Scientific Research Report

Feeding Practices and Early Childhood Caries in Korean Preschool Children

You Hyun Park a, Yoon Young Choi b*

a Department of Biostatistics, Graduate School, Yonsei University, Korea
b Artificial Intelligence Big Data Medical Center, Yonsei University Wonju College of Medicine, Wonju, Korea

ARTICLE INFO

Article history:
Received 14 January 2021
Received in revised form 2 July 2021
Accepted 5 July 2021
Available online 28 August 2021

Key words:
Breast-feeding
Early childhood caries
Feeding practices
Formula-feeding

ABSTRACT

Objectives: This study aimed to investigate the association between feeding practices and early childhood caries using representative Korean national survey data.

Methods: Data of 2772 children (aged 1-3 years) from the fourth to seventh Korean National Health and Nutrition Examination Surveys (2007-2018) were analysed. Data on decayed-filled teeth (dft) were obtained, and early childhood caries was determined as dft ≥ 1. Chi-squared test was performed to examine the experiencing of dental caries by participant characteristics, whilst analysis of variance was performed to compare the difference in dft values amongst the 3 groups (breast-feeding, mixed-feeding, and formula-feeding groups). Logistic regression analysis was performed to evaluate the association between feeding practice and early childhood caries.

Results: Comparison of the mean dft values amongst the 3 groups showed the highest value in the breast-feeding group. Multiple logistic regression analysis results showed that the likelihood of experiencing dental caries was significantly lower in the mixed-feeding group than in the breast-feeding group, whereas no significant difference was seen between the formula-feeding and breast-feeding groups. The likelihood of early childhood caries was higher in the group that introduced weaning food at ≥6 months than that at 4- to 6-month age, whilst the introduction of cow’s milk and use of nutritional supplements had no significant association with the likelihood of early childhood caries.

Conclusions: Breast-feeding and delayed introduction of weaning food were associated with a higher likelihood of early childhood caries.

© 2021 The Authors. Published by Elsevier Inc. on behalf of FDI World Dental Federation.
This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

Introduction

A healthy oral environment during early childhood is very important for lifelong oral health.1 Early childhood caries (ECC) is one of the most prevalent oral diseases during early childhood that causes discomfort, pain, and nutritional imbalance, ultimately leading to a decline in the quality of life of the child.2 ECC is defined as the presence of 1 or more decayed, missing, or filled tooth surfaces in any primary tooth in a child younger than 6 years.3 According to a Korean survey in 2018,4 68.5% of children aged 5 years had experienced ECC. The prevalence of ECC was 33.9%, and the average number of decayed and filled primary teeth (dft) was 3.43. The percentage of children with ECC showed a sharp decreasing trend until the early 2000s, but since 2016 this decrease has stopped. Moreover, the average dft has shown an increasing trend, which is very concerning.4

Factors associated with ECC that have been studied include genetic factors,5 birth weight,6 socioeconomic status,7 familial factors,8 level of parental oral health care knowledge,9 and exposure to environmental tobacco smoke.10 Feeding practices also have a very important influence on the incidence of ECC, as does sugar intake, frequency of consuming ultra-processed foods,11 mode of feeding,12 and feeding frequency.13 However, the conclusions reached have not been consistent amongst studies; for example, various studies on the effects of breast-feeding on ECC have reported contradictory conclusions. Whilst some studies reported that ECC occurred more frequently with breast-feeding,14-17 some reached a contradictory conclusion,18-20 whilst others reported no significant difference in ECC between the breast-
fed and formula-fed groups. A recent systematic review on the association between breast-feeding and ECC reported that a definitive conclusion could not be reached since existing studies reporting results that differed markedly from each other. Therefore, a consensus has not been reached on the factors associated with ECC, and this may be due to difficulties in obtaining high-quality data from young children regarding their oral health. The Korea National Health and Nutrition Examination Survey (KNHANES) data are representative of the population and are important for studying ECC. However, there have been very few studies on the association between ECC and feeding practices based on these data. Therefore, this study aimed to investigate the feeding practices associated with ECC using the KNHANES data.

