Food Consumption Frequency and Dental Caries Status among Adolescents in Jakarta

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Abstract

This study aimed to test the reliability of a Food Frequency Questionnaire (FFQ) and to determine the status of dental caries as well as the relationships of food consumption frequency with dental caries status in adolescents aged 15–16 years old in Jakarta.

Adolescents were randomly selected from 11 high schools. Clinical examination was performed by single calibrated examiner using the DMFT index. The FFQ was cross adapted to Indonesian version and self-administered by the study participants. A total of 471 adolescents participated in the study, with a dental caries prevalence of 75.4% and mean DMFT 2.7. The reliability test of FFQ resulting in ICC=0.940. Carbonated drinks and chips' consumption frequency have a statistically significant weak relationship with dental caries status.

The FFQ used in this study was a reliable tool to obtain data of food consumption frequency. The dental caries status of adolescents in Jakarta was considered moderate based on WHO classification. Only two types of foods in this study revealed significant relationships with dental caries in adolescents.

Introduction

Dental caries remains a global oral health problem, especially in low and middle-income countries where the burden is rising, causing a considerable decrease in the quality of life.[1] Although dental caries is a multifactorial disease, it is believed that sugar consumption imposes a great risk on the demineralization of the tooth structure.[2] A systematic review revealed consistent evidence supporting a relationship between the amount of sugars consumed and dental caries development.[3] Sugars and other fermentable carbohydrates produce substrate for oral bacteria metabolism, which in turn producing harmful acids that disintegrate the tooth structure.[4,5] A previous study indicated that approaches to controlling dental caries are still failing due to relatively high level of sugar intake across the globe. Therefore, it is crucial to develop intervention programs to reduce sugar intake since the use of fluoride alone is insufficient to reduce substantially the burden of caries over the lifetime of individuals.[6]

The prevalence of dental caries in adolescents in Jakarta is high.[7] Dental caries prevalence correlates significantly with presence of the impact of the oral health status on daily performances, decreasing the quality of life of these adolescents.[8] The development of dental caries in adolescents may be attributed to many factors, including high sugar consumption.[9] Various studies found high sugar intake among adolescents across many countries, with sugary beverages and confectionery being the greatest contributors.[10-12] The current status on dental caries prevalence and its contributing factors indicates that population-based prevention program is necessary, suggesting that the protective role of fluoride act as an important factor in decreasing dental caries in the community.[13] Developing countries, including Indonesia, have a limited resource for fluoride-based prevention program;

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therefore, the prevention program should focus on a more attainable approach, such as limiting sugar consumption. In 2015, the World Health Organization released The WHO Guideline on Sugars Intake for Adults and Children, which put forward a distinct recommendation of free sugar intake reduction in both age groups. The sugar intake should be lower than 10% of total energy intake, even lower than 5% is suggested for lifetime oral health protection.[14]

Adolescents are considered an essential target for health promotion activities because the behaviours that are formed during adolescence can persist in adult life. Adolescents possess more risk of dental caries due to dietary habit, inappropriate oral hygiene regime, and other social factors.[15,16] Therefore, good oral health behaviour, such as limiting sugar consumption needs to be encouraged during this stage. In formulating an effective oral health prevention program related to sugar consumption limitation, supporting evidenced-based data is required. However, to this date, data on the level of intake and dietary sources of free sugars are lacking for many countries, including Indonesia. This study aimed to test the reliability of food consumption frequency questionnaire and to determine the status of dental caries as well as the relationships of food consumption frequency with dental caries status in Indonesian adolescents.

Materials and methods

This was a cross-sectional study conducted on adolescents who were high-school students in Jakarta. The sampling method used was multistage cluster random sampling to select adolescents aged 15–16 years old in 11 schools, both public and private schools. Sample size estimation was performed with reference to a previous survey, which reported that the prevalence of decayed, missing, and filled teeth in 12-year-old children was 61%.[7] The marginal error of the estimate was set at ≤ 5%. With a two-sided confidence level (CI) of 95%, the computed minimum sample size was 366. Assuming a response rate of 85%, the number of participants to be invited needed to be at least 420. Samples were 20–80 students from each school (based on the proportion of the area), with a total number of 471 healthy adolescents who were not undergoing orthodontic treatment and who were willing to participate cooperatively in this study. All subjects were granted parental consent for inclusion in the study. School data were accessed through the website of the Jakarta provincial education department. The study protocol (No. 030230219) had been approved by the Ethics Committee of the Faculty of Dentistry, Universitas Indonesia.

