2022-06-03

Cardiovascular diseases and oral health – the impact of pregnant women’s oral health on children’s cardiovascular health

Mesihovic Dinarevic, Senka

Academy of Sciences and Arts of Bosnia and Herzegovina

CHAPTER II
ORAL AND CARDIOVASCULAR HEALTH

Prof. Senka Mesihović-Dinarević, MD, PhD
Prof. Lutvo Sporišević, MD, PhD

The correlation between oral health and cardiovascular diseases was evaluated in the past, but not the influence of mother's nutrition and oral health on the fetal cardiovascular development which can lead to:

- slow fetal growth,
- low birth weight,
- difference in the development of blood vessels

Pregnancy is a state during which the body undergoes complex physical and physiological changes that have important impact on multiple organs and systems.

Some authors suggest a possible link between periodontal disease in pregnant women and the risk of premature childbirth, low birth weight newborns and possible cardiovascular diseases.

Hence, the aim of this research, the results of which are presented in the following pages, is to evaluate the link between maternal oral health, their diet during the pregnancy with the development of coronary and carotid arteries and cardiovascular system.

The consideration of origin of the development of diseases of the cardiovascular system will start with a brief overview of the development of atherosclerosis.

Atherosclerosis

As a cardiovascular disease, atherosclerosis is a multifactorial in its etiopathogenesis and is treated by: family doctor, pediatrician, pediatric cardiologist, cardiologist, neurologist, diabetologist, endocrinologist, cardiovascular surgeon, neurosurgeon, radiologist, nuclear radiologist, epidemiologist, nutritionist, pathologist, and biochemist with the aim of early detection and

treatment of atherosclerosis and also minimizing the development of risk factors for coronary artery diseases.

Pathophysiology of atherosclerosis is characterized by the damaged cells located in the inner surface of the arteries where endothelium is exposed to chemical or mechanical injury.

Elevated blood cholesterol, smoking or elevated homocysteine (one of researched causes of atherosclerosis today) are some examples of chemical and mechanical cell injury as well as high blood pressure, injury caused by catheter during diagnostic procedures and even infections.

The first stage of atherosclerosis development occurs in the form of a "fatty streak".

Fatty streak is totally reversible, which means that endothelial cells can completely recover when harmful activities of pathogens are terminated. However, if harmful activities continue, atherosclerotic plaque grows and narrows lumen even further.

This results in inadequate blood flow and oxygen delivery to the tissues. In the blood vessel, itself due to reduced elasticity, an increase of blood pressure occurs. Elevated blood pressure can lead to rupture of the blood vessel or formation of aneurysms or plaque which can calcify and narrow down blood vessel walls and help form a blood clot.

Plaque composition is much more important than plaque size for atherosclerosis. *Subclinical atherosclerosis* is and early indicator of cardiovascular changes. It is very important and alarming since the process can be stabilized and reversed if treated in time.

Ultrasound measurements of carotid intima-media thickness cIMT is considered a valid surrogate marker for assessing cardiovascular risk, which allows the assessment of the atherosclerotic changes at an early stage.

Oral health

The association between oral health and atherosclerotic cardiovascular disease

Oral diseases are among the most common chronic noncommunicable diseases. Oral health is key indicator of well-being and quality of life and have close linkages with general health.

Periodontitis is progressive disease of tooth-supporting apparatus-*paradoncium* whose role is to support the tooth and keep it fixed to the bone. It includes: cementum, alveolar bone, periodontal ligament and gingival tissue.

If one of these elements is jeopardized, the whole apparatus begins to decay. It happens gradually which makes this a progressive disease. The cause of periodontitis are bacteria from dental plaque.

If not diagnosed and treated, periodontitis becomes chronic inflammatory, immune-driven disease, characterized by deterioration of periodontal ligament and alveolar bone.

Links between oral diseases and general health are multifaceted and complex.

Most oral diseases have common risk factors, including:

- unhealthy diet high in free sugars,
- tobacco use and
- excessive alcohol consumption by people with cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes mellitus.

Oral cavity is an integral part of human body and thus there is a link between oral and systemic health. There is reciprocity between periodontitis and some systemic diseases, such as diabetes, osteoporosis, HIV infection, and trisomy 21.

People with periodontitis are more prone to some systemic diseases than healthy people:

- chronic periodontitis is a risk factor for future cardiovascular diseases,
- pregnant women with chronic periodontitis are at a higher risk of preterm births and
- women give birth to low-birth-weight infants.

The explanation for the pathophysiological mechanisms *of periodontal focus and systemic disease* is linked to the increased level of circulating pro-inflammatory cytokines and prostaglandins derived from: periodontal disease, gram-negative bacteria and endotoxin-like substances that appear from subgingival biofilms directly entering the bloodstream.