Methods

Participants

KNHANES is conducted every 3 years; it uses a 2-stage stratified cluster sampling method based on census data to select 20 sample households per enumeration district, and the members of the selected households are the study population. The present study selected data of young children aged 1 to 3 years amongst the study population of the fourth through the seventh KNHANES (2007-2018). From a total of 3284 children, 512 with missing study variables were excluded, leaving data from a total of 2772 children for analysis. Written informed consent was obtained from all KNHANES participants and/or their legal guardians. All data analyses and study procedures were performed with approval from the Public Institutional Review Board committee designated by the Ministry of Health and Welfare, Korea (P01–202,002–21–002) and conducted according to the World Medical Association Declaration of Helsinki.

Variables

Based on the responses to the questionnaire, the included demographic characteristics were age, sex, and household income, whilst tooth brushing frequency and regular dental checkup were the oral hygiene care-related characteristics. Data on the mode of feeding, introduction of weaning food, introduction of cow’s milk, and use of nutritional supplements were included as feeding practice-related variables from the responses to the questionnaire. The mode of feeding was divided into breast-feeding, mixed-feeding, and formula-feeding, whilst the introduction of weaning food was divided into timely introduction (4-6 months old) and delayed introduction (≥6 months old) groups. Introduction to cow’s milk was divided into <12, 12-17, and ≥18 months old, whilst the use of vitamin/mineral, probiotic, and other nutritional supplements was divided based on the response into “yes” or “no” groups. The participants’ dental caries status was determined based on the results of the oral health examination performed by dentists who participated as investigators. The participants were divided into non-ECC (dft = 0) and ECC experience (dft ≥ 1) groups.

Data analysis

Chi-squared test was performed to examine the distribution of ECC according to the characteristics of the participants, whilst analysis of variance (ANOVA) and independent t test were performed to compare the difference in dft values between the groups. Simple logistic regression analysis was performed to determine whether feeding practice or other potential risk factors were related to the presence or absence of ECC experience. In addition, a multiple logistic regression model was constructed using the presence or absence of ECC experience as a dependent variable and all other variables used in this study as independent variables, whilst subgroup analyses were performed stratified by sex. All statistical analyses were performed using SAS 9.4 (SAS Institute Inc.) with a statistical significance level of α = 0.05.

Results

Amongst the participants with dft ≥ 1, the percentages of children aged 1, 2, and 3 years were 5.7%, 30.9%, and 63.4%, respectively, and most (57.9%) were boys (Table 1). In addition, 37.6% of the ECC experience group were breast-fed, whilst 26.0% of the non-ECC group were breast-fed (P < .001). The mean dft values amongst children aged 3 years were higher than those of children aged 1 and 2 years (P < .001; Table 2), and those of boys were significantly higher than those for girls (P < .01). The mean dft differed significantly, with 0.62 ± 1.56, 0.35 ± 1.28, and 0.48 ± 1.33 in the breast-fed, mixed-fed, and formula-fed groups, respectively (P < .001), and was lower when weaning food was introduced between 4 and 6 months of age than when introduced later (P < .01). Significant differences also occurred with the introduction of cow’s milk at 12 to 17 months, with a lower mean dft than in the other groups (P < .001). By use of vitamin/mineral supplements, a higher mean dft value was observed amongst those who used nutritional supplements than those who did not (P < .01).

Comparison of differences in the distribution by mode of feeding amongst participants (Table 3) showed that boys were less frequently breast-fed than girls (P < .01); the formula-fed group experienced the most delayed introduction of weaning food compared with the other 2 groups (P < .001), and in this group, children were more likely to be introduced to cow’s milk at ≥18 months of age (P < .01).

