

## Risk behaviors and its association with caries activity and dental caries in Japanese children

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**Abstract** The aim of this study was to assess risk behaviors and its association with caries activity and dental caries in Japanese children. The subjects were 392 young Japanese children who underwent dental health check-up at 18, 30 and 42 months of age. Oral examinations, Cariostat tests and dental health questionnaires were carried out at each time. The caries prevalence of children was 1.5% at 18 months, 9.9% at 30 months and 28.1% at 42 months. Caries activity based on the Cariostat scores of children was correlated with caries status (caries-free/carious) at 42 months. In children with caries during each examination period at 42 months, eating snacks while playing was ranked as the most important behavioral risk ( $P<0.001$ ), followed by breast-feeding ( $P<0.01$ ), non setting of time for snacks ( $P<0.05$ ) and frequency of snacks ( $P<0.05$ ) at 18 months old; non brushing by mother ( $P<0.05$ ) and eating snacks while playing ( $P<0.05$ ) were ranked highest at 30 months old. In addition, eating snacks while playing ( $P<0.001$ ) at 42 months old was the only a significant factor for children with caries. Caries activity and risk behaviors were associated with caries experience at different age periods of childhood.

### Key words

Caries activity,  
Cariostat,  
Dental caries,  
Questionnaires,  
Risk behaviors

### Introduction

Dental caries is widely recognized as an infectious disease induced by diet. Dental caries has a multifactorial etiology in which there is interplay of four principal factors; cariogenic bacteria, fermentable carbohydrates, a susceptible tooth and time<sup>1,2</sup>.

Mutans streptococci are acidogenic and aciduric. They can produce acids which can dissolve the tooth enamel and survive and even in a low pH environment. Mutans streptococci are divided into seven species by serotype. The species most commonly isolated from dental plaque in humans is *S. mutans* (serotypes c, e and f) and *S. sobrinus* (serotypes d, g).

The Cariostat<sup>®</sup> test, a caries activity test, was

invented by Shimono in 1974<sup>3</sup>. The test measures acid production capacity and can predict the occurrence of caries with good validity and reliability in young children or effective for screening high-risk populations in young children<sup>4,5</sup>.

The colonization of the mouth by cariogenic bacteria is by human transmission, mostly from mothers, fathers, caregivers to infants, and depends upon the rearing style given to infants and the quantity of harbored bacteria of the rearing individual. There is no single test that takes into consideration all these factors and can accurately predict an individual's susceptibility to caries. The risk of dental caries can be evaluated by analyzing and integrating several causative factors. Thus, this study was made to analyze risk behaviors that cause dental decay and assess risk behaviors and its association with caries activity and dental caries in Japanese children.

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Table 1 Comparison of between caries prone and caries free at 42-month-old

	18 months		30 months		42 months	
	High Risk	Low Risk	High Risk	Low Risk	High Risk	Low Risk
Caries (110)	32.7% (36)	67.3% (74)	44.5% (49)	55.5% (61)	58.2% (64)	41.8% (46)
Caries-free (282)	21.3% (60)	78.7% (222)	33.3% (94)	66.7% (188)	31.2% (88)	68.8% (194)
<i>P</i> value	<0.05		<0.05		<0.001	

Table 2 Logistic regression analysis of contributing risk factors to caries status

Risk factors	Risk factors at 18 months to caries status at 42 months		Risk factors at 30 months to caries status at 42 months	
	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio
Breast feeding (yes/no)	1.60–6.62	3.26**	0.97–31.67	5.54
Eat snacks while playing (yes/no)	1.44–3.77	2.33**	1.01– 2.60	1.61**
Frequency of snacks ( $\leq 2$ times/ $\geq 3$ times/day)	0.83–3.73	1.76	0.65– 2.67	1.32
Brushing assistance by mother (yes/no)	0.87–2.26	1.40	1.01– 3.07	1.76*
Set time for snacks (yes/no)	0.58–2.01	1.08	0.33– 1.24	0.64

\* $P < 0.05$ , \*\* $P < 0.01$ 

## Subjects and Methods

Subjects were 392 children at the age of 42-month-old who underwent dental health examination in a regular dental check-up system at a health center in Katano City of Osaka, Japan between April 2004 and March 2005. All of the children have received dental health check-up 18 months and 30 months.

Caries risk assessment using the Cariostat was done for every child. The swab with the dental plaque sample was put into the Cariostat medium (Sankin Co., Japan) and incubated at 37°C for 48 hrs. SCORING was done after a predetermined incubation period using the reference of 7-scale grading system. And then, the Cariostat scores results were grouped as low risk (CAT 0, 0.5, 1.0 and 1.5) and high risk (2.0, 2.5 and 3.0).

