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Risk factors associated with early childhood caries in 18- to 23-month-old children in a Japanese city

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Abstract

Objectives: The aim of this cross-sectional study was to investigate factors associated with early childhood caries (ECC) in 18- to 23-monath-old Japanese children.

Methods: Study subjects were 2,771 children aged 18 to 23 months. A self-administered questionnaire was completed by parents or guardians of the children. The survey contents included such things as sex, birth weight, the existence of smokers in the home, maternal smoking during pregnancy, nocturnal breastfeeding, snacking habits, parents sharing of utensils with child, and socio-economic status. We obtained the number of decayed, missing, or filled teeth per person (dmft) via dental examination. Logistic regression analysis was performed to estimate odds ratio of ECC.

Results: The average number of decayed, missing and filled teeth (dmft index) was 0.11. The prevalence of dental caries was 3.2% (90/2771). Nocturnal breastfeeding habits were documented in 668 subjects (24.1%). Environmental tobacco smoke (ETS) was reported for 1,704 children (61.5%). After excluding items of multicollinearity, the results of multivariate analysis were as follows: the existence of smokers in the home, the number of smokers, nocturnal breastfeeding, breastfeeding more than or equal to 18 months, drinking or eating sweets after dinner, and high birth weight were significantly associated with the risk of ECC.

Conclusions: This study suggests that ETS from family members, nocturnal breastfeeding, prolonged breastfeeding, high birth weight, and snacking habits are correlated with ECC.

keywords: breastfeeding; environmental tobacco smoke; early childhood caries; birth weight

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I. Introduction

Early childhood caries (ECC) is a common public health problem worldwide. ECC has been defined as “the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger” [1]. The etiology of ECC is multifactorial. Heretofore, ECC has been shown to result from the transmission of bacteria from mother to child [2], daily habits such as oral hygiene practice, snacking habits, and socio-economic status [3-7].

We previously reported a significant multivariable-adjusted association between nocturnal breastfeeding and snacking habits and dental caries in 18 to 23-month-old infants both in the Tokachi area [8] and in the eastern Iburi area [9]. In other previous studies, although the age of subjects was ≧ 2 years, nocturnal breastfeeding has been identified as a risk factor for ECC [10-13]. Additionally, ECC has been shown to be associated with prolonged breastfeeding among children aged ≧ 2 years [12-17]. We previously did not investigate the duration of breastfeeding. However, the association between breastfeeding and ECC is somewhat controversial. Several studies have observed that the association between breastfeeding and ECC was insignificant among children aged ≧ 1 years [6,18-20], and the World Health Organization (WHO) has recommended

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that children be breastfed until 24 months of age [21].

We previously reported by multivariable analysis that ECC was not significantly associated with environmental tobacco smoke (ETS) from the family in 18 to 23-month-old Japanese children in the Tokachi area of Hokkaido in 2006 [8] and in the eastern Iburi area of Hokkaido in 2012 [9]. However, in most previous studies, although the age of subjects was ≧ 3 years, it was suggested that children exposed to ETS have an increased risk of dental caries in the deciduous dentition [14,22-30]. Additionally, ECC has been shown to be associated with maternal smoking during pregnancy among children aged ≧ 2 years [5,6,14]. We previously did not investigate maternal smoking during pregnancy.

Previous studies [7,31-33] have shown that birth weight was related to the increase of ECC. dos Santos Junior et al. [7] reported that the prevalence of ECC was related to low birth weight among preschoolers aged from three to four years. Conversely, Yokomichi et al. [32] reported that high birth weight was associated with an increased risk of ECC among 3-year-old Japanese children. However, there are few studies on the association between birth weight and ECC.

We aimed to identify risk factors associated with ECC in 18- to 23-month-old Japanese children by a cross-sectional study.

