Nutritional Status and Dental Caries in 12- and 13-Year-Old Adolescents in Central Surabaya, Indonesia

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Abstract

Adolescents are at particular risk of malnutrition and dental caries. Evidence related to the contribution of nutritional status on dental caries among adolescents is scarce. Aims: To investigate the association between nutritional status and dental caries among 12- and 13-year-old adolescents in Central Surabaya, Indonesia.

This was a cross-sectional study on 122 adolescents aged 12 and 13 in Central Surabaya. Nutritional status was assessed by calculating the Body Mass Index (BMI) for age. The diagnosis of dental caries was recorded by using the Decayed, Missing, and Filled Teeth (DMFT) index. Bivariate and logistic regression analyses were performed using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, New York, U.S.A).

This study shows that 75.9% of adolescents aged 12 and 13 in Central Surabaya experienced dental caries. The prevalence of untreated dental caries was 74.1%. Nutritional status was inversely associated with dental caries. Compared to thinness participants, the likelihood of having a low number of dental caries (DMFT≤2) was higher among participants in normal category of nutritional status (OR: 36.32, 95%CI: 2.65-497.52, P: 0.001) and among overweight participants (OR: 5.04, 95%CI: 1.03-24.75, P: 0.046).

The prevalence of dental caries and the mean DMFT score among 12- and 13- year-old adolescents in Central Surabaya were high. Our result indicated an inverse association between nutritional status and dental caries. Comprehensive strategies for health care delivery are needed to improve nutrition and oral health in adolescents.

Clinical article (J Int Dent Med Res 2023; 16(2): 766-771) Keywords: Nutritional status, dental caries, adolescents, public Health. Received date: 06 January 2023 Accept date: 16 February 2023

Introduction

Adolescence is a crucial time of life at which a range of future health challenges emerge from health conditions during adolescence.¹ An adolescent is defined as a person aged between 10 to 19 years.² Representing 16 percent of the population in the world,² adolescents bear a substantial proportion of the global burden of disease in the world.¹ Despite that, adolescents

*Corresponding author: Dini Setyowati, Department of Dental Public Health, Faculty of Dental Medicine, Universitas Airlangga, Campus A FKG Unair, JI. Mayjen Prof. Dr. Moestopo No.47, Mojo, Tambaksari, Surabaya 60132, East Java province, Indonesia. E-mail: dini-s@fkg.unair.ac.id are often neglected in the health system and services.¹

Malnutrition is one of the chronic conditions that can develop during adolescence and have implications for lifelong health and well-being.¹ Malnutrition occurs when the intake of energy and/or nutrients is either deficient or excessive.³ According to the World Health Organization (WHO), there are three broad groups of malnutrition:³ (1) Undernutrition (wasting, stunting and underweight); (2) micronutrientrelated malnutrition (micronutrient deficiencies or micronutrient excess; (3) overweight, obesity and diet-related non-communicable diseases. Dietary patterns and physical activity affect adolescent nutrition- and health-well-being. Malnutrition is one of the underlying risk factors of the global burden of disease among adolescents.⁴ Furthermore, the global burden of malnutrition

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among adolescents will make the developmental, economic, social, and medical impact not only on the affected individuals but also on their families, communities, and countries. Those impacts are serious and lasting. Therefore, combating malnutrition among adolescents is one of the greatest global public health challenges.³

In addition to malnutrition, adolescents are at particular risk of dental caries. In Indonesia, according to the report on Indonesia Basic Health Research in 2018, 72% of adolescents aged 12 had dental caries with mean of decayed, missing, and filled teeth (DMFT) scores was 1.9, and only 4% of adolescents aged 12 has visited a dental professional.5 The initiation health and progression of dental caries in adolescents are commonly related to diet.⁶ During this age period, parental supervision has been minimized. Adolescents start to independently choose a diet that suits them through a range of dietary experiments and modifications. Unhealthy diets, such as Irregular meals, fast-food, and snacks, are all common. Those dietary behaviors may pose a risk of malnutrition as well as dental caries.7

