

# PREVALENCE AND FACTORS RELATED TO DENTAL CARIES AMONG 6 YEAR-OLD CHILDREN IN NHA TRANG CITY, KHANH HOA PROVINCE, VIETNAM

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## ABSTRACT:

**Background:** Dental caries has become a burden of every country. The National Oral Health Survey of Vietnam 2001 showed that 83.7% children aged 6 years had decayed, missing and filled teeth. Also, there are few available published studies about the prevalence of dental caries in children in Vietnam, especially in 6 year-old children.

**Method:** The study aimed to identify the prevalence of dental caries among 6 years old children in Nha Trang city, Vietnam as well as to generate hypothesis regarding relationship between factors including general characteristics, dietary, oral hygiene practice, supporting environment, accessibility and availability; and the consequences of dental caries. This cross-sectional study was conducted in 248 children whose dental caries status was ascertained by dentists with proper equipment. Their parents were also asked to complete structured questionnaires.

**Results:** The prevalence of dental caries among six year-old children in Nha Trang city was 88.3% with the mean of decayed - extracted - filled teeth score (deft score) was  $5.04 \pm 3.43$ . The proportion of decayed teeth, extracted teeth and filled teeth are 85.9% ( $4.33 \pm 3.12$ ), 23% ( $0.34 \pm 0.69$ ) and 23.8% ( $0.38 \pm 0.82$ ) respectively. There were statistically significant association between the more educated parents and lower children's deft score ( $p < 0.001$ ); the lower total income per month of the family and the higher prevalence of dental caries ( $p = 0.002$ ); the more frequent of tooth brush and the lower chance to get dental caries ( $p < 0.001$ ); the use of toothpaste and the lower deft category ( $p = 0.006$ ); the more frequent to dentist check-up, the lower chance to get dental caries ( $p < 0.001$ ); the more cariogenic food, the higher dental caries proportion ( $p = 0.024$  for the drinks and  $< 0.001$  for the snacks); the better parental knowledge and perception levels the lower proportion of dental caries ( $p = 0.014$ ); School Based Dental Program (SBDP) and supporting environment in poor level and higher dental caries prevalence ( $p < 0.001$ ); the further distance from home to dentist office, the more likelihood of dental caries finding ( $p < 0.001$ ).

**Conclusion:** The intervention or action should be taken to improve community awareness about dental caries in children.

**Keywords:** Dental caries, Dental health, Children, Vietnam

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## INTRODUCTION

Nowadays, dental caries has become a burden of every country. A number of five billion people worldwide were estimated to have experienced dental caries in 2004 by WHO [1]. The report on the State of Oral Health in Europe commissioned by the Platform in 2012 estimated the annual spending in

oral care in the EU-27 to be close to €79 billion in 2012, a figure set to reach €93 billion by the year 2020 if adequate action is not taken immediately. In April 2012, a fact sheet from Media Center of WHO shows that 60-90% of school children and nearly 100% of adults have dental cavities worldwide [2]. The National Oral Health Survey of Vietnam 2001 showed that about 83.7% children aged 6 years had decayed, missing and filled teeth. There are little available published studies about the

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prevalence of dental caries in children in Vietnam, especially in 6 years old children. There is not any previous study related to the prevalence of dental caries and related factors among 6 years old children in Nha Trang, Khanh Hoa. The aim of this study is to find out the prevalence of dental caries among 6 years old children in Nha Trang city as well as determines general characteristics factors, dietary, oral hygiene practice, supporting environment, accessibility and availability factors that associate with dental caries.

## METHODOLOGY

Cross-sectional study design was used in this study. The study was conducted in Nha Trang city, Khanh Hoa province, Vietnam. The participants of study included six years old children who are living in Nha Trang city Khanh Hoa province Vietnam, studying at primary schools which have the school based dental program and have agreements of their parents to participate in the study with informed consent and their parents who responded the questionnaires. There are 248 samples in the study, based on the sampling formula of Cochran Multi-stage sampling technique was used to randomly select 248 children from three primary schools in Nha Trang city [3]. Structured interview questionnaire were adapted to children's parents in order to collect information regarding to characteristics factors, dietary, oral hygiene practice, supporting environment, accessibility and availability factors that associate with dental caries. This questionnaire was pre-tested on 30 children and their parents in Nha Trang city that have similar inclusion criteria as the study sample. The WHO caries diagnostic criterion for decayed, missing, and filled teeth (DMFT) was used to measure the dental health status. Method of assessing dental caries followed instructions of "Oral Health Surveys - Basic methods, 3<sup>rd</sup> edition, 1997" [4]. Dental examination will be done with the child seated on an ordinary chair or in a knee to knee position. A mouth mirror and a CPI probe which are sterilized by an autoclave machine will be used to examine children's teeth. The examiners who will be properly and professionally vested with mask, cap and gloves (the latter were changed at each examination) will use probe very cautiously to prevent damage to the teeth.

