Correlation between Dental Caries Level and Nutritonal Status of Preschool Children Aged 4-5 Years in Perak Timur Village Surabaya

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Abstract: Dental caries and malnutrition in preschool children are public health problems with multifactorial etiologies and mechanisms. Teeth and the oral cavity have an important role of nutritional intake. Nutrition is an important factor that may determine the process of growth and development; accordingly an imbalance between intake and the need of nutrition cause malnutrition. Untreated caries is a disease that may cause pain and discomfort, and therefore may affect the weight, quality of life, and growth of children. Untreated caries may decrease chewing ability, which consequently leads to inadequate nutrient intake. This cross-sectional study aimed to assess the correlation between dental caries and nutritional status among preschool children aged 4-5 years in Perak Timur village, Surabaya. Ninety-three preschool children were involved from two early childhood education programs (ECEP). Caries were measured using def-index, and nutritional status was assessed using anthropometric measurement. Assessment of nutritional status was based on the weight/height (W/H) Z-score. There was an inverse linear correlation between dental caries and the nutritional status of children and significantly lower anthropometric outcomes in children at each consecutive group with higher levels of caries. The significancy of Spearman's test was p=0,000 (p<0,05). The higher the levels of dental caries, the poorer the nutritional status of preschool children.

1 INTRODUCTION

Caries is a chronic condition which involves the hard tissue of teeth due to microorganism activity and imbalance between demineralization and remineralization of the hard tissue of teeth. Caries are one of the most common oral health problems. According to data provided by the Ministry of Health Republic of Indonesia, in 2013 the prevalence of active caries in South Java was still 50.8 percent (Gibney, 2009; Wong, 2012; Departemen Kesehatan RI, 2013).

Nutrition is a crucial factor in maintaining healthy living, growth, and the normal function of organs, as well as to produce energy. An imbalance between intake and need of nutrition may lead to malnutrition. Malnutrition is a serious public health problem in Indonesia. According to National Basic Health Research, RISKESDAS, 2013, the prevalence of underweight preschool children was 12.1 percent. But according to the World Health Organization (WHO) in 2010, public health problems are considered a serious problem if the prevalence of underweight children is from 10-14 percent, and critical if the prevalence ≥15 percent (Gibney, 2009; Departemen Kesehatan RI, 2013; Supariasa et al, 2001).

The teeth and mouth have an important role as the cephalic end of the gastrointestinal tract and entrance of food into the body (Junaidi, 2004). Diseases in the oral cavity may be one of the etiologies of lower nutrient intake into the body and therefore could influence the growth and development of children.

Deciduous teeth in children have such a morphology which may allow greater food retention than permanent teeth, consequently decreasing the oral hygiene of children and facilitating the formation of caries (Kidd, 2005). Severe dental caries may influence the quality of life and growth of preschoolers due to the presence of pain, iritability, and sleep disturbance. Caries that expand to the dentin layer will cause pain and lead to a picky eating habit. In addition, caries may also lead to dental physiological impairment such as incomplete food

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destruction, decrease of saliva production that results in poor dissolution of food, and impaired function of the muscles of mastication. Pain due to untreated caries can cause decreased eating ability which leads to poor weight gain (Junaidi, 2004; Benzian et al, 2011; Bagramian et al, 2009).

In a study conducted by Alkarimi (2014) regarding correlation between dental caries and growth of school-age children, it was found that higher levels of caries in children are associated with lower weight and height compared to those with lower levels of caries (Alkarimi et al, 2014). Another study also revealed the similar correlation: 54.6% of children had untreated dental caries and 26.4% of children had malnutrition (Mishu et al, 2014). Also, another study of Junaidi5 in Lhoknga sub-district, Aceh Besar district, demonstrated that nutritional status is associated with the severity of dental caries. Children with severe caries were found to have poor energy intake.

According to preliminary studies, one of them conducted at Nusa Dua local health post (Posyandu), Perak Timur village, the prevalence of caries in children aged 4-5 years who came to Posyandu remained as high as 85 percent. Another study which involved ECEP students in Perak Timur found they still had a high mean def index of 5.9. Moreover, according to the measurement of nutritional status in Posyandu, it was found that 36 percent of children aged 4-5 years were underweight and 45 percent were normal.

