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Influence of Teeth Brushing Behavior, Saliva Flow Rate, Salivary Hydration, Saliva Viscosity and Saliva PH on Risk of Caries Occurrence in Adolescents in Gianyar, Bali, Indonesia

(Research conducted at SMAN 1Ubud-Gianyar District Bali)

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Abstract

Background: Objective: The purpose of this study was to determine the effect of brushing behavior, salivary flow rate, salivary hydration, salivary viscosity and saliva pH on the risk of caries occurrence in adolescents at SMAN 1Ubud Gianyar. Method: This research is cross sectional study, with 235 samples selected by purposive random sampling. All samples were measured DMF-T, salivary flow rate and salivary hydration, followed by saliva collection 2 hours after eating last meal during the day for analysis of viscosity and salivary pH, followed by an assessment of tooth brushing skill with the guidance of tooth brushing rubric. The collected data were analyzed by chi-square statistic test. Result: there was a significant correlation between tooth brushing behavior with caries incidence rate with $p = 0.00$ ($P \leq 0.05$), whereas flow rate, hydration, viscosity and salivary pH did not significantly affect caries incidence rate with $p \geq 0.05$. Conclusion: Tooth brushing behavior significantly affects caries incidence rate when compared with physical and chemical properties of saliva.

Keywords: tooth brushing behavior, saliva, caries, adolescent

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Introduction

Dental caries occurs due to the interaction of the four factors of the host (teeth and saliva), microorganisms, substrate and time duration, which is the length of the interaction process between these factors.[1] The process of caries occurrence begins with the fermentation of substrates containing carbohydrates by bacteria in plaque on tooth surfaces that can lower plaque pH below 5 within 1-3 minutes. The decrease in plaque pH of plaque will lead to demineralization on the surface of the enamel. The process of neutralization by saliva can increase salivary pH, and the process of remineralization takes place. Caries results from a larger demineralization process than remineralization.[2] According to Rosenberg (2010), caries ranks second after the common cold.[3] The caries experience varies considerably between countries, depending on behavioral factors, age, socio-economic circumstances and the pattern of life and diet of the community.[4] Caries prevalence in developing countries tends to increase with increasing consumption of foods that contain lots of sticky processed sugar and inadequate coverage of dental services. Basic Health Research Results of (RISKESDAS) 2013 showed that there was an increase in dental caries prevalence from 2007 to 2013, and the highest increase at age 12 years was 13.7%. The prevalence of active caries in children aged 12 years reaches 43.4%.[5] Adolescence is a period of transition

from childhood to adulthood and in the process, there is development of physical, psychological and social maturity. According to Hurlock (2001), in general, adolescence is divided into three parts: the beginning of adolescence lasts from the age of 12-15 years, middle adolescence lasts from the age of 15-18 years and the end of adolescence begins from 18-21 years which is legal mature age. Adolescence is characterized by biological, cognitive and socio-emotional changes that influence self-care behaviors including keeping the teeth and mouth clean.[6]

According to Notoatmodjo (2012), behavior is an activity or activity of a highly complex organism, among others: behavior in speaking, dressing, walking, perception, thought and emotion. Brushing behavior is one of the important and effective health behaviors for the maintenance of oral and dental health and prevents plaque buildup in teeth[7]. According to Sihite (2011), tooth brushing behavior is influenced by several factors: brushing, brushing, brushing time and tools and ingredients to brush teeth.[8] Notomatodjo in Sihite (2011), explains that the risk of caries and periodontal disease in society, one of which is the behavioral factor that is the attitude of neglecting tooth and mouth hygiene.[8] Saliva is also one of the factors that contribute to caries risk. Saliva is a secretory secretion of various glands in the oral cavity and plays an important role in maintaining balance in the oral cavity. Adequate salivary function, important in defense against caries attacks.[9] Saliva contains certain organic and inorganic materials which, if excessive or decreased, can cause salivary imbalances. Saliva function is as a lubricant, buffer, cleanser, anti-solvent and anti-bacterial. Chemical composition, flow rate, viscosity, salivary hydration, acid-base properties (pH) and antibacterial properties of saliva are associated with the risk of caries occurrence in a person.[10] Caries risk is a person's chances of having a carious lesion over a period of time. The risk of caries differs from person to person, and may even vary in the same individual, depending on how to maintain oral hygiene and the salivary buffer function.[11,12] Assessment of caries risk in a person is necessary because caries can affect anyone regardless of age, gender, race or socioeconomic level. Caries can affect children, adolescents, adults and geriatrics. Information on caries risk assessment can be used as a strategy in planning the precautions.[13] High school students belong to adolescence which is in late adolescence, susceptible to dental caries because at this time biological, cognitive and socioemotional changes that affect self-care behaviors include maintaining oral hygiene.[14] The average age of high school students ranging from 15-19 years is the right age to measure the salivary flow rate.[15]