The dental caries status was obtained using the DMFT index, which numerically expresses caries prevalence and determined by calculating the number of Decayed (D), Missing (M), Filled (F), Teeth (T). The clinical examinations were conducted by one trained examiner. The intra-examiner reliability was tested by performing second examination on 38 participants, 3 days after the first examination. Kappa agreement result was 0.809 for decay, 0.938 for missing, 1.00 for filling, and 0.868 for free caries examination. The instrument used in this study was adapted from a previous published study.[17] This was a self-administered questionnaire that ask participants to report their intake frequency of commonly consumed foods and/or beverages, which consists of 6 items. The items designed to find out what kinds of food and beverages were preferred by the participants. Frequency of food consumption was classified into 5 score: 1 (never), 2 (rarely), 3 (sometimes), 4 (often), 5 (always).

Prior to the study, the English version of the Food Frequency Questionnaire (FFQ) was translated according to the guidelines for cross-cultural adaptation.[18,19] The forward and backward translation were assessed and revised, for the concept of item equivalence between the original version and the Indonesian version, by an expert panel comprising a bilingual dentist and dental public health researcher, who were familiar with the FFQ. The questionnaire was tested among adolescents aged 15–16 years old to determine the clarity of the consensus Indonesian version of the FFQ to the Indonesian culture. Several types of food often consumed by the participants but had not been included in the original questionnaire were then added into the Indonesian version. Finally, the FFQ was confirmed by the expert panel after revisions. All data were collected in the school setting, with administration of the questionnaires in the classroom and dental examination individually in a separate room. The

Spearman's correlation were applied, with p<0.05 to evaluate the relationship between dental caries status and food consumption frequency.

Results

Of the 471 adolescents participated in this study, 94 were in East Jakarta, 129 in Central Jakarta, 110 in West Jakarta, 98 in South Jakarta, and 40 in North Jakarta. The majority of the participants were female (n=236, 50.1%). Dental caries prevalence in this population was 75.4% (355 students). The mean DMFT was 2.72 (±2.68) with a median of 2.00 (minimum value of 0 and a maximum of 13). The FFQ was tested for reliability and the result showed an intraclass correlation (ICC) of 0.940, proving that this tool had an almost perfect test and retest agreement. Characteristics of the study participants showed in Table 1.

Characteristics	Percentage (n)	DMF-T> 0	p-value
Gender			0.010*
Male	49.9% (235)	70.2% (165)	
Female	50.1% (268)	73.5% (197)	
Mother's Education			0.024*
Higher education	17.8% (84)	69.0% (58)	
High school	56.9% (268)	74.35 (199)	
Middle school	13.8% (65)	81.5% (53)	
Elementary school	11.5% (54)	83.3% (45)	
Father's Education			0.272
Higher education	23.8% (112)	72.3% (81)	
High school	53.9% (254)	75.6% (192)	
Middle school	14.0% (66)	74.2% (49)	
Elementary school	8.3% (39)	84.6% (33)	
Toothbrushing Frequency			0.469
> 2 times	20.4% (96)	77.1% (74)	
2 times	68.4% (322)	75.5% (243)	
1 time	9.6% (45)	75.5 ^ (34)	
Not brushing teeth	1.7% (8)	50.0% (4)	
Dental Visit			0.079
Yes	29.3% (138)	81.2% (112)	
Not	70.7% (333)	73.0% (243)	

Table 1. Characteristics of study participants (n=471).
Chi-square test, *p-value < 0.05

A number of 50.1% were females, most parents' education were high school educated, and most students toothbrush their teeth twice daily (64.4%). Based on Table 2, carbonated drink had a significant relationship with dental caries status with a negative correlation, while chips had a significant relationship with dental caries with a positive correlation.

