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Correlation between Milk Chocolate Consumption Habit and Chronotype with Gingivitis in Children with Mixed Tooth Period

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A B S T R A C T

Children in the mixed dentition period are prone to oral health problems. This can be caused by the frequent consumption of milk chocolate and the child's chronotype being the night type. This study aims to determine the relationship between milk chocolate consumption habits and chronotype with gingivitis in children with mixed dentition. The study used a survey method with a cross-sectional approach. The population of this study were Madrasah Ibtidaiyah (MI) students in the Situbondo district aged 6-12 years with 100 students from 9 MI subjects. Determination of schools using multistage random sampling and selecting subjects using proportional random sampling. The questionnaires used were the Children Chronotype and Semi-Quantitative Food Frequency Questionnaire. Gingival index examination is performed by a dentist. Data analysis used the Pearson statistical test at a significant level a= 0.05. The results showed that 49% of children had a moderate gingival index and 5.8% had a severe gingival index. As many as 23% of children often consume milk chocolate and 13% of children are included in the evening chronotype category. Statistical test results showed a positive correlation between milk chocolate consumption habits and gingivitis (p-value 0.021) and a positive relationship between chronotype and gingivitis (p-value 0.015). In conclusion, there is a correlation between milk chocolate consumption habits and gingivitis and there is a relationship between chronotype and gingivitis in mixed dentition children

Kata kunci:

Periode gigi bercampur
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A B S T R A K

Anak yang memasuki periode gigi bercampur rentan mengalami masalah kesehatan rongga mulut. Hal ini dapat disebabkan karena seringnya konsumsi cokelat susu dan beralihnya kronotipe anak menjadi tipe malam. Penelitian ini bertujuan untuk mengetahui keterkaitan antara kebiasaan konsumsi cokelat susu dan kronotipe dengan gingivitis pada anak periode gigi bercampur. Penelitian menggunakan metode survei dengan pendekatan cross sectional. Populasi penelitian ini adalah siswa Madrasah Ibtidaiyah (MI) di kabupaten Situbondo yang berusia 6-12 tahun dengan subjek sebanyak 100 siswa dari 9 MI. Penentuan sekolah menggunakan multistage random sampling dan pemilihan subjek menggunakan proportional random sampling. Kuesioner yang digunakan adalah Children Chronotype Questionare dan Semi Quantitative Food Frequency Questionare. Pemeriksaan indeks gingiva dilakukan oleh dokter gigi. Analisis data menggunakan uji statistik Pearson pada taraf signifikan α = 0,05. Hasil penelitian menunjukan bahwa 49% anak memiliki indeks gingiva sedang dan 5,8% parah. Sebanyak 23% anak sering mengkonsumsi cokelat susu dan sebanyak 13% anak termasuk kategori kronotipe malam. Hasil uji

statistik menunjukkan bahwa ada korelasi positif antara kebiasaan konsumsi cokelat susu dengan gingivitis (p-value 0,021) dan ada hubungan positif kronotipe dengan gingivitis (p-value 0,015). Kesimpulannya terdapat korelasi antara kebiasaan konsumsi cokelat susu dengan gingivitis dan ada hubungan antara kronotipe dengan gingivitis pada anak periode gigi bercamp

INTRODUCTION

Children aged 6–12 years experience the mixed dentition period, which is the period when the permanent teeth begin to erupt to replace the fallen primary teeth (Bakar, 2012). This is a period that is vulnerable to dental and oral health problems (Ilyas and Putri, 2012). Oral health can affect the health of other organs because it is an integral part of general health (Endang, 2012). One oral health problem that often occurs in elementary school children is gingivitis (Zefanya et al., 2021). Gingivitis is an inflammation of the gum edges accompanied by red to bluish features, edema, and bleeding easily (Andriani et al., 2014).

The 2018 Riskesdas data states that the prevalence of oral health problems in Indonesia based on the characteristics of swollen gingiva is 14.0%, and the prevalence of gingiva that bleeds easily is 13.9%. Meanwhile, the prevalence of dental and oral problems in Indonesia in 2013 was 25.9% and increased to 45.3% in 2018. In 2013, the prevalence of dental and oral problems was 28.9% in the 5-9 year age group and 25.2% in the 10- to 14-year age group.This number increased in 2018, in the 5–9 year age group, to 54% and in the 10–14 year age group, to 41.4% (Riskesdas, 2018).

