Avicenna J Dent Res. 2017 September; 9(3):e13247. doi: 10.5812/ajdr.13247.

Published online 2017 May 20. **Research Article**

Association Between Dental Caries in Primary Dentition with Low Birth Weight and Premature Birth: A Case-Control Study

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Received 2015 August 27; **Revised** 2017 February 14; **Accepted** 2017 March 13.

Abstract

Objectives: Since earlier studies on the association between dental caries with birth problems are very controversial, this study assessed the potential association between DMFT index with low birth and preterm birth.
Methods: In this matched case-control study, 150 children were divided into 75 case (premature birth and low birth weight) and 75 control subjects. The 2 groups were balanced according to age, gender, socioeconomic statuses (including mother's and father's education, family size, district of residence, and type of the kindergarten), mother's job (yes/no), common types of diets during the first 2 years of life, brushing, dental visits, being right-handed or left-handed, and fluoride therapy. The DMFT of children were assessed by a dental student. Their gestational age at birth and birth weight were asked from their parents. The effects of the factors premature birth (less than 37 weeks) and low birth weight (less than 2500 gm) on DMFT were assessed using Chi-square test (α = 0.05).
Results: The 2 groups did not have any significant differences regarding the balanced characteristics. We did not detect a statistically significant result between case children with DMFT > 2 and low-birth weight (P = 0.065) defined as weights $\leq$ 2500 gm or > 2500 gm (P = 0.174). This study also failed to find a significant result regarding gestational age and DMFT (P = 0.480).
Conclusions: This study did not detect significant associations between low birth weight or preterm birth and DMFT values in primary dentition.

Keywords: Low Birth Weight, Preterm Birth (Premature Birth), Dental Caries, dmft

1. Background

Oral health is essential to general health maintenance (1, 2). Many children suffer from poor general health conditions due to uncontrolled dental caries (1). Mastication increases the efficiency of digestive enzymes and gastric emptying (2-5). A poor masticatory performance might lead to malnutrition (2, 3). A complex structure comprising neuromuscular system, proprioceptive feedback, temporomandibular joint, tongue, and the occlusal surfaces of posterior teeth are responsible for grinding food (2-4, 6). Dental decays are one of the most common pediatric problems (1, 7, 8). It is a multifactorial disease with a strong tie to many conditions such as dental hygiene, dietary habits, socioeconomic status, water fluoride, and oral bacteria (9). Dental caries have serious consequences such as pain, infection, tooth loss, and dysfunction of masticatory system, which can negatively affect development and health (10). Considering the importance of deciduous teeth in proper nutrition, development of speech skills, esthetics, and most importantly maintaining the necessary space for eruption of permanent dentition, their early loss in the childhood period can be a serious failure in establishing proper health and development of the child (11).

A predisposing factor for increased rate of dental caries can be premature birth (11, 12), which together, with low birth weight, accounts for about 6% - 7% of childbirth cases (12-14). Considering the inevitable side effects of dental caries in primary dentition, it is of significant importance to study its risk factors. Previous studies have evaluated low birth weight and preterm birth as predisposing factors for the development of caries. Low birth weight is suggested to perhaps be associated with enamel defects such as hypomineralization and hypoplasia, possibly causing facilitation of streptococci mutans colonization and increases in dental plaque (7), which can destroy enamel structure (15). Nevertheless, previous studies are highly controversial. Some studies indicate the link between low

birth weight and dental caries (7, 9, 16-18), while some studies reported insignificant association (12, 14, 15, 19, 20). Besides, previous studies did not assess premature birth and low birth weight as separate variables (7, 9, 12, 14-20). Therefore, this study was conducted to test whether children with higher caries rates have had lower birth weights and premature births or not.

2. Methods

This case-control study was done on 150 children (75 controls and 75 cases, matched according to several criteria) attending 15 kindergarten schools of Tehran during the year 2010. The sample size was predetermined based on previous literature. Data were collected using clinical examinations, questionnaires, interviews, and observations. A list of all Tehran kindergartens were prepared from the city management authorities. Using simple random sampling, some kindergartens were sequentially collected. The research committee of the university approved the ethics of this study.

