the Journal of CONTEMPORARY DENTAL PRACTICE at www.thejcdp.com
Volume 10 Number 4 July 1, 2009

Dental Caries in Pre-term and Low Birth-weight Children and Related Factors

M. Ghasempour, DDS, MS; M. Ahmadpour-Kacho, MD;
S. Sheikhi, DDS

Abstract

Aim: The aims of this study were to determine the prevalence of dental caries in three to four-year-old children born pre-term and with a low birth weight (PLBW) to be compared with normal birth-weight children (NBW) and further to investigate the impact of relative risk factors on the development of dental caries in primary teeth.

Methods and Materials: This cross-sectional case-control study was conducted on 90 children (45 PLBW and 45 NBW). The demographic data and information about feeding practices was ascertained using a structured questionnaire. Dental caries status (dmft) was determined, and the differences between the two groups were tested using the Fisher's exact and the Mann-Whitney U tests at a confidence level of 5%.

Results: Twenty-five children (eight PLBW and 17 NBW) were caries free, and the mean±SD dmft was 2.5±0.3 in PLBW and 2.2±0.4 in NBW children ($p>0.05$). The length of feeding in PLBW children was lower than the NBW group ($p>0.05$).

Conclusion: The prevalence of dental caries did not differ between the PLBW and NBW children.

Clinical Significance: Enamel hypoplasia and snacking were not common in PLBW children which may account for the lack of difference in dental caries between the two groups.

Keywords: Prematurity, dental caries, low birth weight, LBW, case-control study

Citation: Ghasempour M, Ahmadpour-Kacho M, Sheikhi S. Dental Caries in Pre-term and Low Birth-weight Children and Related Factors. J Contemp Dent Pract 2009 July; (10)4:051-058.

Introduction

Low birth weight (LBW) infants, defined as those having birth weights of less than 2500 grams, represent a disproportionately large component of the neonatal and infant mortality rates. Although these low weight births make up only about 6-7% of all births, they account for two thirds of all neonatal deaths.[1] In 2003 Eslami et al.[2] showed 7.9% of all live births in the province of Yazd in Iran were LBW infants. In comparison to infants weighing 2500 g or more, LBW infants are 40 times more likely to die during the neonatal period.[1]

PLBW babies are often admitted to newborn services because of their prematurity and immature organs. Post-delivery, PLBW infants often have a higher rate of medical intervention. This period of hospitalization may cause a marked change in the lifestyle of the family in the first few months of the infant's life.[3]

LBW children are at increased risk of cerebral palsy, seizure, severe mental retardation, and lower respiratory tract infections, among other conditions. Some of the risk factors for LBW infants include the following:[4]

- Maternal age less than 17 years and more than 34 years
- Low socioeconomic status of the mother
- An unwed mother
- Smoking by the mother during pregnancy
- Poor obstetric care during pregnancy

Recent studies seem to suggest a slight or moderate association of periodontal disease and PLBW babies. This association may be heralded by the traditional clinical signs found in periodontal diseases.[5] The relationship between LBW and dental conditions has received very little attention and most studies have just investigated enamel defects, such as hypoplasia. Little is known about whether LBW infants are more prone to develop caries in later life, but if maternal malnutrition during pregnancy is involved, then such a link could be hypothesized.[6]

Enamel hypoplasia of the primary teeth was reported as a common finding by Seow et al.[7] in prematurely born and very LBW children. Its pathogenesis is unclear, although one likely mechanism is related to mineral deficiency which can be diagnosed radiologically as demineralization of long bones. These investigators believe both local and systemic factors are involved. One important local factor is trauma from laryngoscopy and endotracheal incubation, which usually results in localized enamel hypoplasia involving only the left maxillary anterior teeth.[8]

The aims of this study were to determine the prevalence of dental caries in three to four-year-old PLBW children discharged from the Yahyanejad Hospital in Babol, Iran and to investigate the impact of relative risk factors on the development of dental caries among this group.

Methods and Materials

A PLBW infant is defined as a neonate with a gestational age of < 37 weeks and a birth weight of < 2500 grams while a NBW infant is defined as a neonate with a gestational age ≥ 37 weeks and a birth weight ≥ 2500 grams. This study was carried out at Yahyanejad Hospital; a main, general teaching, and training hospital affiliated with Babol University of Medical Sciences in

Babol, Iran. A pediatrician conducted physical examinations of all newborns immediately after birth in a gynecology and obstetrics ward. Prematurity was assessed using the New Ballard Score. A total of 110 children born in this hospital during the last three or four years were selected from birth registry records and invited for a dental examination. Of these, 55 children with the history of PLBW at birth were selected as a case group and the other 55 were NBW children chosen as a control group to participate in the study. All of the children were healthy at the time of the dental examination and not accustomed to being on chronic oral medication. None of the children had a history of topical and systemic fluoride therapy. The parents of ten children in each group declined the invitation to participate in the study resulting in only 45 children in each group of the study.

