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RESEARCH ARTICLES

The cariogenic effect of school snack on risk levels with caries assessment tool study in children age 12-15 years old

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ABSTRACT

The teen years, around the age of 12-14 years, is the time for children to experience physical growth spurt, which increases their appetite, so they love snacks and develop snack eating habit at school. This study aims to determine the cariogenic effect of school snacks on caries risk based on the caries assessment tool (CAT) study in children aged 12-15 years. This is an observational quantitative study with cross-sectional research design. The population in this study were all students of class VII, aged 12-15 years in SMP Negeri (SMPN) Kulon Progo, comprised of 2,047 students. This study used a cluster proportional random sampling technique and obtained a sample size of 100 respondents. Data were collected using a questionnaire about school snacks and observation of caries risk assessment was based on CAT, and the data were analyzed using the Chi-Square test. The results showed that the cariogenic school snacks consumed by children aged 12-15 years in SMPN Kulon Progo were in the low category (71%); risk of caries occurrence based on CAT studies in children aged 12-15 years was in the high category of 50%. There was no significant effect on cariogenic school snacks on the level of caries risk based on CAT study in children aged 12-15 years.

Keywords: cariogenic effect; school snack; caries risk; caries assessment tool

INTRODUCTION

Dental caries is a multifactorial disease caused by several factors, including teeth, saliva, cariogenic bacteria, food, and time.[1] The cariogenic snack is categorized into 3 categories: high, moderate, and low. Snacks with a high cariogenic level contain carbohydrates with a solid and sticky physical form, containing carbohydrates in a liquid physical form. Snacks with moderate cariogenicity contain dry and wet fried carbohydrates, while snacks with low cariogenicity levels contain protein and oil that can stimulate saliva.[2] Some examples of cariogenic snacks that are often consumed by school children are candy, chocolate, donuts, jam-filled cake, layer cake, *dodol,* and cotton candy.

One of the efforts to prevent caries is to recognize the potential size of caries. Every child has a high risk of caries, and thus it is necessary to assess the incidence of caries risk from an early age.[3] The American Academy of Pediatric Dentistry (AAPD) issues a caries assessment tool (CAT) to assist dentists in making decisions about treatment based on caries risk and patient adherence to both children and adults.[4] Caries risk assessment using CAT provides an accurate and useful assessment in clinical terms.[5] It is proven that CAT can identify children who need early prevention and treatment to reduce the occurrence of early caries.[6]

Kulon Progo is a district located in the Special Region of Yogyakarta (DIY) with an area of 58,627,512 km^2. Of the total population of 2,072,245 people, 33,041 are residents aged 10-14 years old. *Dinas Kesehatan Kulon Progo* has implemented a dental and mouth health program through *Usaha Kesehatan Gigi dan Mulut Sekolah* (UKGS) in the *Puskesmas* (Public Clinic), but UKGS activities at the Junior High School (SMP) level have not been running regularly.[7] This study aims to determine the cariogenic effect of school snacks on caries risk based on the caries

assessment tool study in children aged 12-15 years.

MATERIALS AND METHODS

This is a quantitative observational study with a cross-sectional design. The research was conducted to find out the relationship between the variable affecting the level of cariogenic school snacks and the variable affected by the risk of caries, which was measured only once at the same time. Ethical approval of the research (ethical clearance) was obtained from the Faculty of Dentistry, Universitas Gadjah Mada. Informed consent was obtained based on the consent of the parents or guardians of the subjects. Researchers provided written explanations about the course of research to teachers and students. The parents signed the informed consent if they allow their children to participate in the study as subjects.

Research on the influence of the cariogenic school snacks on the risk of caries based on the Caries Assessment Tool (CAT) study in 95 children aged 12-14 years in Kabupaten Kulon Progo including *Kecamatan* (district) Galuh, Lendah, Panjatan, Wates and Temon, was conducted from December 2019 to January 2020. This study used a proportional cluster random sampling technique, which was carried out in two stages. Samples were selected using a clustering process as a way to classify subjects with the same characteristics into the same group and subjects with different characteristics to another group.

