1 (Ref)		

Household expenditure was not significantly associated with DMF-T or caries-free status. In this study, household expenditure may not reflect socioeconomic status, widely known as an important determinant of caries experience [7, 8].

Discussion

Female school-children showed higher DMF-T and were less able to achieve caries-free status (about 25% less caries-free status than male students). Better caries status among male school-children compared to their female counterparts was also reported from studies in Indonesia [22, 23] and other countries [14, 24].

Caries experiences increase with age at a greater rate among females compared to males, in various ethnic groups, ecological background and cultural context [25]. Female sex hormones may compromise responses to microbial film in dental plaque, contributing to caries and periodontal diseases [26].

Permanent teeth erupt earlier among girls than boys [27], allowing for longer exposure to cariogenic substances. Snacking in the morning, afternoon and all periods during the day among US children (aged 9-13 years) was more common in girls than boys [28]. Snacks and sugar-based chewing gums were shown to be associated with higher DMF-T in children [29]. Genes have been implicated in the development of caries [30]. The heritability of caries in permanent teeth is estimated to be 35-55% [31].

Molecular-genetic markers of caries may be associated with immune response, saliva content and flow, and structural formation of teeth [32]. Genetic susceptibility to caries is unequal between females and males [33]. Primary-school children whose father had university level education indicated almost twice the proportion of caries-free status compared to those with paternal education at the level of junior high school or below. Low maternal schooling did not increase DMF-T or decrease caries free status, unlike the findings in Brazil [34, 35] where maternal education played more significant role in caries prevalence.

There is no significant difference in restorative indexes between female and male students, indicating that the discrepancies in caries status between the two sexes were not due to gender preferences in dental health care services. Restorative care was usually higher in adolescent girls, especially among those with better socio-economic status [36, 37].

Conclusion

Gender is a consistent factor affecting the risk of caries among children aged 11 to 13 years, where female students have higher risk for caries experience, controlling for socio-economic status known to influence caries development. Early teeth eruptions in girls, which means longer exposure to cariogenic substance, hormonal fluctuations among girls during and after puberty, frequent snacking, and genetic susceptibility for caries modified by gender are probably responsible to higher risk of dental caries in females. There is no difference in restorative care index, representing equal dental care received by female and male students.

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