II. Methods

1. Subjects

The study was conducted in one city in the eastern Iburi region, located in the central part of Hokkaido, the northernmost island of Japan. The population of the city of observation in the eastern Iburi region was 173,317. The total number of subjects aged 18 to 23 months from April 2014 to February 2016 was 2,828. Among them, 2,771 (98.0%; 1,441 males and 1,330 females) received a dental examination within the examination period of April 2014 to February 2016. When children in Japan reach 18 months of age, the municipality in which the family resides sponsors a physical examination that includes a dental examination, measurement of height and weight, and an interview survey with parents or guardians regarding the child's health, in accordance with the Maternal and Child Health Act. The reason that we selected this city in this study is that it was the principal city of the area having numerous ECC in Hokkaido. This study was approved by the Ethical Committee of Sapporo Medical University on July 6, 2016.

2. Survey method

The self-administered questionnaire was completed by the parents or guardians of the children before dental examination. The questionnaire form was distributed to parents or guardians by mail beforehand and was collected on the day of the examination. After the questionnaire was completed, the data were checked by hygienists or public health nurses. We did not fill in missing values, and the data were not illogical. The dental examinations were carried out at the examination site of the municipality by 68 dentists from local dental clinics with a dental mirror under artificial light. The dentists received adequate meetings before performing the examination. They also were given detailed criteria. We obtained dmft (number of decayed, missing, and filled teeth per person) data from this dental examination. We designed this survey contents in reference to our previous studies [8,9]. The survey contents in common with our previous study [9] were whether a smoker resides in the home, the number of smokers in the home, nocturnal breastfeeding habits, snack times, drinking or eating sweets after dinner, parents brushing their child's teeth daily, and the use of fluoride toothpaste. The added contents in this survey contained items such as; sex, birth weight, socio-economic status, parents sharing of eating utensils with the child, time of starting with baby food, duration of breastfeeding, and application of 2% sodium fluoride solution. ETS was defined as having at least one smoker residing in the home and socio-economic status was defined using the family residence tax (i.e. taxation of residence tax is high socio-economic status, no tax of residence tax is low socio-economic status). The response rate of the survey was 98% (2771/2828). Figure 1 shows the distribution of study subjects by age in months. Ninety-three % (2575/2771) of study subjects were 18- to 19-month old children. Although the age of subjects was between 18 and 23 months, we did not obtain an accurate age in months for each individual subject.

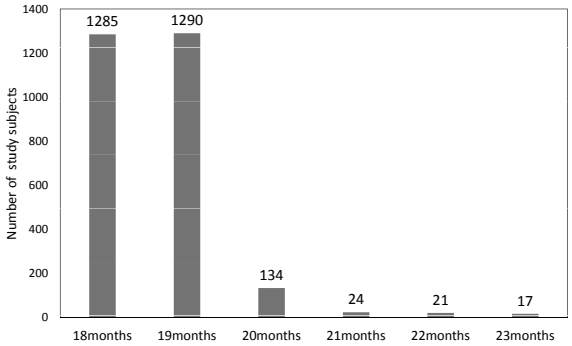

Figure 1 Distribution of study subjects by age in months

3. Analyses

The outcome variable was ECC. Risk factors for the prevalence of ECC were evaluated by univariate and multivariate analysis using a logistic regression model.

The odds ratios (ORs) and their 95% confidence intervals (CIs) were estimated with regard to risk factors for ECC. Before the multivariate logistic regression analysis was conducted, we evaluated multicollinearity among the variables using Spearman's rank correlation test. If r (the correlation coefficient) > 0.7, then we defined that there is multicollinearity. The univariate analysis excluded the study subjects with missing values. The multivariate analysis included all variables, after excluding items of multicollinearity. The data used in multivariate analysis contained only the study subjects without any missing values. The $\chi 2$ test was used for the analyses of the characteristics of study subjects by dmft. Tests of statistical significance were based on a two-sided P-value, and the α-error was set at 5%. The SAS system (ver. 9.4; SAS Institute, Cary, NC, USA) was employed for the analysis.