Caries risk assessment observations based on the CAT study made by the AAPD were carried out using indicators and sub-indicators, including social, biological, protective, and clinical indicators. The compilation of data is presented in tabular form as a result of a descriptive study. All variables studied were described using the average value and the percentage of the observations. The frequency distribution of each variable is to determine the characteristics of the respondents, to see the level of cariogenic school snacks, and the risk of caries using the CAT.

RESULTS

The study was conducted by measuring the level of cariogenic school snacks eaten by subjects at each break, either the first or second, and was examined for 5 days. The distribution of the level based on age and sex is shown in Table 1. Table 1 shows that the majority of respondents (71 subjects with 30% male and 41% female) consumed school snacks with a low cariogenicity. Meanwhile, 29 other respondents consumed school snacks with moderate cariogenicity, 20% of whom were female and 9% were male.

This study also measured the level of risk for caries in each subject using Caries Assessment Tools (CAT) by considering social, biological, protective indicators and clinical conditions of the subject's teeth. Table 2 shows the highest risk level for caries incidence, 20 subjects aged 13 years old were female.

Table 3 shows that out of 100 study subjects, none of whom had high-risk category of caries. A total of 50 subjects had a high-risk caries level, 18% of whom were caries-free and 16% had only 1 to 2 cavities. Most of the subjects (40 subjects) had DMF-T in the very low category, where 16% of whom had a high-risk caries level. This study was conducted to examine the effect of cariogenic school snacks on the risk level for dental caries. The cross-tabulation between the cariogenic school snacks and the risk of caries incidence is shown in Table 4.

Table 4 presents that there are no subjects with a high cariogenicity level. 71% of subjects consumed snacks with a low cariogenic level, and 34% of whom had a high risk of caries incidence. Of 29% of subjects who consumed snacks with moderate cariogenity, 16% of whom had a high risk of caries incidence.

The independent variable in this study is the cariogenic level of school snacks as measured by adding up the scores on the types of snacks consumed by the subject for 5 days according to the Papas table. The scale used is the interval.

The dependent variable of this study is the risk of caries based on the Caries Assessment

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Table 1. Distribution of subjects based on cariogenic level of school snacks, age, and sex

School snack cariogenic level	Age (years-old)															
	12 y.o				13 y.o				14 y.o				Total			
	M		F		M		F		M		F		M		F	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Low 1 - 3	9	(9)	12	(12)	15	(15)	25	(25)	6	(6)	4	(4)	30	(30)	41	(41)
Moderate 4 – 5	5	(5)	6	(6)	3	(3)	12	(12)	1	(1)	2	(2)	8	(8)	21	(21)
Total	14	(14)	18	(18)	18	(18)	37	(37)	7	(7)	6	(6)	38	(39)	62	(62)

Table 2. Distribution of subjects based on the level of risk of caries incidence, age and sex

Age	Sex	Caries Risk Level (CAT)							
		Low		Moderate		High		Total	
		n	(%)	n	(%)	n	(%)	n	(%)
12 y.o	Male	2	(2)	3	(3)	9	(9)	14	(14)
	Female	4	(4)	5	(5)	9	(9)	18	(18)
13 y.o	Male	7	(7)	4	(4)	7	(7)	18	(18)
	Female	5	(5)	12	(12)	20	(20)	37	(37)
14 y.o	Male	0	(0)	4	(4)	2	(2)	6	(6)
	Female	0	(0)	4	(4)	3	(3)	7	(7)
Total		18	(18)	23	(23)	50	(50)	100	(100)