### Data analysis

Data analysis was done by using SPSS 16 software. The missing information was recollected for completion. Descriptive statistic includes frequency distribution and mean were used to

describe dental caries experience (DMFT/deft). Frequency distribution was used to describe the general characteristic, oral hygiene practices, eating habits, and perception of oral problem. Since seven statements in the questionnaire of parental knowledge and perception on oral health were positive statements, 1, 2 and 3 score were assigned for disagree, not sure and agree response. For the parents with the total score of perception and knowledge on dental caries were equal to or above (higher) the median, they were categorized as good score and those with the total score were under the median value, were categorized as poor score. Similarly, SBDP and supporting environment were divided into two groups which were good and poor level. All of the statement were supportive so that positive answer (yes or appropriate) was signed for 1 point and negative answer (no or inappropriate) was signed for zero (0) point for each. Those with score were above or equal to the median value was categorized in the good level group and the other whose score was under the median was categorized in the poor level group.

Chi-square was used to test the association between oral hygiene practices, eating habits and dental caries prevalence when both dependent and independent variables were categorical.

To test the deft score and dichotomous variables, the Mann-Whitney tests were employed. The Kruskal-Wallis tests were used, due to the stratification in more than two categories. The choice of non-parametric tests was justifiable, since the caries index utilized (deft) was not present a normal distribution. The findings were reported through *p-value*, Risk Ratio (RR), and 95% Confidence Interval (CI).

### Ethical consideration

The research proposal will be reviewed and approved by Ethical Review Board of Khanh Hoa Medical College in Nha Trang city, Khanh Hoa province, Vietnam according to decision No. 762/QD-CDYT, issued on 30th December 2013. All study participants will be provided adequate study information before decision of participation in the study. They can discontinue from the study whenever they want.

## RESULTS

A total of 248 first grade pupils in three primary schools in Nha Trang city were examined the dental caries status. Among that, 54.4% were male, and 45.96% were female. The age of parents or care givers are divided into two groups with the percentage is nearly equal between them. The

**Table 1** Frequency and percentage distribution of characteristics factors, dietary, oral hygiene practice, supporting environment, accessibility and availability factors

	Frequency	Percentage (%)
<b>Gender</b>		
Male	135	54.4
Female	113	45.6
<b>Age of parents or care givers (years)</b>		
26-36	128	51.6
37-63	120	48.4
Mean: 36.8 S.D: 6.26 Max: 63 Min: 26		
<b>Highest education of parents</b>		
Cannot read or write	0	0
Primary school	40	16.1
Secondary school	35	14.1
High school	67	27.0
College/ Occupation training/ University	104	41.9
Other ( master degree)	2	0.8
<b>Occupation of parents</b>		
Labor	38	15.3
Farmer/ Gardener	12	4.8
Government employee	92	37.1
Factory worker	46	18.5
Private business	59	23.8
Other (missing, don't know)	1	0.4
<b>Total family's income</b>		
<= 3,000,000 (VND)	31	12.5
3,000,001 – 7,000,000 (VND)	94	37.9
7,000,001 – 10,000,000 (VND)	86	34.7
10,000,001 – 20,000,000 (VND)	36	14.5
>20.000.000 (VND)	1	0.4
<b>Oral hygiene practice</b>		
Frequency of brush		
Once every day	91	36.7
Twice every day	128	51.6
More than twice every day	29	11.7
Time of brush		
In the morning (after getting up)	69	27.8
In the evening (before going to bed)	22	8.9
In the morning and in the evening	128	51.6
After meals	29	11.7
Toothpaste use		
Yes	201	81
No	47	19
Method of brush		
Move the brush back and forth	101	40.7
Move the brush up from the bottom and down from the top with circular motion	84	33.9
Move the brush as strongly as possible	42	16.9
Move the brush on the occlusion surface only	21	8.5
<b>Dental visit</b>		
Dentist check		
Yes	197	79.4
No	51	20.6
<b>Dental visit</b>		
Frequency of dentist check (n=197)		
Once per six months	74	37.6
Once per year	95	48.2
Other (when having dental problems)	28	14.2

**Table 2** Frequency and percentage distribution of characteristics factors, dietary, oral hygiene practice, supporting environment, accessibility and availability factors (Cont.)