The children were examined using dental mirrors and explorers under natural light by one same dentist. Caries was assessed in accordance with the criteria of the Health Policy Bureau, Ministry of Health and Welfare, Japan<sup>6</sup>.

Their caregivers completed a questionnaire concerning oral hygiene habits and dietary histories of the children.

All of the data were entered into the SPSS 11.0 software by the code numbers of the subjects for analysis. Chi-square tests with Spearman's rank-order correlation and odds ratios (95% CI) were used for analyzing relationship between risk behaviors at different age and dental caries at 42 months old. Influences of risk behaviors for caries status were analyzed by logistic regression analyses.

## Results

Twenty-eight point one percent (110/392) of the 42-month-old children had dental caries experience. Findings concerning caries activity assessed by Cariostat are as follows: Twenty-four point five percent (96/392) at 18 months, 36.5% (143/392) at 30 months and 38.8% (152/392) at 42 months were judged having high caries activity. It is rather evident that caries activity appeared to increase with age in the samples. Table 1 summarizes the distribution of caries activity at different age and caries status at 42 months of age. The children with high caries activity were more likely to have caries experience than those with low caries activity (32.7% vs. 21.3% at 18 months,  $P < 0.05$ ; 44.5% vs.

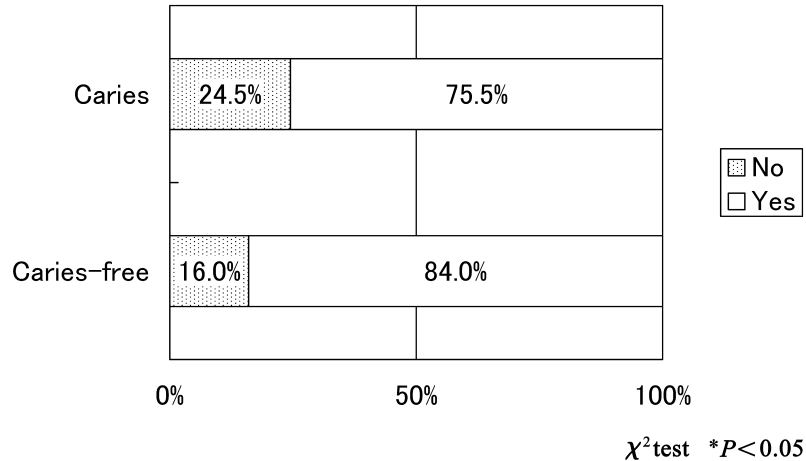


Fig. 1 “Set time for snacks” at 18 months and caries status at 42 months

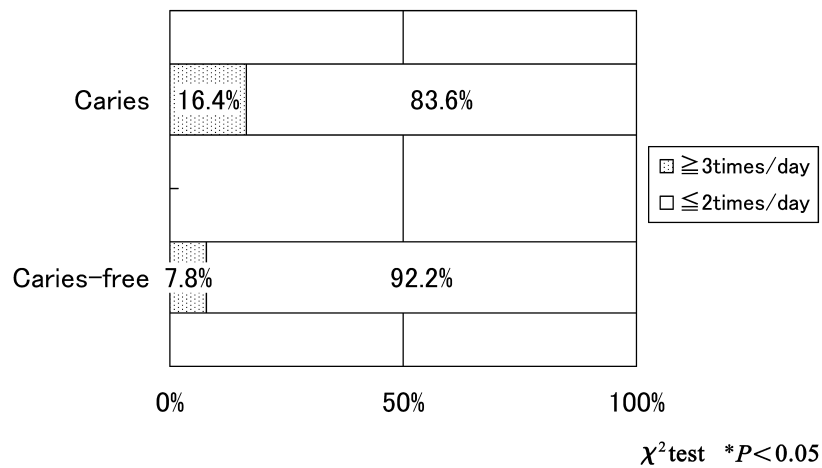


Fig. 2 “Frequency of snacks” at 18 months and caries status at 42 months

33.3% at 30 months,  $P < 0.05$ ; and 58.2% vs. 31.2% at 42 months,  $P < 0.001$ ).

At 18 months of age 9.9% of children (39/392) and at 30 months of age 1.5% (6/392) were still accepting breast feeding from their mothers.