Table 3. Subject distribution based on caries risk level (CAT) and DMF-T

DMFT	Caries risk level						Total	
	Low		Moderate		High			
	n	(%)	n	(%)	n	(%)	n	(%)
Caries free 0	7	7.0)	10	(10.0)	18	(18.0)	35	(35.0)
Very low 0.1-1.1	10	(10.0)	14	(14.0)	16	(16.0)	40	(40.0)
Low 1.2 – 2.6	0	(.0)	8	(8.0)	14	(14.0)	22	(22.0)
Moderate 2.7-4.4	1	(1.0)	0	(.0)	2	(2.0)	3	(3.0)
Total	18	(18.0)	32	(32.0)	50	(50.0)	100	(100.0)

Table 4. Distribution of subjects based on the cariogenic school snacks and the level of risk for dental caries

			Risk of caries (Y)			Total
			Low	Moderate	High	
Cariogenic level of school snacks (X)	Low	Count	12	25	34	71
		% of Total	12.0%	25.0%	34.0%	71.0%
	Moderate	Count	6	7	16	29
		% of Total	6.0%	7.0%	16.0%	29.0%
Total		Count	18	32	50	100
		% of Total	18.0%	32.0%	50.0%	100.0%

Table 5. Chi-square test results

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.172a	2	.557
Likelihood ratio	1.208	2	.547
Linear-by-Linear association	.043	1	.835
N of valid cases	100		

Tools (CAT) study with an ordinal variable scale. Therefore, the statistical analysis used in this study is Chi-square.

The table above clearly depicts that the Asym Sig value is > 0.05, so it can be concluded that there is no cariogenic effect of school snacks on the risk of caries based on the Caries Assessment Tools (CAT) study in children aged 12-14 years.

DISCUSSION

Each school has a canteen to cater the daily consumption need for all students. School snacks have an important role in meeting the energy needs of students because of the high physical activity they do at school. Besides, school snacks play a positive role in increasing children's appetites. However, school snacks also have a negative role in oral health, since the majority of foods in the school canteen tend to contain carbohydrates, which cause plaque accumulation for bacterial fermentation, leading to dental cariogenicity.[8]

The results showed that 71 students (71%) of the cariogenic level of school snack at SMPN Kulon Progo were in the low category. Cariogenicity is a food ingredient characteristic that can accelerate the acidification process (dental caries). Hence, someone consuming snacks with high cariogenicity will have a risk of experiencing dental caries faster than someone who consumes snacks with low cariogenicity.

The study showed that there were 29 students (29%) who consumed snacks with moderate cariogenicity. This indicates that some snacks in the school area still contain cariogenic properties (causing caries), and thus it is necessary to monitor the snacks that are often consumed by children to prevent from the rise of the cariogenic level of the snacks consumed. Besides, schools need to apply the habit of brushing teeth or rinsing their mouths after eating by providing a special facility to increase the cultivation of the habit of maintaining students' teeth and mouth.[9]

The results of this study demonstrate that some of the cariogenic levels of school snacks are in a low category. Several factors can cause low cariogenicity because subjects usually consume snacks as a substitute for breakfast such as *nasi kucing* (rice), tea, milk, *batagor*, *mendoan*, which are foods containing water, fat/oil, protein, and dietary fiber. The food containing oil is generally in the form of a liquid that is easier to clean compared to foods a solid and sticky physical form.[8] Liquid foods must be maintained compared to solid foods.

Dental caries is a disease that often occurs in children, indicated by the damage to the hard tissue of the teeth as characterized by tissue damage, starting from the surface of the tooth (pits, fissures, and interproximal areas) extending to the pulp. The results showed that 50 students (50%) aged 12-14 years at SMPN Kulon Progo are susceptible to a high risk of caries.

The factors causing the level of risk of caries in students involved a combination of factors including diet, fluoride exposure, susceptible hosts, and microflora which influence each other with various social, cultural, and behavioral factors (AAPD, 2014). Thus, the results of this study indicate that the subject who are caries-free (18%, Table 4) can have a high risk because they are influenced by snacking habits and family socio-economic conditions and salivary rate (high risk),[4] while children who have direct caries signs have a high-risk category.