2 METHODS

This was an observational analytical study with a cross-sectional study design. The study sample was preschool children aged 4-5 years enrolled in Dahlia and Lestari ECEP, Perak Timur village, Surabaya. Exclusion criteria in this study were a) preschoolers with infectious disease and b) preschoolers with physical and mental disorders. Total sampling was used as the sampling technique, and the sample size was 93 preschoolers.

Data collection was performed through intraoral examination and nutritional status assessment of children. Intraoral examination was performed using a dental probe and mouth mirror to assess the caries, then the def index was recorded. Each deciduous tooth with caries-induced broken enamel included teeth that made the probe stick in indentations; teeth with secondary caries fillings and teeth with temporary fillings were classified as d (decay); deciduous teeth that had been extracted were classified as e (extracted); and deciduous teeth with permanent restoration due to caries were classified as f (filling).

Individual def index was the total of each component. In this study it was classified into three categories, i.e. low for def total 0-2, moderate for def total 3-5, and high for def total more than 6 teeth.

Moreover, assessment of nutritional status was performed by measuring weight using digital scales, and height using microtoise. Weight and height values of each child were converted to a standard value (Z-score) using the children's anthropometric standard deviation of the WHO 2005. Based on the Z-score value of each indicator, the nutritional status of children was determined as follows: eutrophy for Z-score $\geq$ -2.0 to $\leq$ 2.0, thinness for Z-score < -2.0, and obesity for Z-score $\geq$ -2.0.

The data obtained from caries examination and nutritional status assessment was analyzed with cross tabulation. The result of caries examination in def index and nutritional status assessment by Z-score were analyzed using the Spearman test to find out the correlation between caries levels.

3 RESULTS

The total number of subjects aged 4-5 years in this study was 93 respondents, consisting of 34 boys and 59 girls. According to the distribution of age, subjects aged 4 years numbered 58 respondents, and 5 years numbered 35 respondents.

The study results showed that there were more subjects included in the group with high levels of caries than in the group with moderate and low levels of caries.

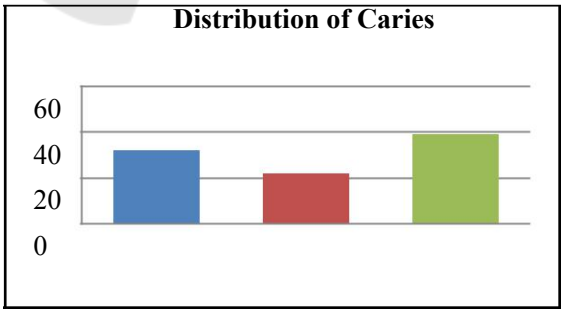

Figure 1. Bar chart of distribution of caries

There were 39 children (41.9%) of all subjects involved in this study that had high levels of caries, while 32 children (34.4%) had low levels, and the remaining 22 (23.7%) had moderate levels.

The result of nutritional status measurement in this study showed the nutritional status W/H in both groups that 28 children (30.1%) were thin, 48 children (51.6%) were eutrophic, and the remaining 17 (18.3%) were obese.

The data of caries examination was compared to the nutritional status using cross tabulation.

Table 1. Nutritional status W/H based on the def index.

Def	Nutritional Status W/H		
	Thinness	Eutrophy	Obesity
Low (0-2)	5 (15.6%)	22 (68.8%)	5 (15.6%)
Moderate (3-5)	6 (27.3%)	9 (40.9%)	7 (31.8%)
High (> 6)	17 (43.6%)	17 (43.6%)	5 (12.8%)

The results of cross tabulation of both data (Table 1) show that among 32 subjects with low levels of caries, 5 children (15.6%) were thin, 22 children (68.8%) were eutrophic, and the remaining 5 (15.6%) were obese, whereas among 22 subjects with moderate levels of caries, 6 children (27.3%) were thin, 9 children (40.9%) were eutrophic, and the remaining 7 (12.8%) were obese. Furthermore, among subjects with high levels of caries, 17 children (43.6%) were thin.

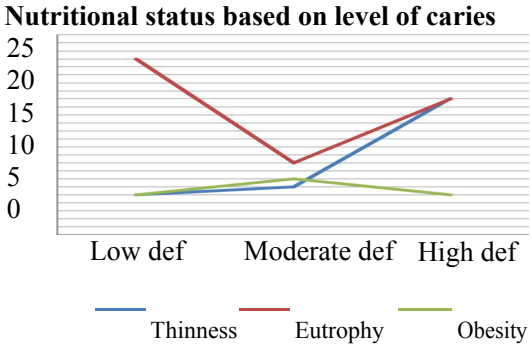

Figure 2. Chart of distribution of nutritional status based on level of caries.