As shown in Table 2, logistic regression analysis for the influence of risk factors of 18 months and 30 months on caries status at 42 months was presented. 18-month-old children with “Breast feeding” were 3.26 times (95% CI = 1.60–6.62) and children with “Eat snacks while playing” were 2.33 times (95% CI = 1.44–3.77) most closely related to caries status at 42 months. Thirty-month-old children with “Non brushing assistance by mother” were 1.76 times (95% CI = 1.01–3.07) and children with “Eat snacks while playing” 1.61 times (95% CI = 1.01–2.60)

most likely to have carious teeth.

In addition, at 18 months, there was higher percentage of 42-month-old children with dental caries who have not “Set time for snacks” than one having ( $P < 0.05$ ) (Fig. 1). The prevalence of caries at 42 months was a significantly different between those with “Frequency of snacks” and those without “Frequency of snacks” when children were 18-month-old ( $P < 0.05$ ) (Fig. 2).

## Discussion

Regular dental health check-ups are the best way to make sure teeth and gums keep healthy. According to 2005 report on the survey of dental diseases by Health Policy Bureau Ministry of Health and

Welfare Japan, average of dental caries prevalence at 3-year-old is 31.3% in Japan and 31.9% in Osaka city. However, in this study, the caries prevalence was 28.1% which is less than the average and Osaka city. Katano Health Center is located in Osaka city. This was probably due to the fact that the subjects in this study underwent dental health examinations at the ages of 6 months, 10 months, 18 months, 30 months and 42 months. Also, the mothers of the children with high caries activity had received dental guidance from the Katano Health Center.

The Cariostat test is effective for screening high population and predicting the occurrence of dental caries in young children<sup>5,7-9</sup>. The contribution of caries activity assessed by Cariostat, 24.5% (96/392) at 18 months, 36.5% (143/392) at 30 months and 38.8% (152/392) at 42 months were judged having high caries activity. The present finding was so closely to same as has been reported by Okazaki *et al.*<sup>10</sup> that the caries activity appeared to increase with age from 18-month-old to 36-month-old. Although Tsubouchi *et al.*<sup>6</sup> also obtained the same result as follows: Forty-four point three percent at 18 months, 46.4% at 24 months and 58.6% at 36 months were designated as having high caries activity, we found approximately 20% difference at 18 months. It is perhaps that the subjects of our study almost started dental health examination from 10-month-old and their mothers already got the dental education from dentists. However, the subjects of Tsubouchi underwent dental health examinations at 18 months.

Breast feeding was the most influential factor. Actually in this study, breast feeding was the preferred with time of infant feeding before sleeping or during midnight. We found that 18-month-old children who breast-fed during waking hours or already weaned compared with breast feeding children, are not likely to be at higher risk for caries experience when the children was 42-month-old. Therefore at-will/on-demand breast feeding was related to nursing caries in previous studies<sup>11-13</sup>, significant association was found.

From logistic regression analysis of influence of risk factors over the 18–42 months period, we also found that at 18 months, the children who have not been weaned yet compared with already weaned children and the children who like to eat snacks while playing compared with those who do not like, are more likely to be at higher risk for developing dental caries at 42 months. At 18 months, the children have not been weaned yet are more than

the children of 30 and 42 months old who still accept breast feeding from their mothers. It means that lifestyle is not regular. It will be likely to be dental caries that sweet snack foods are given to the children. However, at 30 months, the children who had not brushing assistance by mothers and like to eat snacks while playing are most likely to have dental decay at 42 months. At 30 months and 42 months, most molar teeth have erupted and most children have been weaned. It is clear that tooth brushing and setting time for sugar consumption could be the most critical step for children. Evidently, behaviors and dietary variables will change with age. These findings also suggest that it is necessary to pay more attention to behaviors and dietary variables of mothers and children at the each age and prevent dental caries development.

In addition, we found that non setting of time for snacks and the frequency of snacks at 18 months were positively correlated with dental caries at 42 months. It is known that sugar exposure is associated with dental caries by many researchers<sup>14-17</sup>. This indicates that children who do not follow a setting time for snacks or with the frequency of snacks may have more intake of sugar and are likely to develop dental caries.

Although dental caries in this very young population, 18–42 months, is indeed prevalent, we can predict dental caries using the method of risk behaviors combining caries activity in an earlier period. Furthermore, we already have reported<sup>18</sup> that presence of cariogenic bacteria in children and caries risk level of children are significantly correlated with risk behaviors of children. We also especially speculate that increased maternal contact associated with these feeding methods are likely to lead to greater chance of infection from mother to child.

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