



is because dental and oral health can cause more serious complications due to bacterial proliferation. Dental and oral health must be promoted to the community, especially to the risk group through preventive and promotive efforts by instilling personal oral hygiene and five level of prevention, such as one specific protection and early diagnosis with regular dental examination every 6 months [1,2]. Maintenance of oral health can prevent throat cancer, oral infections and injuries, gum disease, tooth decay, tooth loss and other diseases. Maintaining the dental and oral health will help avoid diseases that limit one's ability to bite, speak, chew food, smile, as well as one's psychosocial well-being [4]. Efforts to prevent disease due to poor oral health by personal hygiene that is good for dental and oral hygiene include brushing teeth every day after breakfast and before going to bed, avoiding or reducing cariogenic foods such as sweets, chocolate, and sweet foods that will result in the formation of tooth cavities, in addition to conducting periodic examinations to dentists as preventive dental caries [8]

Dental caries is a chronic regressive process that begins with the dissolution of enamel minerals as a result of disruption of the balance between enamel and its surroundings caused by the formation of microbial acid from the substrate resulting in destruction of organic components which eventually leads cavities [9]. The epidemiology of dental caries includes the agent, host and environment. Dental caries agents are microorganisms caused by dental plaque. Plaque is a soft layer consisting of a collection of microorganisms that multiply on a matrix that form and adhere tightly to the surface of a tooth that cannot be cleaned. Hosts of this disease are human of all age groups, but those with the highest risk are mostly children of both pre-school and elementary school age. The important organs that play an important role in caries formation are teeth and saliva. The environment of dental caries is largely influenced by behavioral factors which are risk factors for dental caries such as the habit of brushing teeth after breakfast and before bed, frequency of brushing teeth, habit of conducting dental check-up every 6 months, cariogenic food consumption habit, use of mouthwash, and use of drinking water containing flouride. Based on a preliminary study of health risk factors that cause dental caries in elementary school children in one of the elementary schools in Singaparna Subdistrict, SD N Cikadongdong, it showed that 10% of elementary school students did not brush their teeth after breakfast and before going to bed; 44% consumed cariogenic foods; and 98% did not have regular dental check-ups every 6 months.

## II. MATERIAL AND METHOD

The study was observational analytical study using cross-sectional design. The population was all elementary school students in Singaparna Subdistrict, Tasikmalaya

Regency 2019. The sample was selected from Class IV-VI elementary school students based on inclusion criteria by stratified random sampling. The sample of this study was from 24 elementary schools in Singaparna District with 281 respondents. The study was conducted in February 2019 in 24 elementary schools in Singaparna Sub-district. The instrument used in this study was questionnaire. Data analyses used were univariate, bivariate and multivariate analyses.

## III. RESULT

TABLE I. UNIVARIATE ANALYSIS

Variable	F	%
Age		
9 years old	16	5.7
10 years old	88	31.3
11 years old	96	34.2
12 years old	74	26.3
13 years old	7	2.5
Sex		
Male	114	40.6
Female	167	59.4
Class		
Class IV	93	33.1
Class V	91	32.4
Class VI	97	34.5
Consumption of Cariogenic foods		
Yes	116	41.3
No	165	58.7
Tooth-Brushing Habit After Breakfast and Before Sleeping		
Yes	121	43.1
No	160	56.9
Tooth-Brushing Habit for Twice a Day		
Yes	271	96.4
No	10	3.6
Dental Examination Every 6 Months		
Yes	116	41.3
No	165	58.7
Total	281	100.0

In this study, the characteristics of respondents were based on their age, consisting of 9, 10, 11, 12 and 13-year-old respondents. The majority of the respondents were 11 years old with as many as 96 children (34.2%); female respondents had the highest proportion with as many as 167 children (59.4%); most respondents were from class VI with as many as 97 children (34.5%); more children did not consume cariogenic food with as many as 165 children (58.7%); the majority of the respondents did not brush their teeth after breakfast and before bed with as many as 160 children (56.9%); most of the respondents has the habit of brushing their teeth twice a day with as many as 271 children (96.4 %); and most of them did not check their teeth every 6 months with as many as 165 children (58.7%).