According to the chart in Figure 2, the blue line which represents the group of thin subjects shows an increased number of subjects as the level of caries increases. Meanwhile, the red line as a representation of the eutrophy group shows that most of the subjects had low levels of caries.

The normality test using the Kolmogrov-Smirnov test found values for the data of level of caries as < 0.05 which means the data was not normally distributed, and data of nutritional status > 0.05 which was normally distributed. Statistical analysis used was a bivariate correlation test, i.e. Spearman test. Based on calculations, it found a p value <0.05, which means there is a correlation between the level of caries and nutritional status.

4 DISCUSSION

Dental caries are one of the most common oral health problems in children (Pikham, JR *et al, 2005)*. The present study indicated that subjects with caries remains high. This is shown by the data we obtained in this study which showed a mean def index for both ECEP was 5.63. According to the WHO, this value is classified as high. Subjects with high levels of caries based on individual assessment numbered 39 children or 41.9% of the total of subjects included in the examination. This percentage is higher compared to the total number of children with low (34.4%) and moderate (23.7%) levels of caries.

Development of dental caries in children depends on a correlation between tooth surface, carbohydrate diet, and oral bacteria. Frequency of carbohydrate intake is a more important determinant in the development of dental caries than the amount of consumption. Carbohydrates contained in food products with a longer retention period in the mouth are potentially more cariogenic than that of a shorter retention period.

Nutritional status is a representation of the state of balance or manifestation of nutriture in certain forms of variables. Good or optimal nutritional status can be achieved if the body receives adequate nutrients which are efficiently used (Supariasa et al, 2001; Almatsier, 2002; Moehji, 2003).

Preschool children are in their growth and development period when they are vulnerable to nutritional problems (Moehji, 2003). At this age, children begin to be able to say no to food.

The result of the study indicated that the number of thin subjects remains high as 30.1% of the subjects were thin. According to the WHO (2010), public health problems are considered serious if the

prevalence of underweightness is from 10-14 percent, and critical if the prevalence ≥15 percent, and the study result showed that prevalence of children with thinness in both ECEP remains high. The high prevalence of thin children indicated that there is an imbalance between nutrient intake into the body and the body's nutrient needs.

There are three mechanisms which may cause malnutrition, i.e decreased nutrient intake, for instance in famines or due to chronic disease; decreased nutrient absorption, for example carbohydrate malabsorption in cholera; and, decreased nutrient use in the body (Moehji, 2003). In children with untreated caries, the caries may expand to the dentin layer and cause pain. Consequently, it leads to a picky eating habit, decreasing food intake into the body.

The result of the study of caries and nutritional status in Perak Timur found that the group of children with high levels of caries had 43.6% of subjects with thinness. This value was higher than for the group of children with both moderate (27.3%) and low (15.6%) levels of caries. Meanwhile, subjects with eutrophy or normal were mostly found in the group of children with low (68.8%) levels of caries, compared to those with moderate (40.9%) and high (43.6%) levels of caries. In this study, we found that there is a significant correlation between caries and the nutritional status of preschool children aged less than 5 years. The majority of subjects with thinness had high levels of caries. Based on the Spearman correlation test, the significance value between def index and W/H index was 0.00 or P <0.05, indicating that there is a correlation between dental caries and nutritional status.

The result of the present study is in accordance with the study conducted by Alkarimi9 which stated that in chilren with high levels of caries, which means the dmft was more than 7 had lower mean Z-scores of BMI than those with low levels of caries, which means the dmft is less than 2. There are three plausible mechanisms for how dental caries may be associated with weight loss. First, untreated caries and associated infection may cause pain and discomfort. Second, severe caries may affect children's quality of life and thereby growth due to pain, irritability, and disturbed sleep habits which could affect growth hormones and glucocorticosteroid production. The third possible mechanism is chronic inflammatiom from pulpitis and abscesses which may affect metabolic pathways (Sheiham, 2006; Hayes, 2006). According to the results of the present study, it could be concluded that the higher the levels of caries the poorer the nutritional status of preschool children.

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