Types of foods	% Frequency distribut					p-value	r
	1	2	3	4	5		
Apple	13.6	54.1	26.5	4.9	0.8	0.073	-0.083
Banana	8.5	41.6	32.7	14.6	2.5	0.106	-0.075
Chocolate	14.9	43.3	29.7	10.6	1.5	0.294	0.048
Cookies	5.3	54.8	28.7	10.0	1.3	0.277	-0.050
Chocolate bar	2.8	30.4	35.9	27.2	3.8	0.199	0.059
Sweetened yoghurt	25.7	52.9	16.8	4.0	0.6	0.281	-0.050
Deep fried snacks	2.8	27.2	42.3	23.8	4.0	0.675	0.019
Meatballs/dumplings	1.5	20.8	46.1	27.8	3.8	0.261	0.052
Savoury bread	18.9	55.6	19.7	5.1	0.6	0.425	-0.037
Sweet bread	5.1	32.3	41.0	18.7	3.0	0.309	-0.047
Wheat bread	18.3	52.7	21.0	7.9	0.2	0.207	-0.058
Sweet biscuits	5.5	44.2	32.1	15.5	2.8	0.586	0.025
Sponge cake	6.2	59.4	27.6	5.9	0.8	0.431	0.036
Mineral water	0.6	4.2	6.6	32.1	56.5	0.052	-0.090
Fruit juice	5.9	39.7	39.7	12.3	2.3	0.183	-0.061
Sweet iced tea	1.5	20.2	40.1	30.6	7.6	0.792	0.012
Regular iced tea	26.5	41.8	22.7	6.8	2.1	0.676	-0.019
Plain milk	30.6	41.4	16.8	9.3	1.9	0.068	-0.019
Sweet flavoured milk	5.3	25.5	36.1	25.9	7.2	0.388	-0.040
Coffee with sugar	36.9	36.3	15.7	8.3	2.8	0.849	-0.009
Carbonated drinks	20.6	49.0	22.5	5.9	1.9	0.031*	-0.099
Sweet cereal with milk	34.2	45.9	13.0	5.1	1.9	0.811	-0.011
Green beans porridge	27.2	42.3	24.2	5.3	1.1	0.283	0.050
Rolled sponge cake with jams	31.8	48.5	17.2	1.7	0.4	0.221	0.056
Bread with jams	16.1	38.6	31.8	10.8	2.5	0.573	0.026
Bread with cheese/sausage/floss	25.3	46.9	21.0	5.9	0.8	0.782	-0.013
Fruit yoghurt	42.7	42.3	12.1	2.5	0.4	0.424	-0.037
Instant noodles	10.8	20.2	35.9	28.5	4.7	0.579	0.026
Chicken porridge	6.4	31.8	36.5	21.7	3.6	0.917	-0.005
Coconut riced	3.6	20.8	25.5	32.9	7.2	0.637	-0.022
Nuggets/sausage/eggs	5.7	21.0	34.6	31.0	7.6	0.258	-0.052
Sweet popcorn	42.9	44.8	8.7	3.2	0.4	0.925	0.004
Salty popcorn	43.1	44.4	9.3	2.8	0.4	0.970	-0.002
Chips	10.6	38.6	34.6	13.4	2.8	0.012*	0.115
Dates	36.1	46.5	14.2	2.3	0.8	0.700	-0.018
Nuts	32.7	42.5	18.9	5.3	0.6	0.471	-0.033
Packaged cookies	15.3	41.8	27.4	13.6	1.9	0.443	0.035
Vegetables (cucumber, carrots)	28.7	29.5	23.1	13.0	5.7	0.888	-0.007
Cake	15.7	53.7	24.0	5.3	1.3	0.837	-0.010
French fries with ketchup	9.1	34.0	36.3	17.8	2.8	0.245	0.054
Burger/Pizza/Sandwich/Kebab	10.2	40.8	33.3	13.0	2.8	0.670	0.020
Wafer	6.6	39.5	31.0	19.3	3.6	0.317	-0.046
Bubble drinks/Milk tea	7.0	30.8	30.4	25.3	6.6	0.417	0.037
Doughnuts	14.4	47.6	28.0	8.1	1.9	0.784	0.013