TABLE II. BIVARIATE ANALYSIS

Variable	Dental Caries		No Dental Caries		RR	95% CI	P-Value
	n	%	n	%			
<b>1. Age</b>							
< 11 years	62	41.06	42	32.31	1.18	0.95-1.47	0.129
≥ 11 years	89	58.94	88	67.69			
<b>2. Sex</b>							
Male	56	37.09	58	44.62	0.864	0.867-1.085	0.200
Female	95	62.91	72	55.38			
<b>3. Consumption of Cariogenic foods</b>							
Yes	62	41.06	54	41.54	0.991	0.795-1.236	0.935
No	89	58.94	76	58.46			
<b>4. Tooth-Brushing Habit After Breakfast and Before Sleeping</b>							
No	99	65.56	61	46.92	1.496	1.164-1.922	0.002*
Yes	52	34.44	69	53.08			
<b>5. Tooth-Brushing Habit for Twice a Day</b>							
No	9	5.96	1	0.77	4.76	0.738-30.687	0.043*
Yes	142	94.04	129	99.23			
<b>6. Dental Examination Every 6 Months</b>							
No	145	96.03	120	92.31	0.685	0.361-1.302	0.180
Yes	6	3.97	10	7.69			

TABLE III. MULTIVARIATE ANALYSIS MODEL 1

Variable	$\beta$	S.E.	Exp ( $\beta$ )	95% CI	P
Age	0.100	0.098	1.105	0.912-1.339	0.308
Sex	-0.389	0.258	0.678	0.409-1.125	0.133
Tooth-Brushing Habit for Twice a Day	-2.002	1.069	0.135	0.017-1.098	0.061
Tooth-Brushing Habit After Breakfast and Before Sleeping	-0.753	0.256	0.471	0.285-0.777	0.003*
Dental Examination Every 6 Months	-0.286	0.550	0.751	0.256-2.208	0.603

-2 Log likelihood=368.713

Overall Percentage= 61.6

TABLE IV. MULTIVARIATE ANALYSIS MODEL 2

Variable	$\beta$	S.E.	Exp ( $\beta$ )	95% CI	P
<b>Sex</b>	-0.446	0.254	0.640	0.389-1.052	0.079
<b>Tooth-Brushing Habit for Twice a Day</b>	-1.997	1.069	0.136	0.017-1.102	0.062
<b>Tooth-Brushing Habit After Breakfast and Before Sleeping</b>	-0.742	0.250	0.476	0.292-0.778	0.003*

-2 Log likelihood= 370.138

Overall Percentage= 59.4

*A. Relationship between Age with Dental Caries*

The results of the bivariate analysis showed a Relative Risk (RR) of 1.18 with 95% CI of 0.912-1.333 and p value = 0.129. meaning it was not statistically significant, whereas RR> 1 meaning that age is a risk factor for dental caries. The p value of <0.25 was obtained. Therefore, the age variable was included in the multivariate analysis model 1 which showed that Exp ( $\beta$ ) = 0.100 with 95% CI = 0.912-1.333 and p = 0.308, because the value of p> 0.25 was not included in model 2. According to the results of the analysis, age has no relationship with the incidence of dental caries. Age does not affect dental caries because it depends on a person's preventive pattern of dental caries. Dental caries can threaten everyone, even though increasing age can

correlate with dental caries but if someone does not make preventive efforts with dental caries, he/ she will be at risk of developing dental caries. This study is in line with Khotimah, et al. (2013) in a cross-sectional study in Semarang showing that there was no relationship between age and the incidence of dental caries in children at SD N Karangayu 03 Semarang with p = 0.053 [10]. The age group of elementary school children, aged 6-12 years, had received some information from the learning process, both at school and outside of school, and experience because at that age there is a rapid development of fine and rough motor skills. This is included in the procedures for dental care and efforts to prevent toothache by routinely brushing

teeth and brushing teeth properly so that they can avoid dental caries [5].

