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RESEARCH ARTICLE

Association between childhood obesity, oral health behavior, and dental caries in Jetis, Yogyakarta

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ABSTRACT

The number of school-age children with overweight and obesity is increasing in developing countries. This is a risk factor for prosperity improvement followed by lifestyle changes. People with obesity are reported to be more susceptible to caries than people who are not, and the average numbers of caries in permanent molars increase on higher BMI. Dental caries is an infectious disease as a result of demineralization in enamel and dentine which has a relationship with behavior. The purpose of this study was to determine the relationship between oral health behavior and dental caries among overweight and obese children in Jetis District, Yogyakarta. This research was an analytical observational study with a cross sectional design. One hundred and ninety-six overweight and obese elementary school children in Jetis District were chosen using multistage cluster random sampling. The independent variable was behavior and the dependent variable was dental caries. Behavior variables were measured using questionnaire based on a Likert scale with validity testing (correlation coefficient > 0.30) and reliability testing (Cronbach alpha = 0.819). The caries was measured using teledentisry during the COVID-19 pandemic. Data analysis used Spearman's correlation analysis. Behavior of maintaining oral and dental health in overweight and obese children had a relationship with caries ($p < 0.001$ and $r = -0.410$). There is no difference between overweight and obese children in maintaining their oral health behavior. The better the oral health behavior of the overweight and obese children, the lower the incidence of caries.

Keywords: behavior; caries; obesity; overweight

INTRODUCTION

The prevalence of obesity has increased in both developed and developing countries due to an increase in affluence followed by changes in lifestyle.[1] Obesity and overweight are not only found in adults but also in children. These may result from consumption of fast food and soft drinks, causing imbalances in the body. Overweight is a condition of excess fat accumulation in the body. However, the condition is more severe in obesity because there is an imbalance between energy intake and energy expenditure. Excessive fat accumulation presents after being used for various biological activities or functions, such as development and growth.[2]

Socioeconomic conditions can affect diet in daily activities. Poor diet patterns can lead to malnutrition as seen in obesity which may increase the prevalence of caries in children. Research found that overweight and obese children can have a higher prevalence of caries in primary and permanent teeth compared to children with normal weight.[3,4]

Dental caries is the most common oral infection in children with multifactorial etiology. Eating habits, microorganisms in the oral cavity that can ferment sugar, and individual susceptibility are factors that contribute to dental caries.[5,6] Elementary school-aged children are vulnerable to oral diseases because in general they have poor oral health behavior. The behavior of neglecting dental health or oral hygiene may be caused by a lack of knowledge on the importance of maintaining oral health as a way to prevent and reduce the risk of caries.

The behavior of maintaining dental hygiene refers to actions taken to clean, refresh, keep the teeth and mouth clean, prevent infection in the oral cavity, and increase body resistance.[7] This behavior is classified as operant behavior which is formed after the individual goes through a learning process.[8] It can be in the form of a child's response to a stimulus that leads to real action or practice.

Although caries often occurs in school children, to the best of our knowledge no recent data have documented overweight or obesity and other factors, such as behavior, that have relations to caries. The aim of this study was to determine the relationship between oral health behavior in overweight and obese children aged 9-12 years and the development of dental caries in Jetis District, Yogyakarta City. These school-aged children were chosen because they already had the ability to react to intellectual stimulation and perform tasks with good cognitive abilities.

MATERIALS AND METHODS

This research is an observational analytical study with a cross sectional design. One hundred and ninety-six respondents (n = 196) of elementary school children with overweight and obesity nutritional status who were obtained from elementary school screening in the work area of the Jetis health center in Yogyakarta are involved. The respondents were selected using multistage cluster random sampling which targeted sample from groups in the population. It started by identifying a district in Yogyakarta City which had a higher number of overweight and obese children, which was Jetis, then schools as a group sample were determined, and finally random sample of students were selected. The inclusion criteria were overweight and obese children aged 9-12 years, and children who attended primary school in Jetis area, Yogyakarta City. The exclusion criteria were having a chronic disease that limited movement and caused difficulties in receiving information, children who were uncooperative, and parents or guardians who disagreed to sign the informed consent form.

The dependent variable in this study was oral health behavior. The independent variable was the incidence of childhood caries using DMFT index for describing caries in children with mixed dentition. Nutritional status in respondents was based on conditions caused by excess fat accumulation in the body and was obtained by calculating height and weight at a certain time and age using the value of body mass index for age. This method has a cut-off value on the graph for the overweight group above +1 Z-score and obesity above +2 Z-score. The cut-off value was determined from respondent's age and body mass index in each gender.