Materials and Method

This research is cross sectional with survey design. The sample size is 235 students, selected by purposive random sampling. Intraoral examination was conducted first to measure DMF-T respondents and observed salivary flow rate and salivary hydration. The salivary collection was performed 2 hours after the last meal and conducted on the afternoon, conducting a salivary analysis including: salivary viscosity and salivary pH concluded with an assessment of tooth brushing skill with guidelines for tooth brushing rubric. The collected data were then analyzed using bivariate analysis to find out the correlation between caries risk factor and caries incidence with chi-square statistic test. Results The results of analysis of tooth brushing time with caries experience score (DMF-T) can be seen in table 1 below:

Table 1: The relation between Teeth Brushing Time with Experience of Caries (DMF-T) at Student of SMAN 1 Ubud Gianyar Regency 2017

Tooth Brushing time	Caries experience / DMF-T						Total	%
	High	%	Medium	%	Low	%		
Correct	2	2.13	6	6.383	86	91.5	94	100
Wrong	50	35.5	61	43.26	30	21.3	141	100
Total	52	22.1	67	28.51	116	49.4	235	100

The table above shows that 91.5% of respondents who brushed their teeth at the correct time has a low DMF-T score. While 35.5% of respondents who brush their teeth at the wrong time have high DMF-T numbers. The result of analysis with chi-square obtained value P = 0,00 (<0.05) or there is significant correlation between tooth brushing time with caries experience.

The results of the relationship analysis of tooth brushing techniques with caries experience (DMF-T) are seen in Table 2 below:

Table 2: The Relationship between Tooth Brushing Technique with Experience of Caries (DMF-T) at Student of SMAN 1 Ubud Gianyar Regency 2017

Tooth Brushing Technique	Caries experience / DMF-T						Total	%
	High	%	Medium	%	Low	%		
Correct	3	9.09	3	9.09	27	81.8	33	100
Wrong	49	24.3	64	31.68	89	44.1	202	100
Total	52	22.1	67	28.51	116	49.4	235	100

Table 2 above shows that of 235 respondents were examined, 33 people (14.04%) brushed their teeth with the correct technique and out of these, 81.8% had low caries category. Other 202 people (95.96%), brushing teeth with the wrong technique and from that amount, 49 people (24.3%) experienced caries with high category. The result of analysis with chi-square obtained value P = 0,00 (<from 0.05) or there is significant relation between tooth brushing technique with caries experience.

The effect of salivary flow rate on DMF-T is shown in table 3 below:

Table 3: Effect of Saliva Flow Rate on Caries Experience (DMF-T) at Student of SMAN 1 Ubud, Gianyar Regency 2017

Saliva flow rate	Caries experience / DMF-T						Total	%
	High	%	Medium	%	Low	%		
Low	0	0	1	33.33	2	66.7	1	100
Normal	4	30.8	5	38.46	4	30.8	13	100
High	48	21.9	61	27.85	110	50.2	219	100
Total	52	22.2	67	28.51	116	49.4	235	100

Table 3 above shows that 219 samples (93.19%) have high salivary flow rates but have a high caries experience rate as well, compared with those with low salivary flow rates. The result of analysis with chisquare obtained p-value = 0.602 (p> 0.05), which means there is no significant relationship between saliva flow rate with DMF-T number.

The effect of salivary hydration on DMF-T is shown in table 4 below:

Table 4: Effect of Saliva Hydration on Caries Experience (DMF-T) at students of SMAN 1 Ubud Gianyar Regency 2017

Saliva hydration	Caries experience / DMF-T						Total	%
	High	%	Medium	%	Low	%		
Low	3	15	6	30	11	55	20	100
Normal	22	25	27	30.68	39	44.3	88	100
High	27	21.3	34	26.77	66	52	127	100
Total	52	22.1	67	28.51	116	49.4	235	100

Table 4 shows that most respondents had high salivary hydration. From 127 respondents who have high hydration there are 27 respondents or 21.3% who have high caries. The chi-square test showed no significant relationship with p = 0.757 (p> 0.05) or no significant effect of salivary hydration with caries experience.