#### *B. Relationship between Gender with Dental Caries*

The results of bivariate analysis showed that Relative Risk (RR) was 0.864 with 95% CI of 0.867-1.085 and p value = 0.200, meaning that it was not statistically significant, RR <1 which was a protective factor. The p value of <0.25 was obtained. Therefore, the age variable was included in the multivariate analysis model 1 which showed the Exp ( $\beta$ ) = 0.678 with 95% CI = 0.409-1.125 and with p value = 0.133. And then, it was included in model 2 analysis which showed the Exp value ( $\beta$ ) = 0.640 with 95% CI = 0.389-1.052 and with p = 0.079. The multivariate analysis showed no relationship between sex and dental caries. This is in line with Sari's research (2013) in a cross-sectional study at Ciputat Elementary School 6 Tangerang, which stated that there was no relationship between sex and dental caries (p = 0.483) [12]. It is also in line with the study of Lee, et al. (2015) in a prospective cohort survival analysis of risk factors for dental caries in children over 5 years in Korea, stating that there was no significant relationship between sex with the incidence of dental caries in children [13]. However, it is in contrast with the study of Hu, et al. (2018) in a cross-sectional study in China that there was a relationship between sex and dental caries in children [11]. Gender factors are not related to dental caries because, based on interviews with elementary school children, both male and female children had been exposed to knowledge of how to care for their teeth and mouth from school teachers and parents at home. In theory, there are differences in women and men where women are more at risk of developing dental caries than men. This theory was proven in this study where most of those who experienced caries were female and there were 1 female respondent with dental caries and tooth impingement and bleeding. It is because the anatomy in women allows a faster teeth eruption and oral cavity is associated with the etiology of dental caries, such as teeth, saliva, microorganisms and time [14,15]

#### *C. Relationship between Cariogenic food consumption with Dental Caries*

The results of bivariate analysis showed a Relative Risk (RR) of 0.991 with 95% CI of 0.795-1.236 and a value of p = 0.935, meaning that it was not statistically significant, while the RR value <1, meaning that consumption of cariogenic foods was a protective factor of dental caries. With a p value of > 0.25, it was therefore not included in the multivariate analysis. Based on interviews in this study, 41.3% of elementary school students consumed cariogenic foods, such as cotton candy, banana chocolate ice, candy, chocolate and so on. If the habit is not accompanied by brushing their teeth, theoretically food scraps will be stuck in their teeth, causing the proliferation of dental caries microorganisms. According to Budisuari et al., 2010, many cariogenic foods contain sucrose which is the etiology of dental caries. Tooth plaque build-up is formed if cariogenic food is consumed for 30-60 minutes, which can trigger the caries agent *Streptococcus mutans*. These bacteria change foods containing sugar into acid resulting in decreased pH of the oral cavity (below 5.5) causing decalcification effects of calcium salt, resulting in the tooth enamel thinning. This

study showed no relationship between the consumption of cariogenic food and dental caries due to the exclusion of other factors that may cause dental caries in this study, for example the flour content in drinking water consumed by elementary school students and the use of mouthwash in elementary school students that could affect the statistical analysis [16]. In line with the study of Nuryati, et al. (2018) in a cross-sectional study at SD N Pakualam, Banjar District, there was no relationship between consumption of cariogenic foods and dental caries (p = 0.632) [17]. This study is also in line with Pitriyanti, et al. (2016) in a cross-sectional study in elementary schools in Nusa Penida Health Center's Working Area, where the consumption of cariogenic foods was not associated with dental caries (OR = 1.2, p = 1,000) [18]. Dental caries is caused by the consumption of cariogenic foods such as candy, chocolate, bread, ice cream and milk which can easily stick to the teeth. These foods are made from flour which contains carbohydrates and sugar. If these foods are consumed frequently, they will have an impact on PH in the mouth and will result in dental caries [19]. Cariogenic food is a trigger for dental caries supported by a factor of agents, namely microorganism and time because it contains fermented carbohydrates [20]. Classification of carbohydrates found in cariogenic foods is complex carbohydrates and simple carbohydrates. Complex carbohydrates are divided into two monosaccharide bonds, called polysaccharides found in starch, dextrin, glycogen and non-starch polysaccharides. Meanwhile, simple carbohydrates consist of one or two saccharide molecular bonds, monosaccharides and disaccharides, for example sucrose and lactose. Foods containing sucrose are the cause of dental caries because sucrose is the most cariogenic type of sugar compared to others. In sucrose, the synthesis of extra polysaccharides of sucrose cells is faster than glucose, fructose and lactose. Sucrose is also faster in triggering the growth of dental caries agent microorganisms than other carbohydrates [21]. According to Sukanti (2018) in a cross-sectional study at SDN 06 Gadut Regency, the behavior of elementary school students who had habitual consumption of cariogenic foods at school and did not clean their mouth by rinsing it caused food to stick to their teeth and they had an oral hygiene index (OHI-S) with moderate and poor criteria since food sticking to their teeth had an impact on the proliferation of bacteria and the emergence of dental plaque which were the cause of disease in the teeth and mouth, one of which was dental caries [22]. Preventive efforts in dental caries include reducing consumption of cariogenic foods, consuming low-sugar foods, increasing the intake of fibrous foods such as vegetables and fruits that have a function in cleaning the mouth and stimulating salivary secretions. Saliva has functions in cleaning food scraps, washing teeth, protecting teeth. and oral cavity from viruses and bacteria, especially dental caries agents [23].

