

Prediction about the Incidence of Caries in Children Based on Children's Behaviour, Parents and Environment

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ABSTRACT

Background: Dental caries is one of the diseases suffered by children who mostly do not receive any treatment so that it affects their growth and development. Factor that directly play a role in the incidence of caries on children includes the oral and dental condition, while the indirect factors include children's behavior, parents and environment. This research was aimed at obtaining the order of caries risk factors and the prediction of the incidence of caries in children. **Method:** This research belongs to observational research with the design of cross sectional studies. Population was elementary school students whose their parents living in Yogyakarta Province. 430 Samples were taken using proportional stratified random sampling. Data of the research included saliva pH, amount of plaque, caries experience, use of health service, mother's behavior, children's behavior, school dental health service, peer group, and caries. Data were analyzed using Multivariate logistic regression. **Results:** Based on the analysis of Multivariate logistic regression, from the 11 variables, there were 9 significant variables. The independent variables, namely saliva pH (X_1), amount of plaque (X_2), caries experience (X_3), use of health service (X_4), mother's behavior in selecting food for children (X_6), children's knowledge about dental health (X_7), children's behavior in maintaining dental health (X_8), children's behavior in eating habit (X_9), and school dental health service (X_{10}) indicated the risk factors of caries in children with their coefficients of 0.658, 0.868, 1.398, 0.629, 0.516, 0.745, 0.743, 1.199, 0.613 respectively and the constants of -2.336. **Conclusion:** The order of the risk factors are caries experience (X_3), children's behavior in eating habit (X_9), amount of plaque (X_2), children's knowledge about dental health (X_7), children's behavior in maintaining dental health (X_8), saliva pH (X_1), use of health service (X_4), school dental health service (X_{10}) and mother's behavior in selecting food for children (X_6). The prediction of the incidence of caries in children is as follows: $p=1/\{1+2.7^{(-2.336+0.658X_1+0.868X_2+1.398X_3+0.629X_4+0.516X_6+0.745X_7+0.743X_8+1.199X_9+0.613X_{10})}\}$.

Key words: caries, behavior, risk factors, prediction of the incidence of caries

Introduction

Dental caries is a multifactorial disease caused by direct factors such as bacteria, decrease of dental resistance and environment, carbohydrate diet, and time for the caries to occur [1,2]. Factors affecting indirectly to the incidence of caries include socio-economics, behavior, and caries experience in the past. Caries experience in the past is measured based on the index of dmft/DMF-T [1]. Higher prevalence of dental caries occurs on children from low economic status, that they rarely visit dental health service [3]. Based on several researches, having high dental experience, one will likely suffer caries in the next age [4,5,6].

Indirect factors affecting the incidence of dental caries include the interaction of 4 factors, namely behavior, environment, health service and genetic [7]. Children's behaviors include habit of consuming daily food and maintaining dental hygiene [3]. High education level of the parents, especially the mother, will influence their food selection for their children [8,9]. Mother is the closest parent to the children so that she can play a role in guiding, giving understanding, reminding and providing facilities for their children to maintain their oral and dental hygiene [10]. Parents with high level education and income will pay attention and provide their

children's dental treatment to the available health service [11].

Dental health education for students in Indonesia is carried by public health center (*PUSKESMAS*) through School Dental Health Service (UKGS). One of the activities of UKGS is improving knowledge, awareness, behavior of students in maintaining oral and dental health. Program of UKGS is carried out in accordance with the Three Principle of School Health Service (UKS), namely a) activity to administer oral and dental health education, b) administering oral and dental health service, and c) monitoring school environment in collaboration with community surrounding school [12].

Children experience changes conspicuously from a small world that centers in the family to the broader world. Being along with their friends, children tend to feel more comfortable than that in adult environment although it is a favorable and understanding environment [13]. Peer group is one of the factors that affect the status of children's oral and dental health. It is because at school or home, children have peers who influence their behavior to each other. Selecting daily food and snacks, children are influenced by food consumed by their friends [3].

The objectives of this research were to obtain the order of risk factors of caries incidence and to formulate prediction of their caries incidence.

Material and Method

The research was conducted on 430 children aged 10-11 years old and their parents in 16 Elementary Schools in the Yogyakarta Province after obtaining ethical clearance and informed consent from the parents. The number of children and their parents in each region of Sleman Regency, Kulonprogo Regency, Gunung Kidul Regency, Bantul Regency, and Yogyakarta City was 116,105, 81,73, and 55 children and parents respectively. The selection of the research subject was based on the proportion of the number of Elementary School in each subdistrict of regency or city as shown in the following figure.