Ethical clearance was obtained from the Health Research Ethics Committee of the Faculty of Dentistry, Universitas Gadjah Mada (project number 0053/KKEP/FKGUGM/EC/2022). The data obtained were analyzed using Spearman's correlation analysis because it was not normally distributed ($p < 0.001$). Oral health behavior was measured using questionnaire based on cognitive, affective, and conative considerations with a Likert scale design with a score of 1-4. The questionnaire includes favorable and unfavorable statements with two indicators: maintenance of dental hygiene and utilization of dental health services. All the scores from the questionnaires were summed and divided into three categories: good, moderate and poor behavior. The questionnaire was tested for validity on 30 children (correlation coefficient ≥ 0.30) and reliability test (α cronbach = 0.819). The caries incidence variable was measured using teledentistry photos and it was conducted during the COVID-19 pandemic. Data from teledentistry were provided by parents as a follow-up after the proper instructions and were measured by a dentist. Score of caries was counted from the sum of the decayed and missing teeth in the permanent and deciduous teeth.

RESULTS

The largest average age of the respondents in this study was 10-year-old children (45.41%), while the smallest was 12 years old (9.18%). Table 1 shows that the majority of respondents were males (60.71%) and females were fewer (39.29%).

Table 1. Characteristics distribution of responden

Characteristics	Count (n)	Frequency (%)
Group age		
9 years old	38	19.39
10 years old	89	45.41
11 years old	51	26.02
12 years old	18	9.18
Gender		
Female	77	39.29
Male	119	60.71
Nutrition status		
Overweight	166	84.69
Obesity	30	15.31
Parent salary		
Above UMR	152	77.55
Below UMR	44	22.45
Total	196	100

UMR = minimum regional wage

Nutritional status was dominated by overweight children at 84.69%. More than three quarters of the respondents stated that their parents' income was above the regional minimum wage for the City of Yogyakarta.

Caries examination as presented in Table 2 showed that caries prevalence was 51.02%.

Table 2. Caries distribution

Characteristics	Count (n)	Frequency (%)
Caries	100	51.02
Non caries	96	48.98
Total	196	100

Table 3. Spearman correlation of behaviour

No	Variabel	R	p value
1.	Behaviour*Caries	-0.259	< 0.001
2.	Pkg*Caries	-0.540	< 0.001
3.	Plk*Caries	-0.376	< 0.001

*significant score p < 0.05; r, correlation coefficient; Pkg= Maintenance of dental hygiene; Plk= Utilization of dental health services

The mean value and standard deviation for the DMFT/dmft score was 1.74 ± 2.07. Our study found that caries rate was higher in male (52.1%) than in female (49.4%). The results of the caries examination showed that the overall caries-free percentage was 48.98%, meaning that more than half of the respondents had cavities.

The assessment of oral health behavior used a questionnaire. The results showed that the majority of the respondents were classified as having moderate behavior with 156 children (79.6%), while 28 children had good behavior

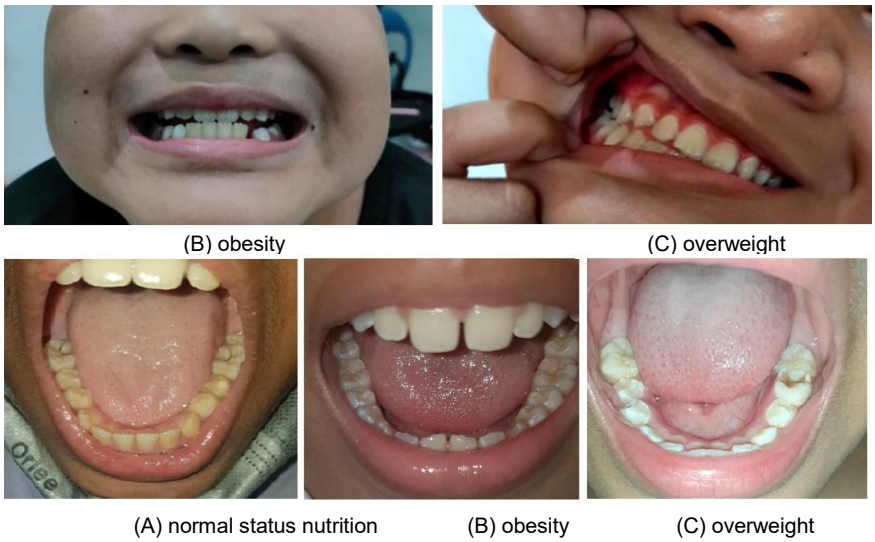

Figure 1. Teledentistry photos of different BMI

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Table 4. The Respon from child-behaviour questionnaire