Dominant problems of everyday dental practice are *caries, periodontal disease, occlusal abnormalities, the link between oral and general health and holistic approach to the patient.*

Caries and periodontal disease are of an infectious etiology, therefore the prevention of dental caries and periodontal disease means preventing odontogenic focuses.

A periodontal pocket is a risk factor for the development or worsening of systemic disease and focal infection because the infection is always present in it. The flora of periodontal pocket is diverse, massive, virulent and penetrates

the soft wall of the pocket. The pocket is under constant mechanical stimulation during chewing, swallowing and speech, and it all benefiting the penetration of bacteria into circulation and the formation of transient bacteremia.

Interdisciplinary cooperation in eliminating potential negative effects of periodontal infections will result in better systemic health.

Dental caries and periodontal disease are the most common and significant oral disease that can cause and aggravate numerous other disease:

- of the cardiovascular system (infective endocarditis, atherosclerosis,
- myocarditis, and myocardial infarction),
- of the respiratory system (pneumonia, chronic obstructive pulmonary disease, bronchial asthma, and pulmonary abscess),
- neurological disorders (cerebral infarction and cerebral abscess),
- diabetes mellitus, rheumatoid arthritis,
- Alzheimer's disease,
- complications of pregnancy (preeclampsia, stillbirth, miscarriage),
- preterm births and low birth weight,
- osteoporosis.

Pregnancy

Pregnancy is a state in which there are complex physical and physiological changes, which have important effects on multiple systems of organs. High levels of circulating estrogen during pregnancy are associated with high prevalence of gingivitis and gingival hyperplasia or certain forms of periodontal disease.

It is believed that approximately 40% of pregnant women have a certain form of periodontal disease. Offembacher et al. (1996) first suggested a possible link between periodontal disease and risks for child delivery of a low gestational age or small birth weight. Many researchers suggest a possible link between periodontal disease in pregnant women with a risk for preterm delivery, i.e., low birth weight. Researchers show that pregnant women with periodontal disease have 2-7 times higher risk for premature birth.

That is why dentists need to motivate, educate, and instruct pregnant women towards a higher level of oral hygiene and to repair all orodental lesions in dental therapeutic procedures, especially periodontal pockets, thereby reducing the number of premature births.

It is considered that genetic factors may be an important factor in developing periodontal disease. Scientists believe that DNA sequence variations

influence the individual risk for the development of periodontal disease because they have found that due to the variation of gene sequences, the activity of alpha defensins (antimicrobial peptides present in neutrophil granulocytes) which is responsible for the destruction of periodontopathogenic bacteria, could be stopped. Munz et al. discovered that gene loci linked with chronic and aggressive periodontal disease susceptibility is due to disorders in congenital and acquired immunity which leads to development of periodontal disease.

Prematurity

Incidence of premature births and low birth weight deliveries varies from 5% to 18% depending on the geographical area and characteristics of population.

Causes of premature births are believed to be unknown in 50% of cases, and other possible causes are: socio-economic factors, acute and chronic diseases, multiple pregnancies, gynecological causes, hereditary diseases, placental and other causes.

It is extremely important to identify *potential risk factors* of preterm birth because this can significantly decrease incidence of preterm birth and low birth weight deliveries which reduces perinatal mortality rate and potential perinatal complications.

Preterm infants and low birth weight infants are at increased risks of cardiovascular disease vs. full-term infants and normal birth weight infants.

Risk factors for prematurity are:

Prior premature birth, multiple pregnancies, uterine or cervical problems/ uterine infections, cervical insufficiency, placental abruption, chronic high blood pressure, preeclampsia, diabetes, smoking, alcohol use, age, lack of prenatal care, poor nutrition, untreated infection. Mothers who gave birth to preterm infants or low birth weight infants have significantly higher levels of PGE2 in gingival fluid as opposed to mothers who gave birth to full-term and normal birth weight infants.

During pregnancy there is an increased susceptibility to caries due to:

- increased acidity in the oral cavity,
- increased consumption of refined sugars and
- poor oral hygiene.

Caries in children is usually transmitted by direct transmission through the mother's saliva. Mothers with high level of Streptococcus mutans in their saliva are more likely to transmit the bacteria to their baby – by vertical transmission, creating conditions for the development of caries in early childhood.

Time and frequency of bacteria transmission, proneness to the accumulation of bacteria on child's teeth, saliva composition and flow, the amount of refined sugar in child's diet are all significant indicators of early childhood caries development.

Due to the immaturity of their organ systems, preterm and low birth weight infants belong to the vulnerable group of infants – preterm birth complications are the leading cause of death among children under five years of age. Preterm or low birth weight infants exhibit a higher incidence of cardiovascular risk factors (obesity, hypertension, dyslipidemia), and type 2 diabetes mellitus.