The relationship between nutritional status and dental caries has become growing research interest, yet remains unclear. Current research and action are concerned about nutritional status and dental caries in preschool children and/or school-age children.8,9 However, research and actions, which predominantly target maternal and child oral health, are not sustained in adolescence. Adolescent's oral health is often left behind in the oral health agenda. Evidence related to the contribution of nutritional status on dental caries among adolescents is scarce. Specifically, to the best of our knowledge, none of the previous studies in Indonesia has investigated nutritional status and dental caries in adolescents.

This study aims to investigate the association between nutritional status and dental caries among 12- and 13-year-old adolescents in Central Surabaya, Indonesia. Adolescents aged 12 and 13 were selected as the study participants, because, in Indonesia, adolescents aged 12 and 13 are experiencing a transition period from primary to junior high school. During this transition period, there will be a substantial change in their lifestyles, including dietary behaviors, which may negatively impact on their nutrition and/or dental health.⁷ Furthermore, most

of the 28 permanent teeth have fully appeared at age 12,¹⁰ and therefore, age 12 is the target population for the prevention of dental caries aiming to achieve the global oral health goals by the year 2020.¹¹ This study would fill the gap of data about nutritional status among 12- and 13year old adolescents and its relation to dental caries. The findings may provide a basis for designing more comprehensive intervention programs aiming to improve nutritional status and reduce the incidence of dental caries among adolescents, particularly in Central Surabaya, Indonesia.

Materials and methods

This was a cross-sectional study on 12and 13-year-old adolescents schooling in a public Junior High School in Kapasan, Surabaya. Kapasan was selected because it is an urban commune located in the most populated district in Surabaya.¹² The high population density was one of the community risk indicators of oral health in Indoneisa.¹³ This study was carried out between September and October 2021. The Ethics Committee of Faculty of Dental Medicine, Universitas Airlangga, Indonesia, approved the study protocol.

The study sample included 112 adolescents aged 12 and 13 enrolled in a public Junior High School in Kapasan, Surabaya. Sample size estimation was calculated with the marginal error of the estimate was set at 10%. With the total number of adolescents aged 12 and 13 in the school was 391, the computed minimum sample size was 79. Assuming a response rate of 85%, the minimum number of participants required was 95. A simple random sampling method was performed to recruit 120 participants from a list of adolescents aged 12 and 13 in the school. Written informed consent was sought from the parents or the responsible guardian before the commencement of the study. Only participants who were present on the day of data collection and with parental consent were included in this study. Participants who did not cooperate with the body weight and height measurement and/or the dental examination, or who had severe general health problems, or who refused to participate in the study were excluded. 120 participants approached, Amona 112 participants were included in this study (response rate was 93%), whereas the other 8 students

were not present on the day of data collection.

Data collected from participants included name, date of birth, gender, body weight, body height, and dental caries in permanent teeth. The measurement of body weight and body height and the dental caries examination were all carried out by one of the researchers in the school under sufficient natural daylight. Bodyweight was measured using a digital weighing scale, whereas body height was measured using a stadiometer. The diagnosis of dental caries was determined according to the World Health Organization (WHO) criteria and was recorded by using the Decayed, Missing, and Filled Teeth (DMFT) index.¹⁴ Dental caries were identified by visual inspection only. No Xrays were taken. A disposable mouth-mirror and dental probe were used to assist in the examination of dental caries.