A dental student who had been trained by an experienced pediatric dentist visited each kindergarten. After asking for permission from the authorities of the kindergartens, children between 2 and 5 years of age were examined clinically, using a dental explorer, dental mirror, dental mask, and disposable gloves under indirect room light. Children were selected randomly (simple random sampling) and were evaluated against the inclusion criteria. They were subsequently approved and enrolled, until arriving at the predetermined sample size.

The index for decayed, missing, and filled teeth (DMFT) was recorded for each patient (21): decay was regarded as positive when there was a lesion on the enamel with a soft base. Any filling with temporary materials was considered as decay. Any filling with accompanying decay was considered carious. Proximal surfaces were evaluated and were considered decay-negative if there was doubt about carious enamel, and considered decay-positive if the dental explorer entrapped. The missing index showed any tooth losses due to previous caries. The filling indexed indicated a restored tooth with no remaining caries (22).

Afterwards, the questionnaires were filled by interviewing the parents in a face-to-face manner. The questionnaires focused on personal and social characteristics of each child, gestational age, and birth weight.

The sample was divided into the case and control groups according to the DMFT indices. Children with DMFT $>$ 2 were considered as case, and those with DMFT of 2 or less were considered as controls (23).

Each control child was matched with a case child according to the all of the following factors: age, gender, socioeconomic statuses (subjectively decided by the researchers as good or moderate based on each child's parents' education level, family size, district of residence, and type of the kindergarten), mother's job (yes/no), common types of diets during the first 2 years of life, brushing, dental visits, being right-handed or left-handed, and fluoride therapy. Socioeconomic status was graded as 0 to 19. Each of the factors "education level of mother and father" had 0, 2, and 4 points based on if they had an elementary school or lower, high school, or university licenses, respectively. Residence district could have 0, 2, or 4 points based on living in southern, central, or northern Tehran. Family size could have 4, 2, or 0 points based on being up to 3 members, between 4 and 6 members, and more than 6 members. Kindergarten type (governmental or private) could have 0 or 3 points. Premature birth was considered as fetal age less than 37 weeks at birth (9). Low birth weight was considered as birth weights of 2500 gm or less (9, 12, 18). As a modified criterion, low birth weight was considered as less than 2500 gm (7, 14). High DMFT was considered as values more than 2.

2.1. Statistical Analysis

The 2 groups were compared using the Chi-square test to assess the associations between DMFT and low birth weight as well as preterm birth. Furthermore, odds ratios (OR) and 95% confidence intervals (CI) were calculated for low birth weights and preterm births.

3. Results

The children in the 2 groups did not have any significant differences regarding the matched characteristics (Table 1). The t-test showed that the socioeconomic statuses were not as well different between the 2 groups (P = 0.3).

3.1. Birth Weight

Case children with DMFT $>$ 2 might be more likely to be low-birth weighted, however, the result was marginally significant (P = 0.065, Table 2). Their odds of having a low birth weight was 2.4 compared with those who had high DMFT (OR = 2.429, 95% CI = 0.928 to 6.355).

We also evaluated the above relationship when the weight 2500 gm itself was considered in the normal group (being normal $\geq$ 2500 gm). The Chi-square result was insignificant (P = 0.174, Table 3) with an OR of 2.154 (95% CI = 0.699 to 6.637).

3.2. Age at Birth

The Chi-square result regarding the gestational age and DMFT showed that there was no significant association between higher DMFT and age at birth (P = 0.480, OR = 1.397, 95% CI = 0.551 to 3.543, Table 4).

Table 1. Comparison of Characteristics of the Two Groups Using Chi-Square

Factors	Frequency		Percentage		P
	dmft ≤ 2	dmft > 2	dmft ≤ 2	dmft > 2	
Age					0.964
2 years old	7	8	4.7	5.3	
3 years old	19	17	12.7	11.3	
4 years old	24	23	16.0	15.3	
5 years old	25	27	16.7	18.0	
Gender					0.623
Girl	36	33	24.0	22.0	
Boy	39	42	26.0	28.0	
Early feeding					0.923
Mother milk	45	47	30.0	31.3	
Bottle formula	12	12	8.0	8.0	
Both	18	16	12.0	10.7	
Brushing					0.683
Yes	61	59	40.7	39.3	
No	14	16	9.3	10.7	
Dental visit					0.646
Regular	22	21	14.7	14.0	
Emergencies	18	23	12.0	15.3	
Never	35	31	23.3	20.7	
Fluoride therapy					0.412
Done	39	44	26.0	29.3	
Never	36	31	24.0	20.7	
Socioeconomic status					0.402
Good	63	59	42.0	39.3	
Moderate	12	16	8.0	10.7	
Mother's job					0.514
None	36	40	24.0	26.7	
Has a job	39	35	26.0	23.3	
Dominant hand					0.806
Right	65	66	43.3	44.0	
Left	10	9	6.7	6.0	