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Bacteria are a major risk factor contributing to caries with a mean percentage of 21.1% and diet is a risk factor for both causes of caries with a mean percentage of 18.1%.[10] The presence of bacteria indicates that students only brush their teeth on the occlusal surface of the teeth, while diet is related to the frequency of eating per 24 hours. Increasing the frequency of eating is associated with an increase in dental caries, especially since foods that contain sugar easily adhere to the teeth. This study only measured school snacks, so it did not reflect the frequency of eating. Reducing the frequency of meals is more important than reducing the total amount of carbohydrates consumed.

The study also showed that 18 subjects (18%) aged 12-14 years had a low risk of developing caries. Most of the subjects had already brushed their teeth with fluoridated tooth paste. The students were accustomed to using toothpaste with fluorine content and some subjects were accustomed to rinse their mouth with an aantiseptic, which sufficiently prove the reason why they had the low level of caries risk. The low risk of cariogenicity is also influenced by gender. This study revealed that there are 62 female students (62%). At the age of 12 to 14 years, a female student will start to pay attention to her hygiene because it is related to her appearance, so that she has a better tooth brushing habit than male students who tend to be indifferent to their appearance. This fact was reinforced by Alhamda (2011), where from the 352 subjects examined, 121 female students (34.37%) aged 12 years and above have the habit of brushing their teeth according to the recommended time, namely morning and night before bed. Meanwhile, only 21.58% of male students did it, while the remaining 29.82% brushed their teeth in the morning only.

Even so, the role of the school, especially parents, is still needed to ensure that students maintain their dental hygiene or brush their teeth properly and correctly as a way to optimally prevent them from fluor.[11] The relationship between cariogenic feeding patterns and the occurrence of dental caries is related to the formation of plaque on the tooth surface.[12] The repeated and too frequent consumption of cariogenic snacks causes the production of acid by bacteria to occur more frequently, thus increasing the acidity of the oral cavity and dissolving the enamel.[12]

The results of this study indicate that there is no significant cariogenic effect on of school snacks with the risk of caries occurrence in children aged 12-15 years at SMPN Kulon Progo. In line with this, Rosdiana (2015) also stated that there is no effect between consumption of cariogenic foods on a person's dental caries status.[13] This is supported by the cross-tabulation results, which show that most respondents who consume snacks with low cariogenicity have a high risk of caries incidence of 34%.[14] This can happen when the students' oral health conditions are neglected. This means that constant consumption of snacks that do not cause dental caries will certainly have an impact on the occurrence of dental caries if students overlook their oral health. On the other hand, despite the consumption of snacks with high cariogenicity, students are less likely to experience dental caries if they are able to maintain standard and proper care for dental health.[15]

In line with this fact, Rosdiana's (2015) research shows that there are 10% of respondents who consumed foods with high cariogenicity (sweet foods and drinks> 3 times a day) but have very low caries status because respondents regularly brush their teeth with the correct technique and at the correct time, which thus lowers the risk of caries occurrence even though the food they consume belongs to the category of cariogenic food with a frequency of more than 3 times a day.[13]

Middle school children are likely to consume cariogenic snacks, especially sweet foods, which are sticky and easily adhere to the tooth surface. Thus, parents need to play a role in guiding and knowing what causes oral and dental disease. The school, especially teachers, also have an important role in paying attention to the types of snacks sold in the school canteen. There needs to be a visit by dental health workers to schools to provide counseling so that high school children gain knowledge about cariogenic foods and how to maintain oral health to avoid dental and the oral diseases.[12]

CONCLUSION

In conclusion, the cariogenic school snacks consumed by children aged 12-14 years at SMPN Kulon Progo is in a low category (71%). The risk of caries based on CAT study in children aged 12-14 years is in the high category (50%). There was no significant effect on the cariogenity of school snacks on the level of risk.