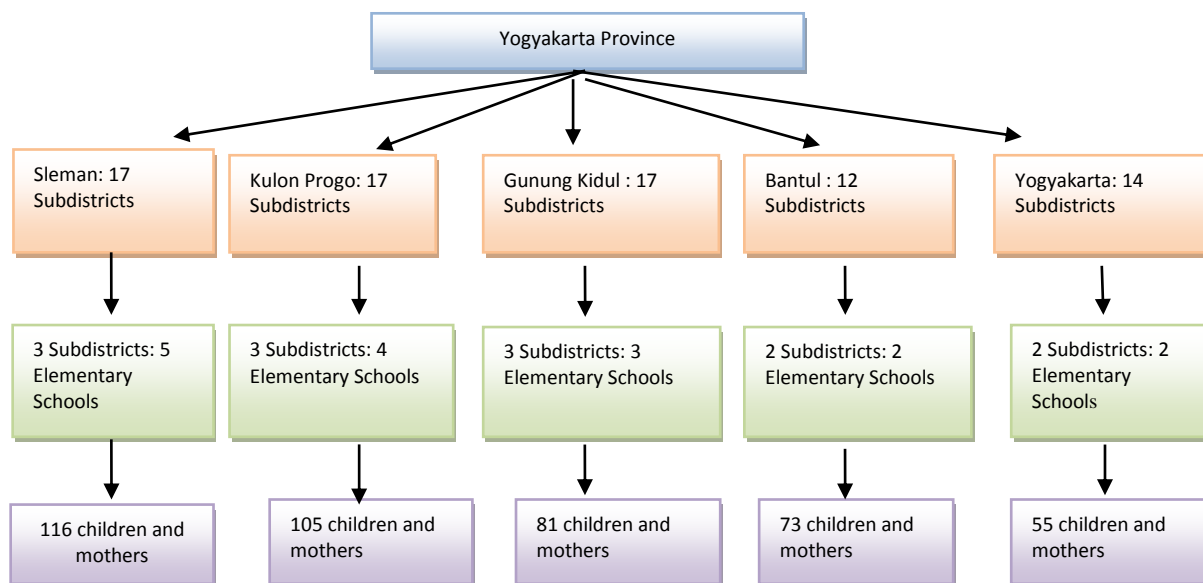


Figure: Method of Research Sampling

Data consisted of the children's oral and dental condition consisting of saliva pH, amount of plaque measured based on PHPM index, caries experience measured with deft/DMFT index. Mother's behavior included using dental health service, maintaining children's dental health and selecting food for children. Children's behavior consisted of children's knowledge, children's behavior in maintaining dental health, and children's behavior in selecting food. Environment was comprised of school dental health service and peer group.

Data were analyzed using univariate to obtain distribution of each variable, bivariate and multivariate logistic regression to obtain odd ration and regression coefficient which resulted in the equation of the order of risk factors of the dental caries incidence in children.

Results

The research was conducted on September-October 2012 in 16 Elementary School in Yogyakarta Province. The profile of the respondents' characteristics is presented in the following table.

Table 1. Characteristics of The Respondents

	n	%
Gender		
Boy	218	50,69
Girls	212	49,31
Mother's education		
Elementary School	25	5,81
Junior High School	223	51,86
Senior High School	94	21,86
College	90	20,93
Family income		
Less Rp. 500.000	98	22,79
Rp. 500.000- Rp.1.000.000	134	31,16
Rp.1000.000 – Rp. 2.500.000	94	21,86
Rp.2.500.000 – Rp. 5.000.000	62	14,42
More Rp. 5 .000.0000	42	9,77

Table 1., shows that the most respondents were males, that was 228 children (50.68%), mother's last education were mostly Elementary School and Junior High School of 223 (51.86%), and the family income rate was mostly below Rp1,000,000, that was 153 (53.95%).