The result of saliva viscosity analysis on dental caries / DMF-T incidence is seen in table 5 below:

Table 5: Effect of Saliva Viscosity on Caries Experience (DMF-T) in students of SMAN 1 Ubud Gianyar Regency 2017

Saliva Viscosity	Caries experience / DMF-T						Total	%
	High	%	Medium	%	Low	%		
Very thick	9	25.7	8	22.86	18	51.4	35	100
Thick	40	23	51	29.31	83	47.7	174	100
Clear	3	11.5	8	30.77	15	57.7	26	100
Total	52	22.1	67	28.51	116	49.4	235	100

Table 5 above shows that most of the respondents (74.04%) had viscosity saliva with thick category, but 47.7% of these had low caries experience. Results of chi-square analysis showed no significant relationship between salivary viscosity with caries experience with p = 0.757 (p> 0.05).

Saliva pH analysis result on dental caries incidence (DMF-T)is seen in table 6 below:

Tabel 6: Effect of Saliva PH on Caries Experience (DMF-T) at SMAN 1 Ubud Students Gianyar Regency 2017

Saliva pH	Caries experience / DMF-T						Total	%
	High	%	Normal	%	Low	%		
Acidic	11	21.6	16	31.37	24	47.1	51	100

Normal	31	21.5	38	26.39	75	52.2	144	100
Alkaline	10	25	13	32.5	17	42.5	40	100
Total	52	22.1	67	28.51	116	49.4	235	100

Table 6 above shows that most respondents had normal and alkaline pH saliva. Of the 51 respondents (21.70%) who had an acidic pH only 11 people (21.6%) and had high caries. The result of statistical analysis with chi-square showed that there was no significant relationship between salivary pH and caries experience with p = 0.839 (p> 0.05).

Discussion

The results showed that there is a significant correlation between tooth brushing behavior and DMF-T number in adolescent at SMA Negeri 1 Ubud with p = 0.00 (p <0.05), so tooth brushing behavior was a risk factor for caries occurrence. Brushing behavior is one of the most effective health behaviors for the maintenance of oral health because it prevents plaque buildup in teeth. Brushing teeth skillfully at the right time can prevent caries (Sihite, 2011). According to Princess, et al. (2010), tooth brushing is the act of cleaning the teeth and mouth of food scraps and debris that aims to prevent the occurrence of disease in the network hard and soft on the mouth.[16] The results also showed that salivary flow rate, salivary hydration, salivary viscosity and salivary pH did not significantly affect the risk of caries occurrence in adolescents. Most students have a high salivary flow rate but have a high DMF-T number as well. Salivary hydration in most students is high but has a high DMF-T number as well. The saliva viscosity of most students is relatively thick, but has a low DMF-T. The saliva pH of most students is normal and has a low DMF-T number as well. Saliva flow rate shows how much saliva is continuously secreted to protect and coat the oral cavity. Salivary flow rate at rest is 0.3 ml / min[17]. Zunt (2010), wrote that the average saliva flow of a normal person is 0.5-1.5 liters/day.[18] When salivary flow is stimulated below 0.7ml / min, it can increase a person's caries risk, but it also depends on other interacting factors.[19] Salivary viscosity is the viscous viscosity that is closely related to the glycoprotein composition. If salivary viscosity is increased, it indicates that saliva in the saliva decreases, so saliva becomes thick, and the individual is at high risk for periodontal tissue disease.[20] A person is said to be at high caries risk if it has a low salivary flow. Salivary deficiency can cause dry mouth, thus increasing the risk of caries occurrence. Multiple salivary secretions, dilute viscosity and normal salivary pH will facilitate control of dental and mouth disease.[13] Saliva is not the only factor that contributes to the caries incidence rate, as other factors contribute to the risk of caries. The risk of caries is a person's chances of having multiple carious lesions over a period in the future. The risk of caries in each person is different, not even permanent for life in the same person. Caries risk may change if the patient performs a caries prevention action either by himself or the dentist.[11]

Conclusion

Tooth Brushing behavior is significantly associated with caries experience in adolescents at SMA Negeri 1 Ubud, but Saliva flow rate, salivary hydration, salivary viscosity and salivary pH are not significantly related to caries experience in students, so it can be concluded that behaving correctly in tooth brushing will prevent caries.

Conflict of Interest : None

Ethical Clearance: Obtained from the University Committee and Respondent agreement

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