III. Results

Figure 2 shows distribution of study subjects according to dmft. No caries were observed 2681 infants. The

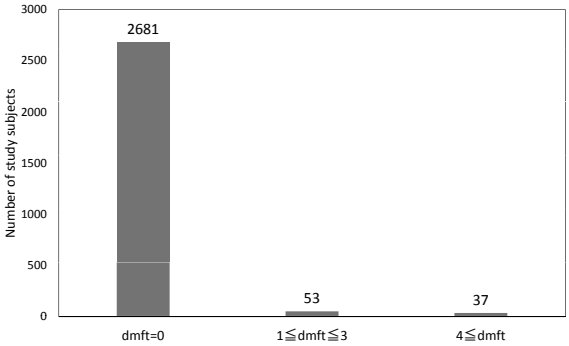

Figure 2 Distribution of study subjects according to dmft

dmft index was 0.11 (standard deviation [SD] 0.71). The prevalence of dental caries was 3.2% (90/2771). Table1 shows characteristics of study subjects by dmft. Nocturnal breastfeeding habits were documented in 668 subjects (24.1%). ETS was reported for 1,704 children (61.5%). High birth weight was reported for 29 children (1.0%). The number of children in a family in the no residence tax group was 212 (7.7%).

Table 2 shows crude and adjusted ORs with 95% CI for

Table 1 Characteristics of the study subjects by dmft

Variables		dmft ≧ 1 n(%)	dmft=0 n(%)	p-value*
Sex : Male		56(62)	1385(52)	0.049
Female		34(38)	1296(48)	
Application of 2% sodium fluoride solution : Yes		22(24)	566(21)	0.391
No		65(72)	2074(77)	
Unknown		3(3)	41(2)	
Use of fluoride toothpaste : Everyday		24(27)	738(28)	0.911
Sometaimes or Never		64(71)	1915(71)	
Unknown		2(2)	28(1)	
Drinking or eating sweets after dinner : Never		36(40)	1743(65)	<0.001
Sometimes		21(23)	501(19)	
Everyday		30(33)	403(15)	
Unknown		3(3)	34(1)	
Frequency of parents brushing child's teeth : Everyday		66(73)	2267(85)	0.002
Sometimes or never		24(27)	386(14)	
Unknown		0(0)	28(1)	
Nocturnal breastfeeding : No		49(54)	2016(75)	<0.001
Yes		40(44)	628(23)	
Unknown		1(1)	37(1)	
Duration of breastfeeding : ≦ 17 months		29(32)	1406(52)	<0.001
≧ 18 months		45(50)	689(26)	
Unknown		16(18)	586(22)	
Time of starting with baby food : ≦ 5 months		33(37)	1217(45)	0.204
6 months		42(47)	1031(38)	
≧ 7 months		9(10)	308(11)	
Unknown		6(7)	125(5)	
Snack times : Regular		30(33)	1465(55)	<0.001
Irregular		58(64)	1166(43)	
Unknown		2(2)	50(2)	
Birth weight : < 2,500g		6(7)	265(10)	0.059
2,500g ～ 3,999g		76(84)	2306(86)	
≧ 4,000g		3(3)	26(1)	
Unknown		5(6)	84(3)	
maternal smoking during pregnancy : No		66(73)	2352(88)	<0.001
Yes		24(27)	283(10)	
Unknown		0(0)	46(2)	
Smoker in family : Absence		14(16)	1013(38)	<0.001
Presence		74(82)	1630(61)	
Unknown		2(2)	38(1)	
Number of smokers in family : No smoker		14(16)	1013(38)	<0.001
One smoker		37(41)	1085(40)	
Two smokers		31(34)	453(17)	
≧ Three smokers		6(7)	93(3)	
Unknown		2(2)	37(1)	
Residence tax : Taxation		58(64)	2020(75)	<0.001
No tax		16(18)	196(7)	
Unknown		16(18)	465(17)	
Parental sharing of eating utensils with the child : Unshared		86(96)	2591(97)	0.044
Common use		4(4)	43(2)	
Unknown		0(0)	47(2)	