Point of statements	n (%)			
	SA	A	D	SD
Maintenance of dental hygiene:				
1. Brushing teeth routinely 2 times a day	45.4	39.3	13.3	2
2. The experience of using mouthwash	23.5	38.8	28.6	9.2
3. Usage of fluoride as inggredients in toothpaste	46.9	32.1	13.8	7.1
4. Brushing teeth before breakfast	38.8	31.6	16.8	18.4
5. Frequency of reducing sweet foods	28.6	36.2	28.1	7.1
6. Free techniques when brushing teeth	27	31.1	27	14.9
7. Usage the same brush more than 1 year	19.9	19.9	31.1	29.1
8. Neglecting brush the teeth at night	17.9	33.7	31.6	16.8
9. Choosing to fill cavities rather than letting it be	42.9	32.1	16.3	8.7
Utilization of dental health services:				
10. Went to see dentist every 6 months	11.7	31.1	42.3	14.8
11. Having treatment after the screening	18.4	34.2	28.6	18.9
12. Treatment at dentist when having a toothache	35.2	31.1	28.6	5.1
13. Resident is far from health centre or no accessible health facilities	13.8	29.1	45.9	11.2
14. Refusing to go to the dentist because responden are afraid of dental instruments	24.5	29.1	36.2	10.2
15. The experience of treatment given by non-medic parent or family	27	34.2	24	14.8
16. Having dental treatment until it finished	23	39.8	29.1	8.2
17. Responden often has tootache treatment at home rather than go to dental health centre	19.9	32.7	37.2	10.2

¶ n (%) = number of respondents; SA, strongly agree; A, agree; D, disagree; SD, strongly disagree

(14.3%), and only 12 children (6.1%) had poor behavior.

The correlation analysis test showed that oral health behavior had a relationship with the DMF-T/def-t score (Table 3). The coefficient correlation value between behavior and DMF-T/def-t was -0.259 which was weak, negative correlation. This indicates that the lower the oral health behavior, the higher the DMF-T/def-t score.

The results of Spearman's correlation analysis test for each domain in the study showed that of the two indicators of assessment on the oral health behavior, maintenance of dental hygiene had a greater association with DMF-T/def-t value and fairly strong correlation. Mann Whitney test was also conducted and the significance value as 0.84 ($p > 0.05$) was shown in both. Overweight and obesity did not have different pattern in oral health behavior.

Table 4 shows the results of the questionnaire on dental hygiene maintenance. The majority of respondents strongly agreed with the statements of brushing their teeth routinely, treating caries with dental fillings, and using toothpaste with fluoride. The majority of respondents agreed on the use of mouthwash and the frequency of reducing sweet foods. However, only 35.2% of the respondents strongly agreed on brushing their teeth after breakfast, 33.7% forgot to brush their teeth before going to bed, and 31.1% used free techniques when brushing teeth.

In terms of the use of health care services, the results showed unexpected responses: routine visits to the dentist every 6 months (42.3%), most children having treatment at home (37.2%), refusing to go to the dentist because they were afraid of dental instruments (36.2%), and fewer visits to the dentist because health facilities were not accessible (45.9%). Most respondents strongly agreed on seeing a dentist when they had toothache. They agreed on having a dental treatment after screening at school and continuing the treatment until it was complete. Most children also agreed on the statement that family provided home treatment when they had a toothache rather than seeing a dentist.

DISCUSSION

Caries can occur if causal factors, such as substrate, microorganisms, time, tooth condition, and saliva, are mutually supportive. Other factors such as behavior are thought to have a relationship to the incidence of caries. Prevalence of caries in children with overweight and obesity in this study was 51.02%, which means that the total number of children who had cavities was almost equal to the number of children who were free of caries. The first permanent molars in overweight and obese children showed that many had caries, especially if the DMF-T caries index was more than 2. The mean value and standard deviation for caries was 1.74 ± 2.07, meaning that each respondent in the study had 1-2 teeth with low-severity caries. Obese people are prone to caries and have higher DMF-T due to the increase in BMI, which is closely related to excessive consumption of cariogenic foods. Differences can occur because children with obesity have high levels of leptin protein that can interfere with the attachment of bacteria like sp. Mutans.[9,10]