#### *D. The relationship between the habit of brushing teeth after breakfast and before going to bed with Dental Caries*

The results of bivariate analysis showed that Relative Risk (RR) was 1,496 with 95% CI of 1,164-1,1922 and the value of p = 0,002, meaning that it was statistically significant (p <0,05), while the RR value > 1, meaning that the habit of

brushing teeth after breakfast and before bedtime was a risk factor. The value of  $p < 0.05$  and  $p < 0.25$  mean that the variable of habit of brushing teeth after breakfast and before bed was included in the multivariate analysis model 1 which showed  $\text{Exp}(\beta) = 0.471$  with 95% CI = 0.285-0.7777 and  $p$  value = 0.003, and was also included in the model 2 analysis which showed  $\text{Exp}(\beta) = 0.476$  with 95% CI = 0.292-0.7778 and  $p = 0.003$ . Multivariate analysis showed that the habit of brushing teeth after breakfast and before bedtime was a dominant risk factor in dental caries with Log like2 value of 370, and overall percentage of 59.4, meaning that the ability to predict the incidence of dental caries in elementary school children that was 59.4 % and 40.4% were caused by other factors. This is because good personal hygiene in dental and oral health in elementary school children can reduce dental caries agents, namely *S. mutans* in the oral cavity. In line with research by Cheng, et al. (2014) in epidemiological survey research with a prospective stratified purposive sampling technique in 12 elementary schools in Xiulin Township Taiwan, there was a relationship between the habit of brushing teeth after breakfast, before dinner, after 3 minutes of eating sweet and meat and dental caries [24]. The habit of brushing your teeth properly will reduce *S. mutans* agent caries infection. The habit of brushing teeth regularly is a preventative effort in dental caries because it can reduce the proliferation of bacteria, such as *S. Mutans* dental caries agent, remove food waste, prevent the formation of plaque, prevent dental and oral diseases, such as gum disease, and prevent halitosis by selecting a soft toothbrush for children and teach them how to brush their teeth properly.

*E. The relationship between the habit of brushing your teeth twice a day with Dental Caries*

The results of bivariate analysis showed a Relative Risk (RR) of 4.76 with 95% CI of 0.738-30.6687 with a  $p$  value = 0.043, meaning that it was statistically significant ( $p < 0.05$ ), while the RR value  $> 1$ , meaning that the variable habit of brushing 2 times a day was a risk factor for dental caries. The values of  $p < 0.05$  and  $p < 0.25$  were obtained. Therefore, the variable habit of brushing teeth twice a day was included in the multivariate analysis model 1 which showed  $\text{Exp}(\beta) = 0.135$ , with 95% CI = 0.0017-1.098 and  $p$  value = 0.061. And then, the variable was included model 2 analysis which showed  $\text{Exp}(\beta) = 0.136$  with 95% CI = 0.017-1.102 and  $p = 0.062$ , meaning that it was not significant or not related to dental caries. This is because elementary school students, in brushing their teeth with a frequency of 2 times a day, were not controlled and monitored by parents on the time and how to brush their teeth properly. This study is not in line with Retnaningsih, et al. (2018), where there is a relationship between the habit of frequently brushing teeth and the correct way and dental caries. It is because brushing teeth can clean teeth from food substrate, plaque, caries-causing agent, *S. mutans* and other bacteria and reduce the discomfort of unpleasant smells [25]. This study is in line with Bebe, et al. (2018) where the practice of brushing teeth is not related to dental caries due to the respondent's statement about the incorrect way of brushing their teeth but the results of Odds Ratio calculation are the risk factors for dental caries ( $\text{OR} > 1$ ) [26]

*F. The relationship between dental examination every 6 months with Dental Caries*