dmft : total number of decayed, missing or filled teeth
* : $\chi 2$ test

ECC. In the univariate analysis, drinking or eating sweets after dinner sometimes (OR 2.03; 95%CI, 1.17-3.51) or everyday (OR 3.60; 95%CI, 2.19-5.92), parents brushing their child's teeth less frequently (OR 2.14; 95%CI, 1.32-3.45), irregular snack times (OR 2.43; 95%CI, 1.55-3.80), nocturnal breastfeeding (OR 2.62, 95%CI, 1.71-4.02), breastfeeding more than or equal to 18 months (OR 3.17; 95%CI, 1.97-5.10), birth weight≧4,000g (OR 3.50; 95%CI, 1.04-11.82), maternal smoking during pregnancy (OR 3.02; 95%CI, 1.86-4.90), existence of smokers in the home (OR 3.29; 95%CI, 1.85-5.85), the number of smokers in family (one smoker: OR 2.46; 95%CI, 1.33-4.59, two smokers: OR 4.95; 95%CI, 2.61-9.40, ≧three smokers: OR 4.67; 95%CI, 1.75-12.43, We used a trend test to investigate dose-response relationship between number of smokers in the family and ECC. The result was significant (P<0.0001).), and no residence tax (OR 2.84; 95%CI, 1.60-5.04) were significantly associated with the odds ratio of ECC. Sex, use of fluoride toothpaste, application of 2% sodium fluoride solution, time of starting with baby food, and parents sharing of eating utensils with the child were not significantly associated with ECC.

As shown in Table 2, the multivariate analysis included sex, residence tax, application of 2% sodium fluoride solution, use of fluoride toothpaste, drinking or eating sweets after dinner, frequency of parents brushing child's teeth, duration of breastfeeding, time of starting with baby food, snack time, birth weight, maternal smoking during pregnancy, smoker in family and parental sharing of eating utensils with the child, after excluding items of multicollinearity. The multivariate analysis included 1,719 infants. Application of 2% sodium fluoride solution (OR 0.44; 95%CI, 0.23-0.86), drinking or eating sweets after dinner everyday (OR 3.58; 95%CI, 1.70-7.50), breastfeeding more than or equal to 18 months (OR 3.37; 95%CI, 1.83-6.20), birth weight≧4000g (OR 5.61; 95%CI, 1.14-27.69), and the existence of smokers in the home (OR 3.18; 95%CI, 1.43-7.08) were significantly associated with the odds ratio of ECC in the multivariate analysis. Sex, use of fluoride toothpaste, frequency of parents brushing child's teeth, time of starting with baby food, snack times, maternal smoking during pregnancy, residence tax, and parents sharing of eating utensils with the child were not significantly associated with ECC.

Also, we conducted a multivariable analysis using variables for nocturnal breastfeeding instead of variables for duration of breastfeeding. Nocturnal breastfeeding (OR 2.27; 95%CI, 1.32-3.91) was significantly associated with the

Table 2 Crude and adjusted odd ratios (ORs), and 95% confidence intervals (CIs) of ECC for risk factors with logistic regression analysis