4. Discussion

The present study failed to show that low birth weight or preterm birth was associated with high DMFT values. This finding was in line with that of Javadi Nejad et al. (18) who evaluated 100 children of 3 and 4 years and found a relationship between high DMFT and low birth weight. Biologic justification for the possible association between low birth weight and dental caries might be attributed to disruptions in development and maturation of enamel structures, which can lead to increased enamel defects due to pre-birth calcium deficiency and physiological stresses (7, 15).

Our results were also in line with that of Jabarifar et al., (19) who found out that premature birth could be associated with high developmental anomalies, but not higher DMFT values among 200 children at their age of 6 to 8

Table 2. Net Distribution of Children According to dmft and Birth Weight[a]

Birth Weight	Frequency		Percentage	
	dmft ≤ 2	dmft > 2	dmft ≤ 2	dmft > 2
Normal (> 2500 g)	68	60	45.3	40.0
Low	7	15	4.7	10.0
Total	75	75	50.0	50.0

[a] P = 0.065.

Table 3. Net Distribution of Children According to dmft and Modified Birth Weight Groups (Weights = 2500 g Were as Well Considered Normal), in Which 2500 gm and Greater are Considered Normal[a]

Birth Weight	Frequency		Percentage	
	dmft ≤ 2	dmft > 2	dmft ≤ 2	dmft > 2
Normal (≥ 2500 g)	70	65	46.7	43.3
Low	5	10	3.3	6.7
Total	75	75	50.0	50.0

[a] P = 0.174.

Table 4. Net Distribution of Children According to dmft and Gestational Age at Birth

Age at Birth	Frequency		Percentage	
	dmft ≤ 2	dmft > 2	dmft ≤ 2	dmft > 2
Normal	66	63	44.0	42.0
Preterm	9	12	6.0	8.0
Total	75	75	50.0	50.0

[a] P = 0.480.

years. In contrast to these findings, Gravina et al. (9) observed that DMFT was lower in children with low birth weight, which might be due to much more appropriate hygiene of those children. However, their results relating to the correlation between DMFT and preterm birth were similar to previous findings, showing no associations (9). On the other hand, Shulman (20) did not find any association between low birth weight and caries.

Generally, a premature birth might cause more enamel defects (9). Although no evidence exists, hypothetically it is suggested that these enamel defects might predispose the tooth to retention of biofilm and better colonization of streptococci mutans (7, 15). A less smooth, less mineralized enamel might be more prone to caries (7, 15). Nevertheless, this study as well as some others, showed that these items were not correlated (12, 14, 15, 19, 20).

Another study done by Saraiva et al., (7) on children between 2 and 6 years old, found a negative correlation between low birth weight and dental decay. The reason might be usage of antibiotics in such children and also delayed eruption of their teeth (7). They also found a positive correlation between preterm birth and high dental caries rates (7). In another study, Saraiva et al. (15) evaluated children at 7 to 11 years and found no association between low birth weight and caries in permanent dentition. Ghasempour et al. (14) compared 90 children 3 to 4 years old who were both low birth weighted and premature born with healthy children and found no significant associations. However, they did not separate low birth weight from preterm birth. Their result was similar to the findings of this study.

This study was limited by some factors. Fetal age at birth should be known as in weeks, however, some parents remembered it in months. Therefore, we had to approximate those ages to weeks. Besides, DMFT diagnosis could be enhanced by radiographic means (24). However, exposure to X-ray without treatment or screening needs and merely for research purposes might not be ethical (25-31). Due to that limitation and lack of cooperation of govern-

mental kindergartens, this research was done only on children in private kindergartens. Such children might have better socioeconomic statuses and thus lower DMFT values (20, 32). Another limiting factor was lack of proper light and examination settings. A powerful light source might be needed for recording DMFT, especially at some points, for example when a tooth was filled with composite materials. Besides, since radiographies were not used to assess DMFT, there is some chance that the true values for DMFT was higher than what was recorded. Another constraint was the lack of sample size determination based on pilot studies and proper statistical formulas. One more limitation was poor cooperation of many parents, which led to the exclusion of many subjects. As advantages, we evaluated 2 variables, low birth weight and premature birth separately, unlike studies that had assessed only 1, or combined those. Additionally, the kindergartens were randomly selected, which might increase the generalizability of the findings. Still, the generalizability was limited to private centers.