REFERENCES

1. Kidd EAM, Bechal SJ. Dasar-dasar penyakit karies dan penanggulangannya, Cetakan 2. Jakarta: EGC; 2006.
2. Papas AS, Palmer CA, Rounds MC, Herman J, McGandy RB, Hartz SC, Russel RM, DePaola P. Longitudinal relationship between nutrition and health. Ann N Y Acad Sci. 1989; 561: 124-142. doi: 10.1111/j.1749-6632.1989.tb20976.x
3. Angela A. Pencegahan primer pada anak yang berisiko karies tinggi (primary prevention in children with high caries risk). Dental Journal (Majalah Kedokteran Gigi). 2005; 38(3): 130–134. doi: 10.20473/j.djmkg.v38.i3.p130-134
4. American Academy of Pediatric Dentistry. Guideline on caries-risk assessment and management of infants, children, and adolescents. Clinical Practice Guidelines. 2014; 37(6): 132-138.
5. Richard WP, Cameron AC. Handbook of Pediatric Dentistry. Mosby Elsevier Science; 2003.
6. Yoon RK, Smaldone AM, Edelstein BL. Early childhood caries screening tools: a comparison of four approaches. J Am Dent Assoc. 2012; 143(7): 756-763. doi: 10.14219/jada.archive.2012.0263
7. Badan Pusat Statistik Kabupaten Kulon Progo. Jumlah Sarana Kesehatan menurut Kecamatan dan Jenis Sarana Kesehatan di Kabupaten Kulon Progo, 2017. Kulon Progo: Badan Pusat Statistik; 2019.
8. Sroda R. Nutrition for a healthy mouth. India: Wolters Kluwer Health/Lippincot Williams & Wilkins; 2010.
9. Alhamda S. Status kebersihan gigi dan mulut dengan status karies gigi (kajian pada murid kelompok umur 12 tahun di Sekolah Dasar Negeri Kota Bukit Tinggi). Berita Kedokteran Masyarakat. 2011; 27(2): 108-115.
10. Wardani PK, Supartinah A, Soeprihati IT, Rantinah SBS. Faktor risiko terjadinya karies baru dengan pendekatan kariogram pada pasien anak di klinik kedokteran gigi anak RGMP Prof Soedomo Yogyakarta. Majalah Kedokteran Gigi Indonesia. 2012; 19(2): 107-109. doi: 10.22146/majkedgiind.12700
11. Sundari P, Suwargiani AA, Wardani R. Perbedaan risiko karies pada anak usia 11 – 12 Tahun di SDN Sirnagalih dan SDN Cibeusi Kecamatan Jatinangor. Padjadjaran J Dent Res Student. 2018; 2(1): 23-30. doi: 10.24198/pjdrs.v3i1.21432
12. Sirat NM, Senjaya AA, Wirata IN. Hubungan pola jajan kariogenik dengan karies pada siswa sekolah dasar di wilayah kerja Puskesmas III Denpasar Selatan, Bali 2016. Intisari Sains Medis. 2017; 8(3): 193-197.
13. Rosdiana WD. Pengaruh frekuensi konsumsi makanan kariogenik dan status gizi terhadap status karies siswa SD Negeri Ngadirejo I Usia 7-8 tahun, Kecamatan Kartasura, Kabupaten Sukoharjo. Universitas Muhammadiyah Surakarta: Skripsi; 2015.
14. Thibodeau EA, O'Sullivan DM, Tinanoff N. Mutans streptococci and caries prevalence in preschool children. Community Dent Oral Epidemiol 1993; 21(5): 288-291. doi: 10.1111/j.1600-0528.1993.tb00776.x
15. Ly KA, Milgrom P, Rothen M. Xylitol, sweeteners, and dental caries. Pediatr Dent 2006; 28(2): 154-163.