The study consisted of four parts:

1. A structured questionnaire was devised to obtain demographic details, gestation weight, gender, and initial and current feeding patterns of the children. The questionnaire was also used to determine if the children were breast or-bottle fed or both and when these types of feedings were discontinued. Data regarding the number of snacks consumed each day were also collected.
2. A clinical examination was carried out to determine the prevalence of dental caries and enamel opacities using the British Association for the Study of Community Dentistry criteria.[9] The subjects were examined by one person using a mirror and study light without prior cleaning of the teeth or with the use of radiographs. However, when visibility was obscured, saliva and debris were removed from individual sites. For purposes of this study, all enamel defects like hypoplasia, hypocalcification, and hypomaturation were classified as enamel hypoplasia.
3. Height, weight, and head circumference were measured for each child.
4. Data from the structured questionnaire were coded and entered into a personal computer prior to carrying out a descriptive analysis using SPSS software (SPSS, Inc., Chicago, IL, USA). The formulated null hypothesis tested was: there is no difference in dental caries between NBW and PLBW children. The differences between the two groups of children were analyzed using the Fisher's exact and the Mann-Whitney U tests at a confidence level of 5%.

Results

Of the 90 children included in the study 45 were of NBW (23 boys and 22 girls), while the other 45 were PLBW (25 boys and 20 girls) (p =0.672). Table 1 shows the distribution of gestational age, birth weight, current weight, height, and head

Table 1. Distribution of gestational age (weeks), birth weight (kg), current weight (kg), height (cm), and head circumference (cm) of NBW and PLBW weight children

Variable	NBW (N=45)	PLBW (N=45)	Significance
Gestational age (week)	38.5±0.3	36.6±3.4	0.001
Birth weight (kg)	3.3±0.3	2.1±0.4	0.000
Current weight (kg)	15.7±2.3	14±2	0.000
Birth height (cm)	49.5±2.2	45.4±4.5	0.000
Current height (cm)	99.5±6.1	93.8±10.1	0.002
Birth head circumference (cm)	35.1±2.5	33.1±1.7	0.000
Current head circumference (cm)	51.3±1.5	52.7±3.1	0.016

Table 2. Infant feeding (breast, bottle, and length), number of meals, snacks consumed, and sugar intakes in NBW and PLBW children at the time of interview.

Variables	NBW (N=45)	PLBW (N=45)	Significance
Initial feeding:			
Breast	40 (88.9%)	43 (95.6%)	0.43
Combination (breast & bottle)	5 (11.1%)	2 (4.4%)	
Length of feeding (months):			
Breast	19.5±6	17.8±5.2	0.02
Combination (breast & bottle)	19.2±9.8	9.7±11.1	0.004
Number of meals per day:			
≤ 3	22 (48.6%)	20 (44.4%)	0.833
≥ 4	23 (51.4%)	25 (56.6%)	
Number of snacks per day	4.1±1.3	3.3±1.6	0.007

Table 3. Dental caries experience (dmft) in NBW and PLBW children.

Variable	NBW(N=45) Mean±SD	PLBW(N=45) Mean±SD	Significance
d	2.2±0.4	2.5±0.3	0.145
m	0.02±0.02	0.02±0.02	1
f	0.04±0.04	0	0.317
dmft	2.2±0.4	2.5±0.3	0.189

circumference by PLBW and NBW. There was a significant difference between PLBW and NBW in all parameters.

Table 2 represents infant feeding patterns, including breast and bottle feeding as well as the duration of each. There were no differences between breast feeding and a combination of breast and bottle feeding (P=0.43). None of the children were fed by bottle only. However, there were significant differences between the two groups with regard to snack consumption. The frequency of snacking between meals was most evident (P=0.007) among the NBW children.

Only 25 children were caries-free among whom 17 (37.8%) children were in the NBW group while eight (18.2%) were in the PLBW group (P=0.059). There were no differences between the two groups in terms of dental caries experience (Table 3).