Dental caries status, as a dependent variable, was dichotomized into low (DMFT≤2) and high (DMFT>2). The cut-off point was made based on acceptable levels of dental health suggested by the World Health Organization (WHO), which is no more than 2 DMFT at age 12.¹⁵ In addition to dental caries status, the mean DMFT score was also calculated to assess the severity of dental caries. Nutritional status was assessed by calculating the Body Mass Index (BMI) for age and gender, according to standards provided by the Minister of Health of the Republic of Indonesia.¹⁶ BMI was calculated by dividing the participant's weight in kilograms by the square of the participant's height in meters. Participant's nutritional status, as an independent variable, was then categorized as severely thinness (z-score <-3 SD), thinness (-3 SD \leq zscore<-2 SD), normal (-2 SD \leq z-score <+1 SD), overweight (+1 SD \leq z-score <+ 2 SD), and obese (z-score > +2 SD).¹⁶

Data were analyzed using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, New York, U.S.A). The Spearman rankorder correlation coefficient was performed to assess the association between nutritional status and dental caries status. The Mann-Whitney U test and Kruskal-Wallis H test was applied, where appropriate, to determine if there were statistically significant differences in the mean DMFT score among age, gender, and nutritional status groups. The statistical significance was set at P < 0.05. P values of less than 0.05 were considered significant.

Results

A hundred and twelve participants had a complete data set. Of these participants, 28 participants (78.1%) were at age 13 and 59 participants (51.8%) were male. With regard to nutritional status, 73 participants (64%) were normal; 19 participants (16.7%) were overweight; 13 participants (11.4%) were obese; and seven participants (6.1%) were thinness. More than half of participants (55.4%) were in a low category of dental caries (DMFT≤2). The characteristics of the study participants are presented in Table 1.

Characteristics	Frequency n (%)
Age	
12 years old	23 (20.2%)
13 years old	89 (78.1%)
Gender	
Male	59 (51.8%)
Female	53 (46.5%)
Nutritional status	
Thinness	7 (6.1%)
Normal	73 (64%)
Overweight	19 (16.7%)
Obese	13 (11.4%)
Dental caries	· · ·
Low (DMFT≤ 2)	62 (55.4%)
High (DMFT>2)	50 (44.6%)

Table 1. Characteristics of study participants.Notes: DMFT= WHO index for dental caries in permanent teethDecayed (D), Missing (M), and Filled (F) teeth (T) due to caries.

total of participants Α 85 (75.9%)experienced dental caries. The mean DMFT score was 2.70 (±2.61) Decayed teeth contributed to the major component of the DMFT score. The prevalence of decayed teeth was 74.1%. The mean score for decayed teeth was 2.39(±2.33). Table 2 presents the dental caries experience of the participants.

Dental Caries Experience	Frequency n (%)	Mean ± SD
Decayed teeth (DT)	83 (74.1%)	2.39±2.33
Missing teeth (MT)	17 (15.2%)	0.29±0.79
Filled teeth (FT)	3 (2.7%)	0.03±0.16
DMFT	85 (75.9%)	2.70±2.61

 Table 2. Dental caries experience.

Notes: DMFT= WHO index for dental caries in permanent teeth (Decayed (D), Missing (M), and Filled (F) teeth (T) due to caries.

The distribution of nutritional status according to age and gender is presented in table 3. Compared to participants aged 13, more

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participants aged 12 were thinness (8.7%), normal (69.6%) and obese (17.4%) than those aged 13; whereas the likelihood of being overweight was much higher among participants aged 13 (20.2%) than those aged 12 (4.3%). However, no statistically significant association was found between age and nutritional status (*P*>0.05).

Variables	Nutritional Status n (%)				Bushus
Valiables	Thinness	Normal	Overweight	Obese	- r-value
Age					
12 years old	2 (8.7%)	16 (69.6%)	1 (4.3%)	4 (17.4%)	0.534
13 years old	5 (5.6%)	57 (64%)	18 (20.2%)	9 (10.1%)	
Gender					
Male	5 (8.5%)	36 (61%)	11 (18.6%)	7 (11.9%)	0.986
Female	2 (3.8%)	37 (69.8%)	8 (15.1%)	6 (11.3%)	

Table 3. Nutritional status according to age and gender.