Simple (Figure 1) and multiple logistic regression analyses (Figure 2) showing factors associated with ECC experience showed similar results. According to the multiple regression model (Figure 2), the likelihood of ECC experience was lower in girls than in boys (adjusted odds ratio [aOR], 0.78; 95% confidence interval [CI], 0.62-0.97). Those who received regular dental checkups showed a higher likelihood of ECC than those who did not. The mixed-fed group showed a significantly lower risk of ECC than the breast-fed group (aOR, 0.53; 95% CI, 0.41-0.67), whilst the formula-fed
Table 1 – Demographic characteristics, oral hygiene care, and feeding practices related to early childhood caries experience.

| Variables                        | dft ≥ 1 (n = 404) | dft = 0 (n = 2368) | P value* |
|----------------------------------|-------------------|--------------------|----------|
| **Age, y**                       |                   |                    |          |
| 1                                | 23                | 817                | 34.5     | <.001 |
| 2                                | 125               | 854                | 36.1     |       |
| 3                                | 256               | 697                | 29.4     |       |
| **Sex**                          |                   |                    |          |
| Boys                             | 234               | 1206               | 50.9     | .009  |
| Girls                            | 170               | 1162               | 49.1     |       |
| **Household income**             |                   |                    |          |
| Low                              | 36                | 134                | 5.7      | .025  |
| Low-medium                       | 136               | 751                | 31.7     |       |
| High-medium                      | 131               | 901                | 38.0     |       |
| High                             | 101               | 582                | 24.6     |       |
| **Tooth-brushing frequency**     |                   |                    |          |
| ≤1/d                             | 97                | 765                | 32.3     | .004  |
| 2/d                              | 151               | 812                | 34.3     |       |
| ≥3/d                             | 156               | 791                | 33.4     |       |
| **Dental checkup**               |                   |                    |          |
| No                               | 215               | 1674               | 70.7     | <.001 |
| Yes                              | 189               | 694                | 29.3     |       |
| **Mode of feeding**              |                   |                    |          |
| Breast-feeding                   | 152               | 616                | 26.0     | <.001 |
| Mixed-feeding                    | 205               | 1518               | 64.1     |       |
| Formula-feeding                  | 47                | 234                | 9.9      |       |
| **Introduction of weaning food** |                   |                    |          |
| 4-6 months old                   | 271               | 1788               | 75.5     | <.001 |
| ≥6 months old                    | 133               | 580                | 24.5     |       |
| **Introduction of cow’s milk**   |                   |                    |          |
| <12 months old                   | 25                | 145                | 6.1      | <.001 |
| 12-17 months old                 | 280               | 1846               | 78.0     |       |
| ≥18 months old                   | 99                | 377                | 15.9     |       |
| **Vitamin and mineral supplement**|                 |                    |          |
| No                               | 311               | 1899               | 80.2     | .138  |
| Yes                              | 93                | 469                | 19.8     |       |
| **Probiotic supplement**         |                   |                    |          |
| No                               | 314               | 1755               | 74.1     | .123  |
| Yes                              | 90                | 613                | 25.9     |       |
| **Other nutritional supplement** |                   |                    |          |
| No                               | 379               | 2188               | 92.4     | .316  |
| Yes                              | 25                | 180                | 7.6      |       |

dft, decayed-filled teeth.
* P value derived using the Chi-squared test.

Table 2 – Comparison of dft values according to the characteristics of participants.