Variables	Crude OR(95%CI)	p-value	Adjusted OR(95%CI)*	p-value
Sex：Male	1.00 (reference)		1.00 (reference)	
Female	0.65 (0.42-1.00)	0.050	0.63(0.34-1.16)	0.137
Application of 2% sodium fluoride solution：Yes	1.00 (reference)		1.00 (reference)	
No	0.81 (0.49-1.32)	0.391	0.44(0.23-0.86)	0.016
Use of fluoride toothpaste：Everyday	1.00 (reference)		1.00 (reference)	
Sometaimes or Never	1.03 (0.64-1.66)	0.911	0.90(0.47-1.72)	0.750
Drinking or eating sweets after dinner：Never	1.00 (reference)		1.00 (reference)	
Sometimes	2.03 (1.17-3.51)	0.011	2.01(0.94-4.28)	0.070
Everyday	3.60 (2.19-5.92)	<0.001	3.58(1.70-7.50)	<0.001
Frequency of parents brushing child's teeth：Everyday	1.00 (reference)		1.00 (reference)	
Sometimes or never	2.14 (1.32-3.45)	0.002	0.87(0.36-2.09)	0.753
Nocturnal breastfeeding：No	1.00 (reference)			
Yes	2.62 (1.71-4.02)	<0.001		
Duration of breastfeeding：≦ 17 months	1.00 (reference)		1.00 (reference)	
≧ 18 months	3.17 (1.97-5.10)	<0.001	3.37(1.83-6.20)	<0.001
Time of starting with baby food：≦ 5 months	0.67 (0.42-1.06)	0.085	0.66(0.35-1.25)	0.202
6 months	1.00 (reference)		1.00 (reference)	
≧ 7 months	0.72 (0.35-1.49)	0.373	0.58(0.19-1.73)	0.326
Snack times：Regular	1.00 (reference)		1.00 (reference)	
Irregular	2.43 (1.55-3.80)	<0.001	1.37(0.74-2.54)	0.324
Birth weight：＜ 2,500g	0.69(0.30-1.59)	0.382	0.26(0.04-1.96)	0.191
2,500g ～ 3,999g	1.00 (reference)		1.00 (reference)	
≧ 4,000g	3.50 (1.04-11.82)	0.044	5.61(1.14-27.69)	0.034
maternal smoking during pregnancy：No	1.00 (reference)		1.00 (reference)	
Yes	3.02 (1.86-4.90)	<0.001	1.31(0.53-3.21)	0.562
Smoker in family：Absence	1.00 (reference)		1.00 (reference)	
Presence	3.29 (1.85-5.85)	<0.001	3.18(1.43-7.08)	0.005
Number of smokers in family：No smoker	1.00 (reference)			
One smoker	2.46 (1.33-4.59)	0.004		
Two smokers	4.95 (2.61-9.40)	<0.001		
≧ Three smokers	4.67 (1.75-12.43)	0.002		
	(P for trend, P<0.0001)			
Residence tax：Taxation	1.00 (reference)		1.00 (reference)	
No tax	2.84 (1.60-5.04)	<0.001	1.74(0.74-4.14)	0.208
Parental sharing of eating utensils with the child：Unshared	1.00 (reference)		1.00 (reference)	
Common use	2.80 (0.98-7.98)	0.054	2.52(0.52-12.10)	0.249

*：Adjustment for sex, residence tax, application of 2% sodium fluoride solution, use of fluoride toothpaste, time of starting with baby food, drinking or eating sweets after dinner, frequency of parents brushing child's teeth, duration of breastfeeding, snack time, birth weight, maternal smoking during pregnancy, smoker in family and parental sharing of eating utensils with the child

odds ratio of ECC (not shown in table).

Furthermore, we conducted a multivariable analysis using variables for the number of smokers in a family instead of variables for the existence of smokers in the home. The number of smokers in a family (one smoker: OR 2.89; 95%CI, 1.27-6.57, two smokers: OR 4.67; 95%CI, 1.74-12.53, ≧ three smokers: not calculated, P for trend, P=0.0098) was significantly associated with the odds ratio of ECC (not shown in table).

IV. Discussion

By the Japan national data in 2015, the dmft index in 18- to 23-month-old Japanese children was 0.05 and the prevalence of dental caries was 1.8%. The caries data of these study subjects was poor compared to the national data of ECC in Japan.

Distribution of these study subjects by dmft was about the same as distribution of our previous study in the eastern Iburi area of Hokkaido in 2012 [9].