The distribution of risk factors that directly affected the incidence of caries in children including saliva pH, amount of plaque and caries experience is presented in the following table:

Table 2. Distribution of Risk Factors that Directly Affected of Caries in Children

Variable	High		Low	
	n	%	n	%
Saliva pH (X1)	231	53,72	199	46,28
Amount of plaque (X2)	252	58,60	178	41,40
Caries experience (X3)	223	51,86	207	48,14

Table 2., shows that more than a half of 430 children had high saliva pH (pH>6.5), amount of plaque (PHPM>30) and caries experience (deft/DMFT > 3), namely 231 children (53.72%), 252 children 58.60%) and 223 children (51.86%) respectively.

Table 3. Distribution of Risk Factors that Indirectly Affected of Caries in Children

Variable	High		Low	
	n	%	n	%
The use of healthcare service (X4)	139	32,33	291	67,67
Mother's behavior in maintaining dental health (X5)	260	60,47	170	39,53
Mother's behavior in selecting food (X6)	207	48,14	223	51,86

Children's knowledge about dental health (X7)	203	47,21	227	52,79
Children's behavior in maintaining dental health (X8)	145	33,72	285	66,28
Children's behavior in eating habit, (X9)	210	48,84	220	51,16
School dental health service (X10)	167	38,84	263	61,16
Influence of peers (X11)	199	46,28	231	53,72

Table 3., shows that the use of healthcare service, mother's behavior in selecting food children's knowledge about dental health, children's behavior in maintaining dental health, children's behavior in eating habit, school dental health service and influence of peers were categorized low, namely 291 (67.67%), 223 (51.86%), 227 (52.79%), 285 (66.28%), 220 (51.16%), 263 (61.16%) and 231 (53.72%) respectively. Mother's behavior in maintaining children's dental health was mostly considered high, i.e. 260 (60.47%) and the prevalence of dental caries on children was 80.93% and the average of deft/DMFT index was 3.

In order to obtain the prevalence of odd ratio and correlation coefficient on the factors that affect both directly and indirectly, analysis of multivariate logistic regression was performed and the following results were obtained as shown in the tables below;

Table 4. Multiple Logistic Regression Analysis of Caries Risk Factors

Variable	Koefisien	p	POR	95% CI	
Saliva pH (X1)	0,658	0,036*	1,932	1,046	3,568
Amount of plaque (X2)	0,868	0,005*	2,382	1,301	4,365
Caries experience (X3)	1,398	0,000**	4,048	2,137	7,668
The use of healthcare service (X4)	0,629	0,042*	1,876	1,024	3,436
Mother's behavior in maintaining dental health (X5)	0,599	0,074	1,819	0,944	3,507
Mother's behavior in selecting food (X6)	0,516	0,048*	1,676	1,012	3,034
Children's knowledge about dental health (X7)	0,745	0,016*	2,107	1,151	3,858
Children's behavior in maintaining dental health (X8)	0,743	0,014*	2,103	1,162	3,805
Children's behavior in eating habit, (X9)	1,199	0,000**	3,316	1,742	6,315
School dental health service (X10)	0,613	0,047*	1,847	1,009	3,381
Influence of peers (X11)	0,256	0,402	1,292	0,709	2,351
Constanta	-2,335	0,000			

** $p < 0.001$, * $p < 0.05$

POR : Prevalence Odds Ratio

CI : Confidence Interval

Table 4 shows that from the 11 variables, there were 9 significant variables ($p < 0.05$), including caries experience (X₃), children's behavior in selecting food (X₉), amount of plaque (X₂), children's knowledge (X₇), children's behavior in maintaining dental health (X₈), saliva pH (X₁), use of dental health service (X₄), school dental health service (X₁₀), mother's behavior in selecting food (X₆). The order of POR with 95% CI is as follows: 1.932, 2.382, 4.048, 1.876, 1.676, 2.107, 2.103, 3.316, 1.847, while the coefficient of regression correlation is 0.658, 0.868, 1.398, 0.629, 0.516, 0.745, 1.199, dan 0.613 respectively.

Discussion

In this research, caries experience was ranked first in the risk factor of the caries incidence in children (53.72%). Such condition was affected by children's behavior in eating habit that was low (51.16%), which in this research was ranked second. It is in line with the research that children prefer sweet and coherent food such as chocolate, candy, bread, noodle, donut and ice cream which can decrease the plaque pH [14,15].