One of the factors that affect the oral health of children in the mixed dentition period is the tendency for children to consume only the foods they like, such as cariogenic snacks, namely foods that contain carbohydrates, are sticky, and break easily (Mohammad, 2015). The mouth is an ideal place for the development of bacteria due to the sufficient temperature, humidity, and food available in the oral cavity. These bacteria can affect the health of the teeth and oral cavity (Sirat et al., 2017).

One of the cariogenic foods that children like is chocolate because it tastes sweet and delicious (Febrian et al., 2013). The effect of chocolate consumption on oral health is due to the sucrose content, which is a medium and substrate for bacterial growth because it can increase the process of dental caries and affect the health of the oral cavity (Riani, 2011). One of the most frequently consumed types of chocolate is milk chocolate (Larsson et al., 2016). Milk chocolate is solid chocolate made with milk in the form of powder, liquid, or sweetened condensed milk. Milk chocolate differs from other types of chocolate primarily through its milk solids and milk fat content. Milk chocolate contains not less than 25% cocoa solids, 2.5% non-fat cocoa solids, and 12% milk solids (BPOM, 2017).

In addition to food as the main factor that can affect oral health, there is also behaviour as an indirect factor (Saidah and Ismawati, 2014). One of the indirect behaviours related to dental and oral cavity disease is sleeping late. Sleeping late at night triggers an increase in appetite due to changes in leptin and ghrelin hormone levels, which are influenced by sleep duration, so that children tend to consume high-glucose foods at night, which if done repeatedly will trigger dental and oral health problems (Alqaderi et al., 2020).

Differences in a person's behaviour regarding sleep time are called chronotypes (Adan et al., 2012). These differences are classified into morning, evening, and intermediate chronotypes. In principle, the morning chronotype sleeps earlier and wakes up earlier, while the evening chronotype sleeps later and wakes up later, while the intermediate type falls between the two (Carvalho et al., 2014). Night chronotype usually occurs in adolescents and adults, but it can also occur in children about to enter their teens (Haraden et al., 2017). Exposure to electric light from gadgets commonly used daily by children can make them chronotype at night (Merikanto and Partonen, 2014). As a result, this study aimed to investigate the relationship between milk chocolate consumption habits and chronotype with gingivitis in children with mixed dentition.

METHODS

This research is an analytic observational study with a cross-sectional design that was carried out in January 2022. This study's population consisted of students from the Islamic Elementary School (MI) in Situbondo Regency.The researchers' preliminary study showed that the prevalence of students suffering from dental and oral cavity problems in Madrasah Ibtidaiyah was higher (59.3%) than that of elementary school students (46.5%). The number of subjects in this study was counted at 100 using the OpenEpi program. Subject criteria in this study were children aged 6–12 who were not using fixed orthodontic appliances and had not had their teeth examined in the last six months.

The sampling technique for determining MI in this study used the cluster random sampling technique. The number of MI studied was 50% of the total MI in each sub-district. MI selection is determined randomly using the Microsoft Excel application. This research was conducted in nine MI out of a total of 19 MI in the Banyuputih, Arjasa, Jangkar, and Asembagus Situbondo districts. The selected madrasahs were MI Muhammadiyah, MI Nahdlatul Ulama, MI Al-Ikhlas, MI Miftahun Najah, MI Al Falah, MI 2 Situbondo, MI Sunan Bonang, MI Darurrahmah Pillow, and MI Makarimal Akhlaq Situbondo Regency. The distribution of the proportion of subjects per madrasah used a proportional random sampling technique. The selection of subjects in each school used simple random sampling.

Data collection techniques included filling out questionnaires and interviewing respondents and their parents, collecting data on characteristics, chronotypes, and consumption habits of milk chocolate, and observing the gingival index examination conducted by dentists. The questionnaires used were the Children's Chronotype Questionnaire and the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ).

Children's chronotype categories are differentiated based on the total score of the Children Chronotype Questionnaire. Children are included in the morning type if the total score is the middle type if the score is 24-32, and the evening type if the total score is 33 (Werner et al., 2009).

Data on milk chocolate consumption habits in this study are based on consumption habits over the last 6 months.The frequency of consumption of milk chocolate was obtained by using the SQ-FFQ, which was previously conducted by a focus group discussion (FGD) to obtain a list of milk chocolate consumers. The milk chocolate studied in this study was bar milk chocolate. Milk chocolate consumption is categorised as rare if the frequency of consumption is 1-3 servings per month, moderate if consumption is 1-2 servings per week, and frequent if consumption is 3-4 servings per week. One serving of milk chocolate is equivalent to 30 grammes (Larsson et al., 2016).