The present study found that ECC was significantly associated with nocturnal breastfeeding between the ages of 18 and 23 months. Our results confirmed that those of our previous studies showed effects of nocturnal breastfeeding on dental caries between the ages of 18 and 23 months [8,9]. Saliva flow decreases markedly during sleeping hours, which is thought to affect the mechanical self-cleansing and the buffering capacity of saliva following fermentation of cariogenic substrates [10]. Therefore, our results suggest that nocturnal breastfeeding is likely to be a risk factor for dental caries in 18- to 23- month-old Japanese children.

In this study, the prolonged breastfeeding was significantly associated with ECC between the ages of 18 and 23 months in the multivariate analysis. Although our results were similar to those of other previous studies showing significantly association between prolonged breastfeeding and ECC [12-17], the age of the subjects in other previous studies was ≧ 2 years. Therefore, our results were of particular value. In a longitudinal investigation, a significant decline over time was observed in the levels of phosphate and calcium in breast milk that help protect tooth enamel [34]. Bowen et al. [35] reported that human milk was significantly more cariogenic than cow's milk, probably because of its lower mineral content and higher level of lactose. Hence, the prolonged breastfeeding more than or equal to 18 months might contribute to caries development.

In a multivariate analysis, the existence of smokers in the home and the number of smokers in a family were significantly associated with the odds ratio of ECC. However, our results differed from the results of our previous studies among 18- to 23-month-old Japanese children [8,9]. Although our results confirmed those of other studies showing an effect of ETS exposure at home on dental caries [14,22-30], the age of subjects in other studies was ≧ 3 years. We thought that the increase in a proportion of ETS was conducive to this result (61.5% in this study, 54.8% in Tokachi area [8], 59.2% in eastern Iburi area [9]). In addition, a number of study subjects increased from 1,317 in Tokachi area [8] and 1,675 in eastern Iburi area [9] to 2,771 in this study. Regardless of the duration of ETS exposure, the present results might suggest that children exposed to ETS have an increased risk of dental caries in the deciduous dentition. Further study among children under 2 years old is needed.

Causes that influenced ETS exposure at home on pediatric dental caries are considered to be as follows: First, Preston et al. [36] reported that ETS can reduce the concentrations of ascorbates in children, even when the amount of exposure to ETS is minimal. Väänänen [37] reported that decreased vitamin C levels have been associated with the growth of cariogenic bacteria. Lindemeyer et al. [38] reported that tobacco enhances the growth of cariogenic streptococci in vitro. ETS exposure may increase cariogenic streptococci in the oral cavity of infants. Secondly, Leory et al. [26] reported that children raised by parents who smoked, brushed their teeth less frequently, received less help with tooth brushing, and consumed more in between meals and nightly beverage may have had poor oral hygiene and were more likely to have dental caries. However, we found a relationship between ETS exposure at home and ECC even after controlling for oral hygiene and snacking habits in this study. Third, ETS is known to increase inflammation of the respiratory tract, producing symptoms of various clinical conditions, including allergic rhinitis, which frequently causes mouth breathing and thus results in dry mouth and increased caries susceptibility [23].

In this study, high birth weight was significantly associated with ECC in the multivariate analysis. The results of this study were in accordance with some previous studies [32,33]. However, in other studies, the age of the subjects was ≧3 years. Our study investigated 18- to -23-month-old children. To our knowledge, there are no other studies similar to our own that have investigated children under 2 years old. The mechanism underlying the formation of caries after exposure to intrauterine over-nutrition is not yet understood. Hoegsberg et al. [39] reported that a subset of macrosomic infants have hyperinsulinemia. As hyperinsulinemia causes an increased appetite, the primary teeth of high birth weight children may be more frequently exposed to cariogenic food and drink.