	Frequency	Percentage (%)
<b>Dietary</b>		
Favorite drink between meals		
Gas drink	61	24.6
Juice	38	15.3
Water	74	39.8
Milk	75	30.2
Other	0	0
Favorite snack between meals		
Fresh fruit	81	32.7
Biscuits/ Cakes	68	27.4
Potato chip/ Other snack	65	26.2
Candies/ Chocolate	34	13.7
<b>Level of parents' knowledge and perception on dental caries</b>		
Good level score	150	60.5
Poor level score	98	39.5
<b>Level of SBDP and supporting environment</b>		
Good level score	100	40.3
Poor level score	148	59.7
Knowing where to take participant to dental service		
Yes	248	100
No	0	0
Distance from resident place to receive dental service		
<3km	87	35.1
3-5km	98	39.5
>5km	63	25.4
Waiting time before receiving dental service		
<30 minutes	72	29.1
30-60 minutes	107	43.1
>60 minutes	69	27.8
Source of media		
Newspaper/ Magazine	39	15.7
TV	173	69.8
Radio	27	10.9
Other (internet, do not know)	9	3.6
Source of persomel		
Dentists	59	23.8
Parents	90	36.3
Teachers	98	39.5
Friends	1	.4
Others	0	0

minimum age is 26, the maximum age is 63, the mean age is 36.8 with the standard deviation of 6.26. The number of parents or care givers with the age from 26 to 36 is 128 (51.6%) and the one from 37 to 63 is 120 (48.4%). Most of the parents graduate from university or college with the number is 104 (41.9%) and high school 67(27.0%). Forty parents (16.1%) have the highest education is high school and very few of the parents only graduate primary school (1.6%). None of them cannot read or write and two of them get the master degree (0.8%). All of the children have their teeth brushed every day. 11.7% brushed teeth more than twice a day, 33.9% of them brush teeth in the right way, 81% of them use

toothpaste. 79.4% of children were brought to dentists at least one time. 15.3% chose juice and 32.7% chose fresh fruit as their favorite snacks between meals. 60.5% of the parents have good knowledge and perception on dental caries while 39.5% of them got the poor level. 40.3% of the children were received SBDP and supporting environment at good level while 59.7% of them were not. 100% of parents know where to take their children to when they need dental services. The percentage of distance from their houses to dental offices is nearly equal between the distance of less than 3 km and 3-5 km which are 35.1% and 39.5%. Most of them (43.1%) said that their children have

**Table 2** Dental status of the participants

Dental status (n=248)	Frequency % (*)	Mean score ± SD
Deft	219 (88.3)	5.04 ± 3.43
Dt	213 (85.9)	4.33 ± 3.12
Et	57 (23)	0.34 ± 0.69
Ft	59 (23.8)	0.38 ± 0.82

\*prevalence of non-zero measurements only, for example 23.8 is prevalence of ft>0

**Table 3.** Relationship between deft score and general characteristic, dietary, parental knowledge and perception on dental caries, accessibility and availability to dental services factors.

	n	Mean rank	Z score (p-value)
<b>Gender</b>			-0.124 (.901)
<b>Age by group</b>			-0.856 (.392)
<b>Highest education</b>			<0.001
Cannot read or write	0	0	
Primary school	40	166.5	
Secondary school	35	135.73	
High school	67	129.91	
College/ Occupation training/ University	104	101.97	
Other(master degree)	2	78.5	
<b>Occupation</b>			0.323
<b>Total income per month</b>			.002
<= 3,000,000 (VND)	31	134.03	
3,000,001 – 7,000,000 (VND)	94	142.36	
7,000,001 – 10,000,000 (VND)	86	116.69	
10,000,001 – 20,000,000 (VND)	36	90.19	
>20,000,000 (VND)	1	57.50	
<b>Favorite drink between meals</b>			9.482 (0.024)
Gas drink	61	143.96	
Juice	38	100.07	
Water	74	126.57	
Milk	75	119.01	
<b>Favorite snack between meals</b>			24.492 (<0.001)
Fresh fruit	81	92.8	
Biscuits/ Cakes	68	133.98	
Potato chip/ Other snack	65	144.28	
Candies/ Chocolate	34	143.25	
<b>Level score of parental knowledge and perception</b>			-2.470 (0.014)
Good	150	115.45	
Poor	98	138.36	
<b>Accessibility</b>			20.207 (<0.001)
Distant to dental service			
<3km	87	109.07	
3-5km	98	133.94	
>5km	63	131.13	
Waiting time			1.850 (0.396)
<b>Availability</b>			
Media source			0.062 (0.996)
Personnel source			0.380 (0.944)