| Variables                        | n      | Mean | SD   | P value* |
|----------------------------------|--------|------|------|----------|
| **Age, y**                       |        |      |      |          |
| 1                                | 840    | 0.08 | 0.55 | <.001    |
| 2                                | 979    | 0.34 | 1.19 |          |
| 3                                | 953    | 0.85 | 1.86 |          |
| **Sex**                          |        |      |      |          |
| Boys                             | 1440   | 0.52 | 1.54 | <.001    |
| Girls                            | 1332   | 0.35 | 1.16 |          |
| **Household income**             |        |      |      |          |
| Low                              | 170    | 0.52 | 1.31 | .328     |
| Low-medium                       | 887    | 0.49 | 1.49 |          |
| High-medium                      | 1032   | 0.39 | 1.33 |          |
| High                             | 683    | 0.41 | 1.30 |          |
| **Tooth-brushing frequency**     |        |      |      |          |
| ≤1/d                             | 862    | 0.33 | 1.19 | .012     |
| 2/d                              | 963    | 0.45 | 1.26 |          |
| ≥3/d                             | 947    | 0.52 | 1.62 |          |
| **Dental checkup**               |        |      |      |          |
| No                               | 1889   | 0.32 | 1.18 | <.001    |
| Yes                              | 883    | 0.69 | 1.69 |          |
| **Mode of feeding**              |        |      |      |          |
| Breast-feeding                   | 768    | 0.62 | 1.56 | <.001    |
| Mixed-feeding                    | 1723   | 0.35 | 1.28 |          |
| Formula-feeding                  | 281    | 0.48 | 1.33 |          |
| **Introduction of weaning food** |        |      |      |          |
| 4-6 months old                   | 2059   | 0.39 | 1.26 | .001     |
| ≥6 months old                    | 713    | 0.58 | 1.65 |          |
| **Introduction of cow’s milk**   |        |      |      |          |
| <12 months old                   | 170    | 0.46 | 1.48 | <.001    |
| 12-17 months old                 | 2126   | 0.37 | 1.20 |          |
| ≥18 months old                   | 476    | 0.72 | 1.92 |          |
| **Vitamin and mineral supplement**|      |      |      |          |
| No                               | 2210   | 0.40 | 1.29 | .004     |
| Yes                              | 562    | 0.59 | 1.67 |          |
| **Probiotic supplement**         |        |      |      |          |
| No                               | 2069   | 0.46 | 1.44 | .103     |
| Yes                              | 703    | 0.36 | 1.17 |          |
| **Other nutritional supplement** |        |      |      |          |
| No                               | 2567   | 0.44 | 1.40 | .260     |
| Yes                              | 205    | 0.33 | 1.07 |          |

dft, decayed-filled teeth; SD, standard deviation.
* P value derived using the analysis of variance and independent t test.
group showed a nonsignificant result (aOR, 0.71; 95% CI, 0.48-1.04). The group with delayed introduction of weaning food showed a higher likelihood of ECC than the group with timely introduction of weaning food (aOR, 1.37; 95% CI, 1.07-1.75), whilst the introduction of cow’s milk and the use of nutritional supplements did not show a significant association. The area under the receiver operating characteristic curve, which indicates the accuracy of the model, was 0.77 (Appendix Figure S1).

Table 3 – Mode of feeding according to the characteristics of participants.

| Variables                        | Breast-feeding (n = 768) | Mixed-feeding (n = 1723) | Formula-feeding (n = 281) | P value* |
|----------------------------------|--------------------------|--------------------------|---------------------------|----------|
| Age, y                           |                          |                          |                           |          |
| 1                                | 238 (31.0)               | 527 (30.6)               | 75 (26.7)                 | .338     |
| 2                                | 253 (32.9)               | 621 (36.0)               | 105 (37.4)                |          |
| 3                                | 277 (36.1)               | 575 (33.4)               | 101 (35.9)                |          |
| Sex                              |                          |                          |                           |          |
| Boys                             | 360 (46.9)               | 936 (54.3)               | 144 (51.2)                | .003     |
| Girls                            | 408 (53.1)               | 787 (45.7)               | 137 (48.8)                |          |
| Household income                 |                          |                          |                           |          |
| Low                              | 41 (5.3)                 | 103 (6.0)                | 26 (9.3)                  | .001     |
| Low-medium                       | 249 (32.4)               | 526 (30.5)               | 112 (39.9)                |          |
| High-medium                      | 308 (40.1)               | 637 (37.0)               | 87 (31.0)                 |          |
| High                             | 170 (22.1)               | 457 (26.5)               | 56 (19.9)                 |          |
| Tooth-brushing frequency         | ≤1/d                    | 240 (31.3)               | 520 (30.2)                | .246     |
|                                   | 2/d                     | 274 (35.7)               | 595 (34.5)                |          |
|                                   | ≥3/d                    | 254 (33.1)               | 608 (35.3)                |          |
| Dental checkup                   | No                      | 496 (64.6)               | 1192 (69.2)               | .033     |
|                                   | Yes                     | 272 (35.4)               | 531 (30.8)                |          |
| Introduction of weaning food     | ≤6 months old           | 592 (77.1)               | 1291 (74.9)               | <.001    |
|                                   | >6 months old           | 176 (22.9)               | 432 (25.1)                |          |
| Introduction of cow’s milk       | <12 months old          | 64 (8.3)                 | 94 (5.5)                  | .001     |
|                                   | 12-17 months old        | 595 (77.5)               | 1325 (76.9)               |          |
|                                   | ≥18 months old          | 109 (14.2)               | 304 (17.6)                |          |
| Vitamin and mineral supplement   | No                      | 587 (76.4)               | 1399 (81.2)               | .024     |
|                                   | Yes                     | 181 (23.6)               | 324 (18.8)                |          |
| Probiotic supplement             | No                      | 661 (86.1)               | 1201 (69.7)               | <.001    |
|                                   | Yes                     | 107 (13.9)               | 522 (30.3)                |          |
| Other nutritional supplement     | No                      | 726 (94.5)               | 1584 (91.9)               | .054     |
|                                   | Yes                     | 42 (5.5)                 | 139 (8.1)                 |          |