This study found that ECC was not significantly associated with parental sharing of eating utensils with the child. Milgrom et al. [40] found no significant association between maternal sharing of utensils and the presence of white spot lesions or enamel cavitation in the offspring in 6- to 36-month-old children. Wakaguri et al. [41] reported that multivariate logistic regression analysis did not show any significant association between behaviour to prevent vertical transmission and caries experience in 3-year-old Japanese children. However, the association between parental sharing of utensils with child and ECC is controversial. Cogulu et al. [41] reported that children with maternal sharing of utensils trended to have higher rates of caries by longitudinal study. Further study among children under 2 years old is needed.

In present study, frequent drinking or eating of sweets after dinner was significantly associated with ECC. We previously reported a significant multivariable-adjusted association between frequent drinking or eating of sweets after dinner and dental caries in 18 to 23-month-old infants in the eastern Iburi area of Hokkaido in 2012 [9]. Subsequently, we obtained a similar result in one city of eastern Iburi area of Hokkaido in this survey. Therefore, our results suggest that frequent drinking or eating of sweets after dinner is likely to be a risk factor for dental caries in 18- to 23-month-old Japanese children.

In this study, children who experienced the application of a 2% sodium fluoride solution had more dental caries compared to children who did not have the sodium fluoride application. One city in the eastern Iburi area of Hokkaido did not conduct a public service project for the application of a 2% sodium fluoride solution. Therefore, children might receive the application of a 2% sodium fluoride solution at dental clinics when children had a dental caries.

There were some limitations to our study. First, the data on dental caries used in the present study were gathered during routine examinations by dentists at local dental clinics. The dentists were given detailed criteria for performing the examination but were not specifically trained so as to ensure standardization of their examinations. Second, although the age of subjects was between 18 and 23 months, we did not obtain an accurate age in months for each individual subject. Incidence of dental caries likely increases with age, so the age in months has potential influence on the occurrence of dental caries of infants. Third, because the sample size of dmft > 0 was insufficient, some of the significant findings should be carefully interpreted. Fourth, there were missing values in this study. The largest rate of missing value was 21.7%. However, there were no missing values in the outcome variable.

In conclusion, this study suggests a significant association of the existence of the smokers in the home, the number of smokers in the home, nocturnal breastfeeding, prolonged breastfeeding, high birth weight, and snacking habits with the prevalence of dental caries among 18- to 23-month-old Japanese children after adjusting for potential confounders such as socio-economic status. We need to highlight that these results are available for oral health guidance or health promotion planning such as efforts against passive smoking for one city in the eastern Iburi region of Hokkaido prefecture.

Acknowledgements

The authors claim no conflicts of interest.

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18 ～ 23 ヶ月の小児におけるう蝕のリスク因子の検討

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抄録

目的：この研究の目的は，断面調査によって，日本の18～23ヶ月児の低年齢小児う蝕（ECC）と関連する要因を調査することである．

方法：研究対象者は，18～23ヶ月児の2,771人であった．質問調査は，保護者が回答した．調査項目は，性別，出生児体重，家庭内での喫煙者，妊娠中の母親の喫煙，夜間授乳，間食習慣，食具の共用，社会経済状況などであった．う蝕経験歯数（dmft）は，1歳6ヶ月児歯科健康診査から入手した．分析は，ロジスティック回帰分析を用いた．

結果：一人経験う蝕経験歯数（dmft index）は0.11本で，う蝕有病者率は3.2％であった．夜間授乳の習慣のある児は668人（24.1％）であった．環境たばこ煙（ETS）にさらされている児は1,704人（61.5％）であった．多変量解析の結果，う蝕と関連のあった要因は，家庭内喫煙者の存在，喫煙者人数，夜間授乳，授乳期間が18ヶ月以上，夕食後の甘い飲み物やおやつの飲食，出生時体重が4000g以上であった．

結論：この研究は，夜間授乳，長期間の授乳，家族からの環境たばこ煙，出生時体重が高体重，間食習慣がう蝕と関連性があることを示している．今回の結果は，東胆振地域の市の歯科保健指導や受動喫煙対策に役立てられるだろう．

キーワード：授乳，環境たばこ煙，幼児う蝕，出生時体重