to wait from 30-60 minutes before being checked at dental offices. The highest percentage of media and interpersonal source which give children information dental caries knowledge is 69.8% that belongs to television and 39.5% that came from teacher at school (Table 1). The prevalence of dental caries among six year old children in Nha Trang city is 88.3% with the

mean of deft score is  $5.04 \pm 3.43$ . The proportion of dt, et and ft are 85.9% ( $4.33 \pm 3.12$ ), 23% ( $0.34 \pm 0.69$ ) and 23.8% ( $0.38 \pm 0.82$ ) respectively (Table 2).

Statistical test findings revealed that there was no significant association between gender of children and their parental age group with deft score. However, the more educated parents the less

**Table 4.** Relationship between deft category and oral hygiene practice, SBDP and supporting environment level

	deft category		<i>p-value</i>
	deft=0	deft>0	
<b>Self- brush</b>			<b>.617</b>
<b>Frequency of tooth brush</b>			<b>&lt;0.001</b>
Once every day	2 (6.9)	89 (40.6)	
Twice every day	9 (31.0)	119 (54.3)	
More than twice every day	18 (62.1)	11 (5.0)	
<b>Time of brush</b>			<b>&lt;0.001</b>
In the morning	1 (3.4)	68 (31.1)	
In the evening	0 (0)	22 (10.0)	
In the morning and in the evening	10 (34.5)	118 (53.9)	
After meals	18 (62.1)	11 (5.0)	
<b>Toothpaste use</b>			<b>0.006</b>
Yes	29 (100)	172 (78.5)	OR = .856 95% CI = (.080-.906)
No	0 (0)	47 (21.5)	
<b>Dentist check (n=248)</b>			<b>.053</b>
Ever	27 (93.1)	170 (77.6)	OR=3.891 95% CI=(.89-16.94)
Never	2 (6.9)	49 (22.4)	
<b>Frequency of dentist check (n=197)</b>			<b>&lt;0.001</b>
Once per six months	24 (88.9)	50 (29.4)	
Once per year	2 (7.4)	93 (54.7)	
Other (having dental problems)	1 (3.7)	27 (15.9)	
<b>Supporting environment and SBDP level</b>			<b>&lt;0.001</b>
Good level	27 (93.1)	73(33.3)	OR=27 95%CI=(6.248-116.673)
Poor level	2 (6.9)	146(66.7)	

children's deft score had a strongly statistical significant association ( $p$ -value <0.001). Similarly, higher deft score were found in lower total income per month group. This association is also significant with  $p$ -value is 0.002. All the categories of oral hygiene practice had significant association with dental caries status with the  $p$ -value is all less than 0.005, except for the self-brush element. These associations were found significant between dietary habit and deft score with the  $p$ -value are 0.024 and <0.001. Children with good parental knowledge and perception levels have less dental caries than the rest. This association is statistically significant with  $p$ -value=0.014. Children who received SBDP and supporting environment in poor level tend to get dental caries 27 times compare with those who received the good quality (OR=27, 95%CI=6.248-116.673). This association is significant with  $p$ -value <0.001. The relationship between deft category and the distance from children's houses to dentist offices has the statistically significant association with deft score with  $p$ -value less than 0.001 (Table 3 and 4).