Correlation analysis in this study showed that oral health behavior had a relationship with the caries score. The behavior in each category of nutritional status was evaluated for further testing. Overweight children's behaviors could affect the DMF-T/def- score with a fairly strong correlation value. The obese group was also tested and showed the same results. Analysis to compare oral and dental health behavior in both groups at more than 0.05 significance level found that the pattern of oral health behavior between overweight and obese children was not different. The nutritional status of the respondents in this study did not affect the pattern of oral health behavior. Both overweight and obese children had high prevalence of caries if they had poor behaviors.

Dental and oral health behavior can be influenced by knowledge. Individuals who have sufficient knowledge about how lifestyle can affect health will have strong reasons to change their unhealthy behavior. The same behavior between overweight and obese children in this study may occur because their level of knowledge is almost uniform. According to social cognitive theory, it is not only knowledge that can shape individual or group's behavior, but also social influence.[11] Knowledge and social influence from the environment will interact and cause changes in action. As a result, it has an impact on self-efficacy and personal cognition to perform a behavior.

The percentage of respondents who had moderate dental health behavior was 79.6%. The results of this study showed that many overweight and obese children had poor oral health behavior. Oral and dental health behavior had a close relationship with caries score. Children with poor oral health behavior had a higher caries score than children with moderate dental health behavior. Protection against caries was shown by the majority of children who agreed on the use of mouthwash and brushing their teeth twice a day using toothpaste containing fluoride. Fluoride can increase the durability of enamel in the remineralization process, has bactericidal properties and can reduce the ability of bacteria to produce acid.[12]

It has been proven that children who brush their teeth properly have a lower caries index.[13] The results of the questionnaire on brushing time showed that many respondents strongly agreed to brush their teeth before breakfast and go to school. This may make the oral cavity less clean

after being exposed to food or drinks containing carbohydrates for a certain duration at school. Consequently, dental caries and bacteria may develop and initiate demineralization. The majority of respondents also agreed that they forgot to brush their teeth before going to bed. Dental caries rates by gender in this study showed that boys exhibited higher prevalence rates than girls. Gender can affect teeth brushing behavior where boys do it less at night.[14]

Poor dental hygiene at bedtime is seriously detrimental to children because it can lower the pH, which will initiate caries. Salivary rate in obese children can be different from children with normal nutritional status. The average flow rate of stimulated whole saliva in obese children is lower than that in children who have normal weight.[15] The flow rate can be reduced during sleep because most of the saliva produced is unstimulated saliva and because of the BMI status. A decrease in the amount of saliva may indicate a high risk of caries because saliva has a function to moist the teeth which affects the environment such as the pH in the oral cavity, increases the integrity of the teeth, and is present in tooth remineralization. Low salivary flow rate in obese children is due to the accumulation of adipose in parotid gland which causes the ducts and acini in the salivary gland parenchym to enlarge, thus reducing salivary flow rate.[16]

The method and technique of teeth brushing could affect which parts of the teeth were at risk for caries. Many respondents in this study agreed that they used free techniques when brushing their teeth. The majority of the respondents did not use the proper techniques of toothbrushing as recommended by experts. The use of modified Stillman or Roll and Bass techniques in toothbrushing can maximize the results of cleaning the dental area. Research on obese people found that the use of less dental cleaning products may result in decreased oral hygiene. However, this study did not find any similarity with this finding because the majority of the respondents were in agreement about the questionnaire statement regarding the use of mouthwash.[17]

People with severe obesity can have low physical activity and have different muscle endurance when carrying out activities for a certain period of time. The size of the upper and lower arms of obese people can limit position for placing the brush.[18] The results of this study found that the overweight and obese children had a thicker mucobuccal area than children with normal nutritional status because there was a buildup of fatty tissue on the parotid gland area. This would potentially block access to the posterior teeth when these children clean their teeth and could increase the risk of caries. Untreated tooth decay due to caries may cause infection, damage the tissue around the teeth, cause a focus of infection in other organs of the body, and reduce the quality of life.

CONCLUSION

The better the oral health behavior, the lower the incidence of caries in overweight and obese children aged 9-12 years in Jetis District, Yogyakarta City.

CONFLICT OF INTEREST

The authors declare no conflict of interest with the data contained in the manuscript.

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