The results of bivariate analysis showed that Relative Risk (RR) was 0.685 with 95% CI of 0.361-1.302 and a  $p$  value of = 0.180, meaning that it was not statistically significant ( $p > 0.05$ ), while the RR value  $< 1$ . The  $p$  value  $< 0.25$ , therefore the variable of dental examination every 6 months was included in the model 1 multivariate analysis which showed the  $\text{Exp}(\beta) = 0.751$  with 95% CI = 0.256-2.208 and  $p = 0.603$ , meaning that it was not related to dental caries. This was because the majority of elementary school children say they lack the support from parents for routine dental and oral health examination. In addition, the role of the School Dental Health Business (UKSG) had not been optimum in carrying out preventative programs for dental and oral health for elementary school students. Respondents who routinely went for dental examinations with the dentist every 6 months were only 3.97% while those who did not were 96.03%. In line with the research by Nuryati, et al (2018) in a cross-sectional study at SD N Pakualam, Banjar District, there was no relationship between dental examinations every 6 months with dental caries. Furthermore, in line with Mustika's research (2016), students' awareness in dental and oral health examinations with dentists was still low (37.4%) and students only visited the dentist if they had complaints of large cavities and if they needed to extract their teeth (78.8%) in Cepu District, Blora Regency [17]. This study is in line with Dudovitz, et al. (2017) stating that there was no relationship between dental check-ups every 6 months with dental caries of elementary school students in 6 Los Angeles Elementary Schools ( $p = 0.53$ ). The incidence of dental caries could be suppressed because the elementary school in Los Angeles had a program in reducing dental caries through dental caries screening, fluoride varnishes and sealants [28].

#### IV. DISCUSSION

In this study, the habit of brushing teeth after breakfast and before going to bed is the dominant factor associated with dental caries in elementary school students in Singaparna District, Tasikmalaya Regency. Based on interviews with respondents, the high rate of dental caries in elementary school students was due to the performance School Dental Health Business in schools that was not optimum yet. Therefore, it is expected that Elementary Schools in the Singaparna District of Tasikmalaya Regency increase the role of the Trias UKS, namely health education, health services and environmental health development. One of the health Educations related to dental and oral health of elementary school students is counselling, dental and oral health education such as providing dental caries epidemiology material, information dissemination on the importance of personal hygiene maintenance, correct way of brushing teeth, frequency of brushing teeth and the importance of routine dental check-ups every 6 month, as well as brushing teeth after breakfast. Dental and oral health services were done by holding free dental examinations for school students, dental caries screening by Singaparna Health Development Center of environmental health, providing guidance to food sellers at the canteen and street vendors near schools to limit the availability of cariogenic snacks as preventive dental caries efforts for elementary school students [28]. The School Dental Health Business or

“Usaha Kesehatan Gigi Sekolah” (UKGS) is a means that schools use in preventing dental and mouth diseases. One of which is dental caries by conducting dental health education as early as possible to elementary school students through an approach to good personal hygiene habits because elementary-school-age-children is experiencing a change in milk teeth to permanent teeth [27]. Street vendors are given training by schools about the importance of healthy snacks and not to sell cariogenic snacks to reduce the number of dental caries in elementary school students and are given understanding on the importance of healthy snacks for dental health in elementary school students. The role of parents at home is also very instrumental in preventing dental caries by supervising their children, by teaching them how to brush their teeth twice a day after breakfast and before going to bed, teaching them how to brush their teeth properly to avoid the growth of dental caries, limiting cariogenic snacks and always giving understanding on the impact of cariogenic snacks, which can cause dental caries, cavities, disruption of dental nerves causing pain in the teeth that will eventually interferes with the development process in children. Parents also need to realize the importance of dental examinations every 6 months with a dentist so that they can find out dental caries status in their children. Teachers in school as parents of the students at school need to always control the students in the application of certain habits in preventing dental caries. For example, by making a checklist of tooth-brushing routine after breakfast and before going to bed and by giving rewards to elementary school students who are diligent in brushing their teeth. This is an effort to prevent and reduce dental caries in elementary school students. In addition, it is expected that parents at home present balanced nutrition to the children by always serving meals with vegetables and fruits because watery and high-fibre foods can prevent dental caries since they help saliva in washing teeth to reduce the breeding of *s. mutans* [27]. As an effort to prevent and reduce dental caries in schools, there was also an integrated non-communicable disease post (Posbindu PTM), where the school conducted a survey of risk factors for non-communicable diseases, one of which was dental caries, by brushing teeth twice a day after breakfast and before going to bed. The survey results of dental caries risk factors in elementary school children were used as the basis for the intervention of dental caries problems, starting from health promotion and counselling in schools with poster installation of dental caries risk factors, brochures for dental caries risk factors and screening of the importance of dental and oral hygiene health. Specific protection is self-protection by the habit of brushing teeth after breakfast and before going to bed, avoiding cariogenic foods, early diagnosis with dental examination every 6 months, plaque cleansing by a dentist, monitoring cavities, monitoring dental caries to the dentist as well as rehabilitation by dental surgery which is affected by dental caries

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