4.1. Conclusions

This study failed to detect significant association between low birth weight or preterm birth with DMFT. However, a marginally significant result regarding the low birth weight calls for future studies with greater samples to validate our results.

References

1. Dean JA, Avery DR, McDonald RE. McDonald and Avery dentistry for the child and adolescent. *Mosby.* 2010.
2. Khosravanifard B, Ghanbari-Azarnir S, Rakhshan H, Sajjadi SH, Ehsan AM, Rakhshan V. Association between orthodontic treatment need and masticatory performance. *Orthodontics (Chic.).* 2012;**13**(1):20–8. [PubMed: 22567649].
3. English JD, Buschang PH, Throckmorton GS. Does malocclusion affect masticatory performance? *Angle Orthod.* 2002;**72**(1):21–7. doi: 10.1043/0003-3219(2002)072<0021:DMAMP>2.0.CO;2. [PubMed: 11843269].
4. Ngom PI, Diagne F, Aidara-Tamba AW, Sene A. Relationship between orthodontic anomalies and masticatory function in adults. *Am J Orthod Dentofacial Orthop.* 2007;**131**(2):216–22. doi: 10.1016/j.ajodo.2005.03.027. [PubMed: 17276862].
5. Toro A, Buschang PH, Throckmorton G, Roldan S. Masticatory performance in children and adolescents with Class I and II malocclusions. *Eur J Orthod.* 2006;**28**(2):112–9. doi: 10.1093/ejo/cji080. [PubMed: 16272209].
6. Kazemi M, Geramipanah F, Negahdari R, Rakhshan V. Active tactile sensibility of single-tooth implants versus natural dentition: a split-mouth double-blind randomized clinical trial. *Clin Implant Dent Relat Res.* 2014;**16**(6):947–55. doi: 10.1111/cid.12053. [PubMed: 23490397].
7. Saraiva MC, Bettiol H, Barbieri MA, Silva AA. Are intrauterine growth restriction and preterm birth associated with dental caries? *Community Dent Oral Epidemiol.* 2007;**35**(5):364–76. doi: 10.1111/j.1600-0528.2006.00345.x. [PubMed: 17822485].
8. Brown LJ, Wall TP, Lazar V. Trends in total caries experience: permanent and primary teeth. *J Am Dent Assoc.* 2000;**131**(2):223–31. [PubMed: 10680391].
9. Gravina DB, Cruvinel VR, Azevedo TD, de Toledo OA, Bezerra AC. Prevalence of dental caries in children born prematurely or at full term. *Braz Oral Res.* 2006;**20**(4):353–7. [PubMed: 17242798].
10. Goel M, Babu GV, Sharma M. Early childhood caries: A dental form of health care neglect. *J Pure Applied Sci Technol.* 2011;**1**(1):51–4.
11. Pahlevani Z, Eghbalian F, Esfehani FM, Chitgar Z. Evaluation of the incidence and pattern of early childhood dental caries and effective factors on 2-6 year old children in Hamedan in 2006. *Feyz J Kashan Univ Med Sci.* 2008;**12**(1).
12. Burt BA, Pai S. Does low birthweight increase the risk of caries? A systematic review. *J Dent Educ.* 2001;**65**(10):1024–7. [PubMed: 11699973].
13. Seow WK. Effects of preterm birth on oral growth and development. *Aust Dent J.* 1997;**42**(2):85–91. [PubMed: 9153835].
14. Ghasempour M, Ahmadpour-Kacho M, Sheikhi S. Dental caries in preterm and low birth-weight children and related factors. *J Contemp Dent Pract.* 2009;**10**(4):51–8. [PubMed: 19575054].
15. Saraiva MC, Chiga S, Bettiol H, Silva AA, Barbieri MA. Is low birthweight associated with dental caries in permanent dentition? *Paediatr Perinat Epidemiol.* 2007;**21**(1):49–56. doi: 10.1111/j.1365-3016.2007.00782_1.x. [PubMed: 17239179].
16. Rakovic R, Dumic L, Petrovic R. [Dental caries prevalence in prematurely born children]. *Stomatol Glas Srb.* 1979;**26**(2):111–6. [PubMed: 296608].