A total of 11 children (five NBW and six PLBW) displayed enamel defects, but no differences between the two groups in terms of enamel hypoplasia (p=1) were found. On the other hand, the number of teeth with enamel hypoplasia in PLBW and NBW was 5.6±3.5 and 3.4±1.9, respectively (P=0.262), but dental caries was more common in children with enamel hypoplasia. The frequency of brushing was 1.8±0.44 in PLBW and 1.31±0.51 in NBW children (p=0.156). Eight children (seven NBW and one PLBW) had previously seen a dentist.

A total of 23 (51.1%) PLBW and 11 (24.4%) NBW children were hospitalized at birth (p=0.016). Four (8.9%) of the PLBW children and one (2.2%) NBW child were intubated in the Neonatal Intensive Care Unit (NICU) to achieve mechanical ventilation (p=0.361). Hospital policy calls for the use of orotracheal intubations to be used in the NICU.

Discussion

Current weight, height, and head circumference in PLBW children were all lower than in NBW children (p<0.05). These findings were similar to those of Davenport et al.[10] which could be attributed to any one of the following factors: lack of growth, genetics, socio-economic, diet, illness, and poor living conditions.[11,12]

Feeding patterns are important for a child's well-being both in childhood and in later life. According to Baker[13] the nourishment of a baby before birth and during infancy along with its exposure to infections during early childhood influences the diseases the child will develop later in life. The American Academy of Pediatric Dentistry (AAPD) endorses the policy statement of the American Academy of Pediatrics (AAP) on breast-feeding and the use of human milk. The AAP statement acknowledges breast-feeding as the best way to ensure the best developmental and psychosocial outcomes as well as overall health for the infant.[8] All children in this study were either breast fed or both breast-bottle fed. None of them was bottle fed only. Fortunately, breast feeding is a cultural norm in Iran and is promoted by the governmental health system during the first year of life.

Lifetime lengths of feeding in PLBW children were less than NBW children during the first two years of life. Despite the good intentions of mothers, Ripa[14] and Matee[15] have implicated breast-feeding as a cause of early dental caries (nursing caries) in infants and young children. Although both the AAP and AAPD endorse breast feeding as stated previously, both organizations discourage extended or excessive frequency of feeding times (from either the breast or a bottle) and encourage appropriate oral hygiene measures for infants and toddlers.[8] Hallonsten et al.[16] found children who experienced prolonged breast feeding tend to develop unsuitable dietary habits that put them at risk for caries at an early age. Weaning has a profound effect on the development of infants and is influenced by biological (e.g., the health of both child and mother), cultural (e.g., traditions, education, and advertising), and economic (e.g., household and community) factors.[10] In dental terms weaning can have a major influence on both the immediate and future dental health of an infant. Furthermore, good dietary practices from birth have the potential to secure a healthy dentition for life. In real terms a weaning diet should meet the nutritional requirements for the growing child and contain a variety of foods and beverages.[17] Ramos-Gomez et al.[18] stated there were no clear patterns of cariogenic food frequency and disease status as a result of their study of children of age six or less. Their findings also questioned whether feeding patterns with human breast milk, formula, or bovine milk are sufficient etiologic factors for this condition.

Frequency of meals and snacks is an important factor for children who are prone to dental caries. Dental caries is more frequent in children who

snack between meals. There was no significant difference in frequency of meals between the two study groups, but snack consumption was more common in the NBW group. According to Jose et al.[19] consuming snacks is a risk factor for dental caries. The frequency of snacking in PLBW children was less than in NBW children which was the opposite finding by Davenport et al.[10]

The present study revealed 18.2% of PLBW children and 37.8% of NBW were caries-free with a mean dmft of 2.5 and 2.2, respectively. There were no differences in dmft, d, m, f in the two groups. Burt and Pai[20] have recently reported no relationship between low birth weight and the development of dental caries in a systematic review. In addition, Shulman[21] found no association between low birth weight and caries of the primary dentition. Saraiva et al.[22] stated pre-term birth is positively associated with dental caries while there is an indication a "small for gestational age" (SGA) birth and "fetal growth restriction" (FGR) are negatively associated with dental caries. Although the negative association is counterintuitive, they also suggest an increased use of antibiotics and delayed tooth eruption may explain the negative association between intrauterine growth restriction and dental caries.