A gingival index examination is performed by a dentist. Gingival index measurements were grouped into four gingival assessments, namely mesial, distal, labial/buccal, and lingual/palatal (Panagakos and Davies, 2011). The gingival index was determined by calculating the score for each tooth. The score for each tooth is obtained by adding up the scores of the four sides examined, then dividing by the number of sides examined (four). Then perform the calculation of the gingival index with the following formula:

$$\text{Dental Index} = \frac{\Sigma \text{score of all examined teeth}}{\Sigma \text{tested teeth}}$$

Children are classified as having mild gingivitis if the gingival index is 0.1-1, moderate gingivitis if the score is 1.1-2, and severe gingivitis if the score is 2.-3 (Jeffrey et al., 2011).

Data on chronotype, milk chocolate consumption habits, and gingival index were processed using SPSS software version 23. Data normality was tested using the Kolmogorov-Smirnov test and then analysed using Pearson. If the p-value is less than 0.05, the data is significant.

This research has received ethical approval from the Health Research Ethics Commission (KEPK) of Sebelas Maret University No:107/UN27.06.6.1/KEP/EC/2021.

RESULTS AND DISCUSSION

Table 1. Characteristics of Research Subjects

Variable		N	%
Age			
	6	4	4%
	7	12	12%
	8	12	12%
	9	11	11%
	10	20	20%
	11	22	22%
	12	19	19%
Gender			
	Male	43	43%
	Female	57	57%
The Habits of Milk Chocolater Consuption			
	Never	10	10%
	Rerely	33	33%
	Moderate	34	34%
	Often	23	23%
Chronotype			
	Morning	52	52%
	Moderate	35	35%
	Night	13	13%
Gingival Index			
	Mild	45	45%
	Moderate	49	49%
	Severe	6	6%

Table 2. Correlation between The Habits of Milk Chocolate Consumption and Gingivitis in Mixed Teeth Period Children

Variable		Gingival Index						P-Value	R-Value
		Mild	%	Moderate	%	Severe	%		
Milk Chocolate	Never	8	8%	2	2%	0	0%	0,021	0.230
	Rarely	20	20%	13	13%	0	0%		
	Moderate	7	7%	27	27%	0	0%		
	Often	10	10%	7	7%	6	6%		

Table 3. Correlation between Chronotype and Gingivitis in Mixed Teeth Period Children

Variable		Gingival Index						P-Value	R-Value
		Mild	%	Moderate	%	Severe	%		
Chronotype	Morning	26	26	25	25	1	1	0,015	0,243
	Moderate	14	14	20	20	1	1		
	Night	5	5	4	4	4	4		

Table 1 showed the characteristics of the respondents according to age, sex, consumption habits of milk chocolate, chronotype and gingival index. The results showed that most of the respondents were 10 years old (20%) and at least 6 years old (4%). Most of the respondents are women (57%). The majority of respondents had moderate milk chocolate consumption habits (34%), the majority of respondents belonged to the morning chronotype category (52%), and the majority of respondents had moderate gingival index (49%)

Correlation between The Habits of Milk Chocolate Consumption and Gingivitis in Mixed Teeth Period Children

Table 2 showed that there is a relationship between milk chocolate consumption habits and the gingival index (p-value 0.021), but the correlation level is weak (R-value 0.230). The results showed that most respondents who frequently consumed milk chocolate had a mild gingival index (10%) and the majority of respondents whose habit of consuming milk chocolate never had a mild gingival index (8%).

Table 3 showed that there is a relationship between chronotype and gingival index (p-value 0.15), but the level of correlation is weak (R-value 0.243). The results showed that the majority of respondents with the morning chronotype category had a mild gingival index (26%) and the majority of respondents who belonged to the evening chronotype had a mild gingival index (5%).

DISCUSSIONS

Correlation between Milk Chocolate Consumption Habit and Gingivitis in children with mixed teeth period

The results showed that the habit of consuming milk chocolate was associated with gingivitis (p-value 0.021). These results are in line with the research of Decker and Loveren (2015), which stated that consumption of chocolate can affect the health of the oral cavity because it is sticky and contains a lot of fermentable sugar. Research by Folayan et al. (2021) also states that there is a significant correlation between consumption patterns of cariogenic foods and the incidence of gingivitis. The results of Rehena's research (2020) state that there is a relationship between the type and amount of cariogenic food consumed and the incidence of dental caries in children. The impact of dental caries can lead to gingivitis (Hasturk and Katarci, 2015). Caries is a risk factor for gingivitis because it functions as a plaque retention factor through several pathways (Jepsen et al., 2017). This is in line with Sriani's research (2019), which states that there is a relationship between dental plaque and the occurrence of gingivitis.