* P value derived using the Chi-squared test.

Fig. 1 – Simple logistic regression analysis of potentially related factors of early childhood caries experience.

Discussion

To investigate the epidemiological association between feeding practice and ECC amongst young children, the present study analysed the 2007-2018 KNHANES data of children aged 1 to 3 years. Tinanoff et al. extracted data from 72 worldwide studies between 1998 and 2018, and mean ECC prevalence from these 72 reports for 1, 2-, and 3-year-olds was 17%, 36%, and 43%, respectively. The rates of children with dft ≥1 in our study participants of the same age were 2.7%, 12.8%, and 26.9%, which were low compared to the results of Tinanoff et al. This may be a regional difference, but as ECC is
decreasing, our results may be lower than those based on 1998-2018 data.

Tooth brushing is an important related factor in the development of ECC; therefore, it was selected as a confounding variable in this study. A Swedish study reported tooth-brushing behaviour in 336 children and reported that 77.3% of the 2-year-olds had their teeth brushed more than twice a day; this is similar to the 68.9% observed in our study. One study reported that 57.4% of the respondents had their teeth brushed more than once a day, whilst yet another study reported that only 29.1% of the participants had their teeth brushed more than twice a day; these data indicate large regional differences in tooth-brushing behaviours.

According to the multiple logistic regression model with the inclusion of all variables, girls showed a lower likelihood of ECC than boys, and higher household income was associated with a lower likelihood of ECC, which was consistent with the results of a previous study. Tooth brushing frequency did not have a significant association with ECC, whilst those who had regular dental checkups had a higher likelihood of experiencing ECC. However, it would be inappropriate to interpret these results to mean that tooth brushing frequency was not associated with ECC experience or that frequent dental checkups increase the likelihood of ECC. In fact, children who experienced dental caries may have been more receptive to tooth brushing and undergoing dental checkups, and there is a very strong likelihood that this assumption may be reflected in the findings of the present study. A previous study showed a higher percentage of dental visits for checkups in the ECC group than in the caries-free group.

Those with a timely introduction to weaning food (4-6 months old) showed a lower likelihood of ECC than those with a delayed introduction, which is consistent with the results of a previous study. On the other hand, the introduction of cow’s milk and the use of nutritional supplements showed no significant association with ECC experience. The mixed-feeding group showed a significantly lower likelihood of ECC than the breast-feeding group. Moreover, the mean df/t value was also highest in the breast-fed group, followed by the formula-fed and mixed-fed groups. Previous studies have reported varying conclusions about the association between breast-feeding and ECC and, recently, some epidemiological studies have reported that breast-feeding is associated with a higher likelihood of dental caries. A Chinese national survey conducted in 2018 revealed a higher prevalence of dental caries amongst breast-fed children than amongst the mixed-fed group. Similarly, a longitudinal study conducted in Japan in 2015 revealed a higher risk of dental caries in young children who were exclusively or predominantly breast-fed. Other recent studies pointed out that prolonged breast-feeding of ≥12 months could be a risk factor for dental caries. Based on this evidence, the British Society of Paediatric Dentistry published its position statement in 2018, which included content about the potential link between dental caries and prolonged breast-feeding of ≥12 months, especially nighttime breast-feeding.