## DISCUSSION

The prevalence of dental caries which was found in this study is 88.3%, higher than the

proportion 83.7% of six years old children, who were affected by dental caries from National Oral Health Survey of Vietnam in 2001, the main reference source of this study. However, the deft score of this study was found to be 5.04, lower than the survey in 2001 which is 6.15. The dt component (4.33) is also lower this of the survey in 2001 (5.9). This means the number of children in the population affected by dental caries is increased but the number of affected teeth of each participant is decreased. The et and ft score in this research is higher than those in the survey with the number of 0.34 and 0.38 compare with 0.2 and 0.0. It can be explained by the increasing of the use of dental services which was the result of the increasing of living level and the developing of health care system. The higher ft score is a good finding, showing more attention from parents and social support to children's dental health care.

Among 248 first grade pupils in three primary schools in Nha Trang city, who were examined the dental caries status, 54.4% were male, and 45.96% were female. This proportion was expected to be nearly equal but the finding is not. Aside, this finding can be suitable for the situation in Vietnam that the ratio of gender is tending to be higher in male in recent years. However, there was no significant association between gender of children

and their parental age group with deft score.

Another finding of this study is that the more educated parents the less children's deft score with a strongly statistical significant association ( $p$ -value <0.001). Similarly, higher deft score were found in lower total income per month group. This association is also significant with  $p$ -value is 0.002. This is appropriate with Basto's study which has statistical evidence showed that dental caries have the relationship with low educational level of mothers and low income families. He found that the children of the mothers who finished eight or less years of study (CI 95% 1.7-5.0) were more likely to have 2.9 times of dental caries compare with children that have mothers with higher education levels. Children were raised in families with the incomes per month which are less than six Brazilian minimum wages were also more likely to have high prevalence of dental caries (OR 2.3: CI95% 1.4-.8). This relationship can be easily explained in every society. The more education people received, the more knowledge they get, including dental knowledge. And since having more money, parents will give more attention on their children's health. This can lead to the decreasing of deft score in the group of children whose parents are more educated and family total income is higher. Besides, there is no significant association was found between parental occupation and dental caries from this study.

All the respondents said that their children's teeth were brushed every day. Among that only 13.3% did not brush teeth themselves. Six years old is the age that children can manage to do their individual oral hygiene practice. Moreover, most of parental occupation which was found in this study is government worker so that they did not have time to brush their children teeth. It is also good for children to brush themselves so they can do it at school and make it a good habit.

Most of them brush teeth twice a day and 33.9% did it by moving the brush up from the bottom and down from the top with circular motion which is the right way. However the proportion of children who move the brush back and forth is the highest one. It is absolutely not a good way to brush their teeth. This is suited with the finding that 60.5% the participants said that they received the knowledge of tooth brushing from teachers at school. 201 (81%) of the children use toothpaste and 79.4% said that they have been to dentists for dental check. Even though 70.2% respondents agree that dental services are expensive but the proportion of dental visit is still high, that can be explained by the increasing of total income per month of the family and the higher education of parents. All the categories of oral

hygiene practice have significant association with dental caries status with the  $p$ -value is less than 0.005 all, except for the self \_brush element. Same conclusion can be found in Vehkalahti et al. study conducted in 1988 that high frequency of tooth brushing was significantly associated with a low present of root caries for both men (OR = 4.3,  $P$  < 0.001) and women (OR = 4.1,  $P$  < 0.001). A low occurrence of root caries was also related to regular dental visits. For those who check-up at least once in two years (OR =.4,  $p$ -value < 0.001) in women and (OR = 4.5,  $p$ -value < 0.001) in men [5].

The number of 38/248 and 81/248 of children liked juices and fresh fruit which is good for dental health. Most of them would rather use gas drink and snack, sweet things as their snacks between meals. Dental caries status as presented by deft score is lower in children with the habit of having fresh fruit and worse in group who like sweets food. These associations were found significant between dietary habit and deft score with the  $p$ -value are 0.024 and <0.001. This is similarly with Lingstrom's study which showed food intake frequency had associated with the development of dental caries. A high food intake frequency leads to shorter time for the teeth to demineralize and gives longer periods for the teeth to be demineralized.

High proportion of parents (81.5%) know that food with high sugar consumption can cause dental caries. 72.6% supported the statement that brushing teeth after every meals in the right way can prevent dental caries and 75.4% know that it is necessary to visit dentists every six month. However few of parents (31.9%) know that it can have sixth teeth in children at six years old and the percentage of parents supported extracting teeth to reduce the pain caused by decayed or it is not necessary to fill a primary decayed teeth is still high. This shows an alarm to the oral health communication to give more knowledge to parents about oral health. Sixth teeth are permanent teeth and it is very dangerous if it is decayed in such the early age of six and not to be treated or to be extracted. It also influences the permanent teeth when the primary teeth are extracted too early before the right age.