Table 2. FFQ Result on Types of Food Frequently Consumed.
Spearman Correlation test, *p-value < 0.05

Discussion

This study demonstrated a higher DMFT in female adolescents, which is consistent with results of previous studies in Jakarta.[20,21] The results showed that the prevalence of dental caries was significantly associated with gender. Although girls were found to have a higher caries risk, other studies found boys to have a higher or similar risk. Factors associated might include different compositions and flow rates of saliva, conditions of hormone fluctuation, lifestyle including dietary habits, genetic variation, systemic diseases and certain social roles.[22] Further results showed that mother's education had a significant association with the prevalence of dental caries, similar to other studies. Mothers who have relatively lower level of education will consume more snacks and sugary beverages, so that their children have a higher

prevalence of dental caries.[23,24] Mothers' nutrition-related knowledge and attitudes affect their decision to purchase children's food. Mothers who lack knowledge about nutrition may be limited in their ability to understand and evaluate health claims related to food selection, especially for foods that contain sugar.[25] Previous study suggests that there is an inverse relationship between nutritional knowledge and motivation to buy food that meets nutritional requirements.[26] Therefore, mothers as person who play an important role in the family in selecting food for the family need to be involved in health interventions.

Diet is a major factor that can be modified in the etiology of dental caries. It is beyond debate that consumption of sugary foods risks tooth integrity.[2,3,14] In healthy individuals, the presence of caries will unlikely develop into advanced lesion if the person is consuming less cariogenic food. By consuming fermentable carbohydrates frequently, especially sugar, it increases the risk of developing dental caries. Analysis of oral microbiome in healthy and caries teeth suggests that specific changes in the local environment allow cariogenic species to defeat normal flora and dominate when carious lesions begin to occur and develop. This condition causes demineralization of tooth enamel, which is largely due to the production of acids produced by bacteria from sweet foods consumed by the host.[27,28] In this study, significant positive relationships between food consumption frequency and dental caries status were only found in chips. Chips has a significant positive relationship with dental caries status, although with low correlation. This may be due to their primary ingredients, potatoes and cassava, which contain carbohydrates like starch. This is in line with the previous study, which found that carbohydrates such as starch can affect carcinogenicity.[27,29]

Carbonated drinks are usually considered as a source of high sugar. Nonetheless, the adolescent in this study rarely drink carbonated drinks, causing statistically week negative correlation between carbonated drinks consumption and number of dental caries. The distribution of the number of decade teeth among the studied adolescents is relatively homogeneous. Therefore correlation between the cariogenic diets was not apparent. Although most of the studied food and beverages variables had no statistical significant correlation with dental caries, it is worth to note that the consumption of sweet iced tea, sweet flavoured milk, bubble drinks/milk tea, and chocolate bar were high in this study. When the teeth are often exposed to and sugary beverages, it will causes an increase in dental caries in the future.[6]

Nonetheless, dental caries is a multifactorial disease, which makes it difficult to determine profound association with various variables.

The association between diet and dental caries was not implicit. This may be due to the distribution of the sample which mostly carried out in adolescents who have dental caries as much as 2 teeth, according to WHO classification, this belongs to the moderate group. Also, most students brushed their teeth twice a day, which could be a factor in preventing caries from eating sugary foods/drinks. Because the dental caries status was relatively good, it showed an indistinct correlation to the food consumption frequency. This study also conflicted with social desirability bias.

Conclusions

The FFQ used in this study is a reliable tool to obtain data of food consumption frequency. The dental caries status of adolescents in Jakarta is considered moderate based on WHO classification. There were only two types of foods in this study, which have significant relationships between food consumption frequency and dental caries status in adolescents.

Maternal influence on children's oral health could be a key role in health interventions.

Declaration of Interest

The authors report no conflict of interest.

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