The cariogenicity of chocolate depends on its composition, texture, solubility, shelf life, and ability to stimulate salivary flow. Riani (2011) states that the effect of chocolate consumption on dental caries is more on the sucrose content, which can be a medium and substrate for bacterial growth, so that it can increase the process of dental caries. Milk chocolate contains sucrose from the sugar particles and lactose from milk, making it a fermentable carbohydrate. Sucrose is known to have the highest cariogenic properties compared to other simple sugars such as glucose, lactose, and fructose because it tends to be more efficient at fostering the growth of acidogenic microorganisms (Ramayanti and Purnakarya, 2013). The rest of the food settles and ferments into acids, causing plaque to form on the teeth (Winahyu et al., 2019).

Milk chocolate melts easily in the mouth (Jumriah et al., 2019). Kidd and Bechal's (2012) study stated that cariogenic foods that settle for more than 30 minutes on the teeth will accelerate tooth decay due to their acidic nature. A study by Janani et al. (2019) states that consumption of milk chocolate can lower salivary pH. The normal limit for the degree of acidity of saliva ranges from 6.7–7.2; if the degree of acidity of saliva is 5.5 or reaches a critical pH, it will facilitate the growth of acidogenic bacteria such as Streptococcus mutans and Lactobacillus. These bacteria are present in the plaque attached to the teeth and metabolise cariogenic food scraps, especially those from fermentable carbohydrates such as sucrose (Putri et al., 2019). Decreased salivary pH (acidic) and a lower amount of saliva indicate a high risk of caries, thereby increasing the risk of gingivitis (Mardiati and Prasto, 2017).

Pressure Correlation between Chronotype and Gingivitis in children with mixed teeth period

The results of this study indicate that chronotype is associated with gingivitis (p-value 0.015). This result is in line with the study of Kurnaz and Kandeger (2020), which stated that the night chronotype is more at risk for the severity of periodontal disease. Findings from Alqaderi et al.'s (2016) longitudinal cohort study showed that short sleep duration and high salivary glucose levels are associated with increased gingival inflammation in children. Children with an evening chronotype tend to have more difficulty falling asleep than morning types (Jafar et al., 2017). Children with a nocturnal chronotype more often experience sleep disturbances, causing a lack of sleep duration (Schroeder and Gurenlian, 2019).

Research by Huynh et al. (2014) states that insufficient sleep duration causes oral health problems. The National Sleep Foundation (2019) recommends 9 to 11 hours of sleep for school-age children.Night chronotype can occur in children who are about to become teenagers, although it usually begins to be experienced by someone as a teenager (Haraden et al., 2017). The shift in children's chronotypes from morning to night is due to exposure to light from electronic items such as gadgets and television, which are used every day by children (Merikanto and Partonen, 2014).

Although there is a correlation between chronotype and gingivitis, the correlation is low (R-value 0.243). The low correlation is due to the fact that chronotype is an indirect factor and many other factors influence the occurrence of gingivitis, such as eating behaviour and dental hygiene behaviour (De Vries, 2015). However, chronotype may correlate with gingivitis indirectly through nocturnal feeding behavior. The evening chronotype is associated with changes in eating behaviour such as poor dietary control, high total calories, consumption of larger portions, and food intake late at night (Lucassen et al., 2013; Arora and Taheri, 2014; Mota et al., 2017).

Sleeping late at night triggers an increase in appetite due to changes in leptin and ghrelin hormone levels, which are influenced by sleep duration, so that children tend to consume high-glucose foods at night, which, if done repeatedly, will trigger caries on the teeth so that they are at risk of experiencing gingivitis (Alqaderi et al., 2020). Marfuah's research (2015) states that sleep duration (2-4 hours a day) can reduce leptin levels by 18% and increase ghrelin by 28%, resulting in an increase in appetite of 22–34%. Short sleep duration can increase children's chances of overeating, especially if at night they do inactive activities such as playing gadgets or watching television, which are usually done while snacking. The sediment from these snacks will form plaque on the teeth, which causes gingivitis because during sleep at night the volume of saliva tends to decrease, which causes the mouth to become dry so that it cannot carry out the process of cleaning food debris naturally (Rasni et al., 2020).

CONCLUSIONS AND SUGGESTION

In conclusion, the higher the milk chocolate consumption frequency, the more severe the child's gingival index during the mixed dentition period. There is a relationship between chronotype and gingivitis. Further research is needed regarding the amount and type of food children consume with evening chronotype at night before bed.

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