When dividing into two levels, 60.5% of them have good level score and 39.5% are at poor level score. Children with parental knowledge and perception levels are good having less dental caries than the rest. This association is statistically significant with  $p$ -value=0.014. The finding of this study shows the prevalence which are higher than those of the research of Luong Ngoc Khue [7] in Donka Subdistrict, Uthong district, Suphanburi Province, Thailand, showed that only 32.7% of the

interviewed mothers brought their children to the dentist for necessary clinical examination and 15.3% of the mothers had their children dental checked-up every six month.

Most of the children received SBDP activities at school and some of the activities were found to be not appropriate enough like place for children to brush their teeth and the Sodium Fluoride 0.2% supplement to rinse their mouths. Also be divided into two level, children who received SBDP and supporting environment in poor level tend to get dental caries 27 times compare with those who received the good quality (OR=27, 95%CI=6.248-116.673). This association is significant with *p-value* <0.001. It pointed out the important of School based dental program in primary school and the effectiveness of it on preventing dental caries in children.

The study found that 100% of respondents know the place of dental service to take their children to when they need. Most of them live not too far from dentist offices with 39.5% have the distance varies between 3 and 5 km and 35.1% live not further than 3km from dentist office. Since Nha Trang city is not big and the number of dental services here is large including government and private sectors, this proportion can be explained. The highest proportion of availability assessment is 69.8% that belongs to television, which is higher than a study in Nakhon Pathom province, Thailand by Hak Sithan, which showed 40% of respondent got the information from television [6]. This finding also have same conclusion with a study in Thailand conducted by Luong Ngoc Khue which found that television played the most important role as a source of information about dental health [7]. Only 3.6% of children received dental information from internet due to the limited with this source of information at the age of six. Most of them received dental knowledge from the SBDP by their teachers and only 0.4% received from their friends. It is appropriate for this age since six years old is too young to have effective communication. The relationship between deft category and the distance from children's houses to dentist offices has the statistically significant association with deft score with *p-value* less than 0.001.

This study is a cross-sectional design so that it cannot thoroughly explain the dental caries status and the relationship with independent variables. The statistics technique used in this study is rather simple, which not concerned with multivariable regression such as Linear regression, Logistic regression so that it cannot find out all the relationship between complicated variables. The study limited in 6 years old children in some primary schools in Nha Trang city so that the results cannot be applied to all 6 years

old children in Khanh Hoa province as well as to 6 years old children in Vietnam.

## CONCLUSION

Dental caries prevalence in this study is 88.3% which is a high proportion. This evidence suggested need of dental caries management and prevention. Several factors have been hypothesized to be related to caries condition such as the education level of parents, the total income per month of the family, the frequent of tooth brush, the use of toothpaste, parental knowledge and perception on dental caries and some supporting elements. However, since the relationship is determined through crude measurement and cross-sectional design, the result should be useful for hypothesis generation only. To further identify factors independently associated with dental caries condition, study method which imply temporal relationship and data analysis plan which controls confounders must be considered.

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## REFERENCES

1. World Health Organization [WHO]. Report on global problem of oral diseases. Geneva: WHO; 2004.
2. World Health Organization [WHO]. Fact sheet N°318: Oral health. [updated 2012 April ; cited February 2014]. Available from: <http://www.who.int/mediacentre/factsheets/fs318/en/>
3. Cochran WG. Sampling techniques. 3<sup>rd</sup> ed. New York: John Wiley & Sons; 1977.
4. World Health Organization [WHO]. Oral health surveys: basic methods. 3<sup>rd</sup> ed. Geneva: WHO; 1997.
5. Vehkalahti MM, Paunio IK. Occurrence of root caries in relation to dental health behavior. J Dent Res. 1988; 67(6): 911-4.
6. Sithan H. Dental health preventive behavior among mothers with preschool children in Nakhon Pathom Province, Thailand. Nakhon Pathom: Faculty of Graduate Studies, Mahidol University; 2003.
7. Khue NL. Dental health preventive behavior among mothers with children under 6 years of age in Donka Subdistrict, Uthong district, Suphanburi Province, Thailand. Nakhon Pathom: Faculty of Graduate Studies, Mahidol University; 2003.