Breast-feeding is beneficial to the systemic health of young children; thus, it is actively recommended by the WHO. A previous experimental study reported that the cariogenicity of breast milk was lower than that of formula and, according to this, breast milk itself does not have a negative effect on dental hard tissues. Nevertheless, our study found that breast-feeding groups had a higher risk of ECC. This may be because the time spent breast-feeding is longer than bottle-feeding, and the daily feeding frequency was more than with bottle-feeding. Moreover, children often fall asleep during breast-feeding, which could also be a cause of increased risk of ECC. Therefore, it is necessary for clinicians to recommend education on proper feeding and oral hygiene care methods as well as regular dental checkups for parents of breast-fed children.

The limitations of the present study included its cross-sectional design; the causal relationship between feeding practice and ECC could therefore not be inferred. The variables investigated were limited; therefore, not controlling for some confounding factors (such as sugar intake, fluoride intake, use of fluoride toothpaste, systemic disease, and medication status) could also be a limitation. Despite such limitations, the significance of the present study was that it investigated...
the association between feeding practice and ECC using highly representative national survey data. Prospective studies using big data are needed in the future to identify the causal relationship between these two factors. In addition, consideration should be given to measures that can promote the prevention of ECC by developing appropriate guidelines for the feeding practices of young children.

Conclusions

The findings in the present study showed that the breast-fed group had a higher likelihood of experiencing ECC. The group with delayed introduction of weaning food showed a higher rate of dental caries experience, whilst the introduction of cow’s milk and the use of nutritional supplements did not show a significant association with ECC.

Conflict of interest

None disclosed.

Funding

This research was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF) which was funded by the Ministry of Education (2020R1I1A1A01065882).

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.identj.2021.07.001.