The incidence of caries in children is also affected by children's behavior in maintaining oral and dental health, which was considered poor (66.8%). In this research, such behavior was ranked fifth in the order of risk factor of caries incidence in children. Low behavior is in line with a research result [16] that the skill of the children in brushing teeth has not been a routine habit yet. Behavior of brushing teeth after breakfast and before sleep has not been completely carried out by children. Children who rarely brush their teeth have poor oral hygiene marked with much plaque, especially anterior teeth (17). Such low behavior is also in line with the fourth rank of the risk factor of the caries incidence in children, that is poor children's knowledge about dental health (52.79%). Knowledge is one of the predisposition factors to create behavior [18].

Children's knowledge and behavior on dental health are influenced by environmental factors of school and peer group [3]. In this research, most of the children stated that the activities of school dental health service including dental health education and tooth brushing together were considered low (61.16%). School dental health service was ranked eighth of the risk factors of caries incidence in children. One of its activities was improving knowledge, awareness, and behavior of the students in maintaining oral and dental [12]. Most of the children stated that the influence of peers was low (53.72%). Children's knowledge and behavior were also affected by peers, which were low (53.72%), although in this research peers did not give significant influence. Children in selecting daily food and snacks were influenced by food consumed by their friends [3].

Children's bad behavior in selecting food and maintaining dental health may affect the amount of plaque. In this research, the third rank of the risk factors of caries incidence in children was the amount of plaque, which was mostly high (58.60%). Plaque that sticks to the teeth surface will be acid for a certain period of time. To return to normal pH of 7, it requires 30-60 minutes [19]. If a large amount of plaque is followed with behavior of brushing teeth properly, plaque pH will decrease. The decrease of plaque pH exceeding the critical limit will demineralize enamel in the form of white spot, and if it goes further, it can result in dental caries [2].

The use of health service in this research was also high risk factor of the caries incidence and ranked seventh. More than a half of the mothers (67.67%) stated that their children were received treatment in the health service of less than twice in a year. The use of health service is affected by education and socio-economic condition [3,8]. In this research, 57.67% of mothers had low education level, i.e. junior high school. Low education level resulted in their low knowledge. Mother's knowledge is essential in underlying the formation of behavior toward children's oral and dental health. Mother who does not care about her dental health will not pay attention her children's dental health so that the status of her children's oral and dental health will also be low [20]. The income of parents in this research was mostly (53.95%) low (< Rp1,000,000), so that it affected the behavior of the low use of health service.

The result of this research indicated that the ninth rank of risk factor of caries incidence in children is mother's behavior in selecting food, who were mostly bad (51.86%). Such bad behavior was affected by mother's low education level (57.67%). The research result [8,9] indicates that parents' high education level will influence healthy food selection for their children,

In this research, saliva pH was a high risk factor of caries incidence although saliva pH was mostly (53.72%) above 6.5 pH. Saliva pH was ranked sixth. In children's age, saliva pH is high because the flow of saliva is also high resulting in larger volume [21]. One of the functions of saliva is acting as a buffer which helps neutralizing plaque pH after eating so that if the volume is high, the balance of saliva pH will occur and decrease demineralization [22].

In order to obtain a prediction of incidence risk of a disease, an equation of regression is necessary [23]. Based on table 4, variables having caries risk with $p < 0.05$ and 95% Confidence Interval were put into equation of regression. The significant variables were saliva pH (X1), amount of plaque (X2), caries experience (X3), use of dental health service (X4), mother's behavior in selecting food (X6), children's knowledge about dental health (X7), children's behavior in maintaining dental health (X8), children's behavior in eating habit (X9), and school dental health service (X10), which the coefficient of regression correlation were 0.658, 0.868, 1.398, 0.629, 0.516, 0.745, 0.743, 1.199, 0.613

respectively and the constant was -2.336.

Conclusion

It can be concluded from this research that the order of the factors causing the caries incidence in elementary school students are caries experience, children's behavior in selecting food, amount of plaque, children's knowledge, children's behavior in maintaining dental health, saliva pH, use of dental health service, school dental health service, and mother's behavior in selecting food. The equation of the prediction about the incidence of caries in children is $p=1/\{1+2.7^{(-2.336+0.658X_1+0.868X_2+1.398X_3+0.629X_4+0.516X_6+0.745X_7+0.743X_8+1.199X_9+0.613 X_{10})}\}$.

Acknowledgment

The researcher would like to express her deepest gratitude to parents and fifth grade students of Elementary School in 16 Elementary Schools in Yogyakarta Province, who were willing to be respondents in this research.

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