The relationship between LBW and dental conditions has received very little attention and most studies have just investigated enamel defects, such as hypoplasia. Seow et al.[7] reported 40-70% of pre-term children present with generalized enamel hypoplasia. Fearne et al.[23] speculated the high incidence and the cause of enamel defects in sick preterm infants may be due to oxygen deprivation and mineral substitute depletion. They observed defects more often in LBW children classified as ill during the prenatal period who received ventilator support, intravenous alimentation, and in children born at < 32 weeks gestation when compared with LBW children without these prenatal problems. In the present study the gestational age was > 32 weeks and only four PLBW children required intubation. There was no significant difference in terms of prevalence of enamel hypoplasia (p=1) or the total number of teeth with hypoplasia between the two groups (P=0.262).

In the present study there was a significant relationship between enamel hypoplasia and dental caries. Matee et al.[24] have suggested hypoplastic deciduous teeth are more likely to decay than those without hypoplasia. Zheng et al.[25] demonstrated defective enamel more vulnerable to attack by caries. However, according to Lai et al.[26] the overall prevalence of dental caries in very low birth weight children (VLBW) with a birth weight of <1500 grams was not significantly different from NBW controls in spite of a high prevalence of enamel defects.

The frequency of dental brushing did not differ between the two groups in the present study. Lai et al.[26] found no relationship between plaque score and tooth brushing frequency in terms of dental caries in either VLBW and NBW children. However, Santos et al.[27] stated the presence of thick biofilm on the teeth was the most important factor in the occurrence of early childhood caries.

Since dental caries is a multifactorial disease, this may account for the lack of difference in dental caries between the two groups in the present study. The gestational age of the study group was (36.6±3.4) weeks which was higher than the study population in other studies like the one conducted by Lai et al.[26] The total length of feeding during the first two years of life is an important etiologic factor for dental caries and it was found to be lower in PLBW children. The frequency of snack intake in PLBW children was also found to be lower than NBW children. Also, the frequency of brushing in PLBW and NBW children was the same. All of these factors may play a role which caused an equal distribution of dental caries in the two groups of the present study.

Conclusion

Most of PLBW babies in the present study were not so pre-term and so low in birth weight but rather, they were near-term babies. The findings of the study showed the prevalence of dental caries in near-term children did not differ from NBW children.

A shorter length of feeding during the first two years of life, less frequent snacking, and the lack of differences in terms of the frequency of

enamel hypoplasia may be the reasons for a low prevalence of caries in PLBW group children.

Clinical Significance

Enamel hypoplasia and snacking were not common in PLBW children which may account for the lack of difference in dental caries between the two groups of the study.

References

1. Clarence W. Gowen, Jr. Assessment of the mother, fetus, and newborn, in Behrman Richard E, Kliegman Robert M. Nelson essentials of Pediatrics .fifth Edition. 2006; 271-297.
2. Eslami Z, Aflatoonian A. A study to determine the prevalence of low birth weight (LBW) infants in Yazd. Journal of Shahid Sadoughi University of Medical Sciences and Health Services. 2004; 2(10):8-3.
3. Yuan W, Basso O, Sorensen HT, Olsen J. Indicators of fetal growth and infectious disease in childhood-a birth cohort with hospitalization as an outcome. Eur J Epidemiol. 2001; 17:829-834.
4. Burt AB, Pai SP. Does low birth weight increases the risk of carries systematic review. J Dent Educ. 2001 Oct;65(10):1024-7.
5. Alves RT, Ribeiro RA. Relationship between maternal periodontal disease and birth of preterm low weight babies'. Pesqui Odontal Bras. 2006; 20(4):318-23.
6. Burt BA, Pai S. The Relationship between low birth weight and subsequent development of caries: A systematic review. August 2003. Available from: http:/www.lib.umich.edu/dentlib/nihcdc [accessed on 2008, Feb 21].
7. Seow KW, Brown JP, Freden H, Kjellmer I. Mineralization defects in deciduous teeth of low birth weight infants. Acta Paediatrica Scandinavia.1982; 71:727-733.
8. McDonald RE, Avery DR, Hartsfield JK. Acquired and Developmental Disturbances of the Teeth and Associated Oral Structure, in McDonald, Avery, Dean. Dentistry for the child and adolescent. Eighth Edition.Mosby; 2004: 115-7.
9. Pine CM, Pitts NB, Nugent ZJ. British Association for the Study of Community Dentistry (BASCD) guidance on the Statistical aspects of training and calibration of examiners for surveys of child dental health. A BASCD coordinated dental epidemiological program quantity standard. Community Dental Health 1997; 14(suppl 1):18-29.
10. Davenport ES, Ltyenas C, Barbayiannis P, Williams CES. The effect of diet, breast-feeding and weaning on caries risk for preterm and low birth weight children. Int J Paediatr Dent. 2004; 14:251-259.
11. Teranishi H, Nakagawa H, Marmot M. Social class difference in catch up growth in a national British cohort. Arch Dis Child Educ Pract Ed. 2001; 84:218-221.
12. Huttly SRA, Victora CG, Barros FC, Teeixeira AMB, Vaughan JP. The timing of nutritional status determination: implications for interventions and growth monitoring. European Journal of Clinical Nutrition. 1991; 45:85-95.
13. Barker DJP. Mothers, Babies and Health in Later Life,2nd edition. Edinburgh: Churchill Livingston.1998.
14. Ripa LW. Nursing habits and dental decay in infants: nursing bottle caries. J Dent Child.1978; 45:274-275.
15. Matee MIN, Mikx FHM, Maselle SYM, Van Palenstein Helderman WH. Mutans streptococci and Lactobacilli and weaning habits in Tanzania infants. Caries Res .1992; 26:183-187.
16. Hallonsten AL, Wendt LK, Mejàre I, Birkhed D, Håkansson C, Lindvall AM, Edwardsson S, Koch G. Dental caries and prolonged breast-feeding in 18-month-old Swedish children. Int J Paediatr Dent. 1995 Sep;5(3):149-55.
17. Holt RD, Moyniham PJ. The weaning diet and dental health. Br Dent J. 1996; 131:254-258.
18. Ramos-Gomez FJ, Tomar SL, Ellison J, Artiga N, Sintes J, Vicuna G. Assessment of early childhood caries and dietary habits in a population of migrant Hispanic children in Stockton, California. ASDC J Dent Child. 1999; 66(6):395-403,366.