REFERENCES

1. Pearce M, Thomson W, Walls A, Steele J. Lifecourse socio-economic mobility and oral health in middle age. J Dent Res 2009;88:938–41.
2. Martins-Júnior P, Vieira-Andrade R, Corrêa-Faria P, et al. Impact of early childhood caries on the oral health-related quality of life of preschool children and their parents. Caries Res 2013;47:211–8.
3. Drury TF, Horowitz AM, Ismail AI, et al. Diagnosing and reporting early childhood caries for research purposes: a report of a workshop sponsored by the National Institute of Dental and Craniofacial Research, the Health Resources and Services Administration, and the Health Care Financing Administration. J Public Health Dent 1999;59:192–7.
4. Ministry of Health and Welfare. 2018 Korean children’s oral health survey. Sejong: Ministry of Health & Welfare; 2018.
5. Abbasoglu Z, Bussanelli DG, Tanboga I, et al. Fine-mapping of Xq25. 1–27.2 shows association of early childhood caries with genetic variants depending on dietary habits, protecting children who drink milk before going to bed. Caries Res 2019;53:333–8.
6. da Silva Castro CR, de Sousa Cabral MB, Mota EL, et al. Analysis of the influence of low birth weight on the time of eruption of dental caries in children in early childhood. J Public Health Dent 2019;79:292–7.
7. Edelstein BL. Solving the problem of early childhood caries: a challenge for us all. Arch Pediatr Adolesc Med 2009;163:667–8.
8. Boustedt K, Roswall J, Twetman S, et al. Influence of mode of delivery, family and nursing determinants on early childhood caries development: a prospective cohort study. Acta Odontol Scand 2018;76:595–9.
9. Nahabri N, Chhabra A. Parental knowledge, attitudes and cultural beliefs regarding oral health and dental care of preschool children in an Indian population: a quantitative study. Eur Arch Paediatr Dent 2012;13:76–82.
10. Drummond B, Milne T, Cullinan M, et al. Effects of environmental tobacco smoke on the oral health of preschool children. Eur Arch Paediatr Dent 2017;18:393–8.
11. de Souza MS, dos Santos Vaz J, Martins-Silva T, et al. Ultra-processed foods and early childhood caries in 0–3-year-olds enrolled at primary healthcare centers in Southern Brazil. Public Health Nutr 2020;1–9 Online ahead of print. doi: 10.1017/S1368980020002839.
12. Hu S, Sim YF, Toh JY, et al. Infant dietary patterns and early childhood caries in a multi-ethnic Asian cohort. Sci Rep 2019;9:1–8.
13. Feldens CA, Rodrigues PH, de Anastácio G, et al. Feeding frequency in infancy and dental caries in childhood: a prospective cohort study. Int Dent J 2018;68:113–21.
14. Du MQ, Li Z, Jiang H, et al. Dental caries status and its associated factors among 3-to 5-year-old children in China: a National Survey. Chin J Dent Res 2018;21:167–79.
15. Kato T, Yorifuji T, Yamakawa M, et al. Association of breast feeding with early childhood dental caries: Japanese population-based study. BMJ Open 2015;5:e006982.
16. Peres KG, Nascimento G, Peres MA, et al. Impact of prolonged breastfeeding on dental caries: a population-based birth cohort study. Pediatrics 2017;140:e20162943.
17. Cui L, Li X, Tian Y, et al. Breastfeeding and early childhood caries: a meta-analysis of observational studies. Asia Pacific J Clin Nutr 2017;26:867.
18. Al-Dashti A, Williams S, Curzon M. Breast feeding, bottle feeding and dental caries in Kuwait, a country with low-fluoride levels in the water supply. Community Dent Health 1995;12:42–7.
19. Du M, Guo L, Holt R, et al. Caries patterns and their relationship to infant feeding and socio-economic status in 2–4-year-old Chinese children. Int J Dent 2000;50:385–9.
20. Qadri G, Nourallah A, Splieth CH. Early childhood caries: a meta-analysis of observational studies. Asia Pacific J Clin Nutr 2017;26:867.
21. Devenish G, Mukhtar A, Regley A, et al. Early childhood feeding practices and dental caries among Australian preschoolers. Am J Clin Nutr 2020;111:821–8.
22. Branger B, Camelot F, Droz D, et al. Breastfeeding and early childhood caries. Review of the literature, recommendations, and prevention. Arch Pediatr 2019;26:497–503.
23. Agostoni C, Decsi T, Fewtrell M, et al. Complementary feeding: a commentary by the ESPGHAN Committee on Nutrition. J Pediatr Gastroenterol Nutr 2008;46:99–110.
24. Kim YH, Lee SG, Kim SH, et al. Nutritional status of Korean toddlers: from the Korean National Health and Nutrition Examination Survey 2007–2009. Pediatr Gastroenterol Hepatol Nutr 2011;14:61–70.
27. Boustedt K, Dahlgren J, Twetman S, Roswall J. Tooth brushing habits and prevalence of early childhood caries: a prospective cohort study. Eur Arch Paediatr Dent 2020;21:155–9.
28. AlMarshad LK, Wyne AH, AlJobair AM. Early childhood caries prevalence and associated risk factors among Saudi preschool children in Riyadh. Saudi Dent J 2021 Epub 2021 Apr 21.
29. Sun HB, Zhang W, Zhou XB. Risk factors associated with early childhood caries. Chin J Dent Res 2017;20:97–104.
30. Yon M, Shin HS, Lee HS. Relationship between complementary feeding introduction and early childhood caries: results from the Korea National Health and Nutrition Examination Survey 2008–2015. Korean J Community Nutr 2019;24:97–105.

31. Street L. New advice on feeding and weaning babies to reduce tooth decay risk. Br Dent J 2018;24:399.
32. Horta BL, Victora CG. Long-term effects of breastfeeding. Geneva: World Health Organization; 2013,:74.
33. Signori C, Hartwig AD, da Silva-Júnior IF, et al. The role of human milk and sucrose on cariogenicity of microcosm biofilms. Braz Oral Res 2018;32:e109.
34. Stephen A, Krishnan R, Chalakkal P. The association between cariogenic factors and the occurrence of early childhood caries in children from Salem district of India. J Clin Diagn Res 2017;11:ZC63–6.