17. Maatouk F, Belgacem B, Belgacem R, Ghedira H, Jemmali B. Prevalence of dental caries in children with low birth weight. *East Mediterr Health J.* 1996;**2**(2):311–4.
18. Javadi Nejad S, Karami M, Feiz E. The effect of dietary habits on caries risk prevalence for preterm and low birth weight children. *Shiraz Univ Med Sci J Dentis.* 2008;**9**(3):291–8.
19. Jabarifar S, Roozbehani A, Shahtoosi B. Relationship and Association of Preterm Labor with Developmental Defects of Enamel and Dental Caries. *Journal of Isfahan Dental School.* 2009;**3**(4):159–63.
20. Shulman JD. Is there an association between low birth weight and caries in the primary dentition? *Caries Res.* 2005;**39**(3):161–7. doi: 10.1159/000084792. [PubMed: 15914975].
21. Spencer AJ. Skewed distributions–new outcome measures. *Community Dent Oral Epidemiol.* 1997;**25**(1):52–9. [PubMed: 9088692].
22. Preedy VR, Watson RR. Handbook of disease burdens and quality of life measures. Springer; 2010.
23. Ghandehari MM, Zeraati H, Jamshidi SA. An epidemiologic survey on dmft amony 4-5 year old children of kindergartens under the supervision of behzisti organization in tehran (2003). *J Islamic Dent Associat Iran.* 2004;**16**(50):15–21.
24. Ramezani G, Valaie N, Rakhshan V. The effect of water fluoride concentration on dental caries and fluorosis in five Iran provinces: A multicenter two-phase study. *Dent Res J (Isfahan).* 2015;**12**(1):31–7. [PubMed: 25709672].
25. Rakhshan V. Congenitally missing teeth (hypodontia): A review of the literature concerning the etiology, prevalence, risk factors, patterns and treatment. *Dent Res J (Isfahan).* 2015;**12**(1):1–13. [PubMed: 25709668].
26. Amini F, Rakhshan V, Babaei P. Prevalence and pattern of hypodontia in the permanent dentition of 3374 Iranian orthodontic patients. *Dent Res J (Isfahan).* 2012;**9**(3):245–50. [PubMed: 23087726].
27. Khosravanifard B, Rakhshan V, Raeesi E. Factors influencing attractiveness of soft tissue profile. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2013;**115**(1):29–37. doi: 10.1016/j.oooo.2012.03.021. [PubMed: 22858016].
28. Rakhshan V. Meta-analysis and systematic review of factors biasing the observed prevalence of congenitally missing teeth in permanent dentition excluding third molars. *Prog Orthod.* 2013;**14**:33. doi: 10.1186/2196-1042-14-33. [PubMed: 24325806].
29. Amini F, Rakhshan V, Jamalzadeh S. Prevalence and Pattern of Accessory Teeth (Hyperdontia) in Permanent Dentition of Iranian Orthodontic Patients. *Iran J Public Health.* 2013;**42**(11):1259–65. [PubMed: 26171338].

30. Rakhshan V, Rakhshan H. Meta-analysis and systematic review of the number of non-syndromic congenitally missing permanent teeth per affected individual and its influencing factors. *Eur J Orthod.* 2016;**38**(2):170–7. doi: 10.1093/ejo/cjv008. [PubMed: 25840586].
31. Rakhshan V. Meta-Analysis of Observational Studies on the Most Commonly Missing Permanent Dentition (Excluding the Third Molars) in Non-Syndromic Dental Patients or Randomly-Selected Subjects, and the Factors Affecting the Observed Rates. *J Clin Pediatr Dent.* 2015;**39**(3):199–207. doi: 10.17796/1053-4628-39.3.198. [PubMed: 26208062].
32. Nematollahi H, Mehrabkhani M, Esmaily HO. Dental caries experience and its relationship to socio-economic factors in 2-6 year old kindergarten children in Birjand-Iran in 2007. *J Mash Dent Sch.* 2009;**32**(4):325–32.