19. Jose B, King NM. Early childhood caries lesions in preschool children in Kerala, India. Pediatric Dent. 2003; 25(6):594-600.
20. Burt BA, Pai S. Dose low birth weight increase the risk of carries systematic review. J Dent Educ. 2001; 65:1024-7.
21. Shulman JD. Is there an association between low birth weight and caries in the primary dentition? Caries Res. 2005; May-Jun; 39(3):161-7.
22. Saraiva MC, Bettiol H, Barbieri MA, Silva AA. Are intrauterine growth restriction and preterm birth associated with dental caries? Community Dent Oral Epidemiol. 2007 Oct; 35(5):364-76.
23. Fearne JM, Bryan EM, Elliman AM, Brook AH, Williams DM. Enamel defects in the primary dentition of children born weighing less than 2000 g. Br Dent J. 1990; 168(11):433-7.
24. Matee M, van't Hof M, Maselle S, Mikx F, van Palenstein Helderman W. Nursing caries, linear hypoplasia, and weaning habits in Tanzanian infants. Community Dent Oral Epidemiol.1994; 22:289-293.
25. Zheng S, Deng H, Gao X. Studies on developmental enamel defects in the primary dentition of children with histories of low birth weight and prematurity and their susceptibility to dental caries. Zhonghua Kou Qiang Yi Xue Za Zhi. 1998; 33(5):270-2.
26. Lai PY, Seow WK, Tudehope DI, Rogers Y. Enamel hypoplasia and dental caries in very-low birth weight children: a case-controlled, longitudinal study. Pediatr Dent. 1997; 19(1):42-9.
27. Santos AP, Soviero VM. Caries prevalence and risk factors among children aged 0 to 36 months. Pesqui Odontol Bras. 2002 Jul-Sep; 16(3):203-8. Epub 2002 Oct 24.

About the Authors

M. Ghasempour, DDS, MS

Dr. Ghasempour is an Assistant Professor in the Department of Pediatric Dentistry of the Faculty of Dentistry at the Babol University of Medical Sciences in Babol, Iran. In 1990 she received her dental degree from Shahid Beheshti University of Medical Sciences in Tehran, Iran and her Master's degree in Pediatric Dentistry from Mashhad University in 1995.

e-mail: ma_ghasempour_ir@yahoo.com

M. Ahmadpour-Kacho, MD

Dr. Ahmadpour-Kacho is an Associate Professor of Pediatrics and Neonatology in the Department of Pediatrics at Babol University of Medical Sciences in Babol, Iran. He received his medical degree from Mashhad University of Medical Sciences in 1990 then completed his residency in pediatric medicine in 1994 and a subspecialty fellowship course in neonatology in 2000 at the same university.

e-mail: mousa_ahmadpour@hotmail.com

S. Sheikhi, DDS

Dr. Sheikhi is a general dentist in private practice. She received her dental degree in 2005 from Babol University of Medical Sciences in Babol, Iran.