	Dental Caries n (%)			Mean DMFT	
Variables					
	Low (DMFT ≤ 2)	High (DMFT>2)	P-value	Mean ± SD	<i>P</i> -value
Age					
12 years old	11 (47.8%)	12 (52.2%)	0.420	2.87±2.32	0.424
13 years old	51 (57.3%)	38 (42.7%)		2.66±2.69	
Gender					
Male	34 (57.6%)	25 (42.4%)	0.614	2.56±2.71	0.445
Female	28 (52.8%)	25 (47.2%)		2.87±2.52	
Nutritional status					
Thinness	1 (14.3%)	6 (85.7%)	0.09*	3.71±2.36	0.142
Normal	39 (53.4%)	34 (46.6%)	r _s :-0.25	2.75±2.53	
Overweight	11 (57.9%)	8 (42.1%)		2.89±3.07	
Obese	11 (84.6%)	2 (15.4%)		1.62±2.40	

Table4.DentalcariesandmeanDMFTaccording to age, gender, and nutritional status.Notes: *Significant;DMFT=WHOindex for dental caries inpermanent teeth (Decayed (D), Missing (M), and Filled (F) teeth (T)due to caries)

Concerning gender, male participants had a higher proportion of being thinness (8.5%), overweight (18.6%), and obese (11.9%) than female participants; whereas female participants were more likely to be in the normal category of nutritional status (69.8%) than male participants (61%). However, a statistically significant association was also not observed between gender and nutritional status (*P*>0.05).

Table 4 presents the distribution of the number of dental caries and the mean DMFT score according to age, gender, and nutritional status. More participants aged 12 had a high number of dental caries (DMFT>2) (52.2%) than those aged 13 (42.7%). A high number of dental caries (DMFT>2) was also found among male participants (42.4%) more than female participants (47.2%). A similar pattern was also found with the mean DMFT score, accounting for 2.87(±2.32) and 2.66(±2.69) for participants aged 12 and 13 respectively, and also 2.56(±2.71) and

2.87(±2.52) for male and female participants respectively. However, both age and gender were not significantly associated with the number of dental caries (P>0.05). A significant difference in the mean DMFT score was also not observed concerning both age and gender (P>0.05). Concerning nutritional status, the likelihood of developing a high number of dental caries (DMFT>2) increased with decreasing the BMI score, accounting for 85.7%, 46.6%, 42.1%, and 15.5% for the thinness, normal, overweight and obese category of nutritional status respectively. The association between nutritional status and the number of dental caries was statistically significant, but the strength of the association was weak (rs:-0.25, P:0.09).

In the logistic regression analysis (Table 5), the significant association between the number of dental caries and nutritional status remained, except for obese participants. Compared to thinness participants, the chance of having a low number of dental caries (DMFT \leq 2) was higher among participants in normal category of nutritional status (OR: 36.32, 95%CI: 2.65-497.52, *P*: 0.001) and among overweight participants (OR: 5.04, 95%CI: 1.03-24.75, *P*: 0.046). However, no significant difference in the mean DMFT score was found among the nutritional status groups (*P*>0.05) (Table 4).

Variables	Dental caries			
Valiables	OR [95%CI]	P-value		
Age				
12 years old	(ref)			
13 years old	1.58 [0.58-4.30]	0.37		
Gender				
Male	(ref)			
Female	0.76 [0.34-1.67]	0.49		
Nutritional status				
Thinness	(ref)			
Normal	36.32 [2.65-497.52]	0.001*		
Overweight	5.04 [1.03-24.75]	0.046*		
Obese	4.647 [0.77-28.07]	0.094		

Notes: ref=reference; OR=Odds ratio; CI=Confidence Interval.

Table 5. Logistic regression analysis betweennutritional status and dental caries.

Discussion

This study found that the prevalence of dental caries among young adolescents aged 12 and 13 in Kapasan, Central Surabaya was 75.9% with an average of 2.7 permanent teeth affected by caries. More than half of the participants (55.4%) had a low number of dental caries

(DMFT≤2). The majority of young adolescents aged 12 and 13 in Kapasan, Central Surabaya, Indonesia (64%) were in the normal category of nutritional status, followed by the overweight (16.7%), the obese (11.4%) and the thinness (6.1%) category of nutritional status. This study also found a negative association between nutritional status and the number of dental caries.

The prevalence of dental caries and the mean DMFT score in this study was slightly higher than the prevalence of dental caries (72.9%) and the mean DMFT score (2.51) among 12- and 13-year-old children in Nepal.¹⁷ However, the results of a meta-analysis conducted by Kale, et al. showed that the pooled dental caries prevalence for 12-year-old children in countries in the Southeast Asia Region (SEAR) of the World Health Organization (WHO) was 45%.¹⁸ This dental caries prevalence was considerably much lower than the prevalence of dental caries observed in this study. This is probably because the implementation of the school-based dental program organized by community health centers in Indonesia still poses many challenges. A qualitative study exploring constraints on the performance of school-based dental programs in Indonesia revealed that limited resources, insufficient infrastructure, and lack of financial, acted a major barrier in the provision of schoolprograms.19 dental Furthermore, based adolescents are more likely to receive dental treatment than older people.²⁰

Also, this study supports the findings of a previous study conducted by Bhat et al showing that nutritional status was significantly associated with the number of dental caries.²¹ According to the data from this study, having a low BMI score (thinness) was found to increase the chance of having a DMFT score of more than two (high number of dental caries). This finding corresponds with the result of a previous study conducted by Bhayat et al showing that the risk of developing dental caries increased among 12year-old children who were underweight.22 However, the association between nutritional status and dental caries remains controversial. Not all studies suggested an inverse relationship between nutritional status and dental caries. A study in Lucknow city of India found no significant association between nutritional status and dental caries among adolescents.²³ A systematic review conducted by Hooley et al also revealed three main patterns of the association between

nutritional status and dental caries in children and adolescents:²⁴ (1) no association between nutritional status and dental caries; (2) a positive association between nutritional status and dental caries; and (3) an inverse association between nutritional status and dental caries. This systematic review also revealed that studies supporting an inverse association between nutritional status and dental caries were mostly from developing countries, whereas studies positive association supporting а or no association between nutritional status and dental caries were primarily carried out in more highly developed countries.²⁴

The methodological limitations of this study lie in the nature of the cross-sectional study design, which could not conclude the causal association between nutritional status and dental caries. Prospective longitudinal studies are necessary to examine the causal relationships between nutritional status and dental caries in adolescents. Importantly, the association between nutritional status and dental caries may also be influenced by other variables, which were not included in this study. For this reason, further research is needed to explore the association between nutritional status and dental caries across the full range of potential risk factors. Furthermore, it is important to be mindful when comparing results with other studies, because the difference in collapsing groups across categories of nutritional status and the number of dental caries may not enable comparisons to be made across studies.

The primary strength of this study is that, to the best of our knowledge, this study is the first study investigating the association between nutritional status and dental caries of adolescents aged 12 and 13 in Indonesia, particularly in Surabaya. The contribution of the findings to the current knowledge is by providing new insights about nutritional status among adolescents aged 12 and 13 in Central Surabaya, and how this is related to their dental caries experience. The findings may inform health practitioners and/or policy makers, particularly in Surabaya, in their efforts to improve nutritional status and reduce dental caries among adolescents.

Conclusions

The high prevalence of dental caries and the high mean DMFT score among 12- and 13-

year-old adolescents in this study were alarming. Our result indicated an inverse association between nutritional status and dental caries. Thinness adolescents have a greater likelihood of suffering a high number of dental caries (DMFT>2) than normal, overweight, and obese adolescents. The findings suggest the need for comprehensive intervention programs to improve nutrition and oral health in adolescents.

Declaration of Interest

The authors report no conflict of interest.

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