Animal and epidemiological studies indicate that elevated levels of glucocorticoids in utero are programming the hypothalamic-pituitary-adrenal axis during life which plays a key role in contributing to the higher occurrence of cardiovascular risk in preterm and low birth weight infants.

Apart from the role of oral microbiome (microbiome - all microbes, their genome and mutual interaction in particular environment) as a risk factor for preterm birth or low birth weight infant, it is possible that *microorganisms of the oral cavity during chronic inflammation can become an atherosclerotic risk factor for cardiovascular diseases.*

Appropriate prenatal health care should include oral health care of pregnant women. It is important to point out the importance of practicing regular oral hygiene and the need for regular dental check-ups.

Considerable number of pregnant women have inadequate oral health due to irregular visits to the dentist, poor oral hygiene, unhealthy diet and everything that might cause the occurrence of caries and periodontal disease in pregnant women.

The sufficient oral health screening of pregnant women is not carried out in daily work. Therefore, by reviewing the oral health status of larger number of pregnant women, including the assessment of their oral hygiene, we could timely identify pregnant women who have dental caries or periodontal disease.

Timely dental treatment could decrease occurrence of dental caries and periodontal disease in pregnant women and could reduce the rate of preterm delivery and low birth weight infants, early childhood caries and predictors

of early atherosclerotic cardiovascular risk (increased body mass index, blood pressure and carotid intima-media thickening).

In a group of children who were born prematurely or had low birth weight, a certain number of children aged 3 years have higher body mass index, higher systolic and diastolic blood pressure, as well as thickening of carotid artery intima-media complex with early signs of cardiovascular disease.

Insufficient insight into the possible pathological implications of the oral health status of pregnant women and their eating habits on premature expression of cardiovascular risk factors in children initiated this research.

References

1. Pezelj-Ribarić i sur. Oralno zdravlje – uvjet za opće zdravlje. Rijeka; medicinski fakultet Sveučilišta u Rijeci; 2013.
2. Teles R, Wang CY. Mechanisms involved in the association between periodontal diseases and cardiovascular disease. Oral Dis 2011;17:450–461.
3. Zoellner H. Dental infection and vascular disease. Semin Thromb Hemost 2011;37:181–192.
4. Kamer AR, Craig RG, Dasanayake AP, Brys M, Glodzik-Sobanska L, de Leon MJ. Inflammation and Alzheimer's disease: possible role of periodontal diseases. Alzheimers Dement 2008;4:242–250.
5. Boggess KA, Edelstein BL. Oral health in women during preconception and pregnancy: implications for birth outcomes and infant oral health. Matern Child Health J 2006; 10 (5 Suppl):S169-174.
6. Hemaltha V, Manigandan T, Sarumathi T,Aaarthi Nisha V,AmudhanA. Dental considerations in pregnancy − a critical review on the oral care. J Clin Diagn Res 2013; 7:938.
7. American College of Obstetricians and Gynecologists. Oral health care during pregnancy and through the lifespan. Committee Opinion No. 569. Obstet Gynecol 2013;122:417–422.
8. Offenbacher S, Katz V, Fertik G, Collins J, Boyd D, Myynor G i sur. Periodontal infection as a possible risk factor of preterm low birth weight. J Periodontal 1996;67:1103-1113.
9. Soroey M, Avanbadejo P, Savage K, Oluwole A. Association between periodontal disease and pregnancy outcomes. Odontostomatol. Trop. 2015; 38 (152):5-16.
10. Turton M, Africa CW. Further evidence for periodontal disease as a risk indicator for adverse pregnancy outcomes. Int Dent J. 2016 Dec 17. doi: 10.1111/idj.12274.
11. Trivedi S, Lal N, Singhal R. Periodontal disaease during pregnancy. J Orofacial Sci 2015; 7:67.
12. Govindaraju P, Venugopal S, Shivakumar MA, Sethuraman S, Ramaiah SK, Mukundan S. Maternal periodontal disease and preterm birth: A case-control study. J Indian Soc Periodontol. 2015;19(5):512-515. doi: 10.4103/0972-124X.164751
13. Reza Karimi M, Hamissi JH, Naeini SR, Karimi M. The Relationship Between Maternal Periodontal Status of and Preterm and Low Birth Weight Infants in Iran: A Case Control Study. Glob J Health Sci. 2015 ;8(5):184-188. doi: 10.5539/gjhs.v8n5p184.

14. Moore S, Ide M, Coward PY, Randhawa M, Borkowska E, Baylis R, Wilson RF. A prospective study to investigate the relationship between periodontal disease and adverse pregnancy outcome. Br Dent J. 2004 Sep 11;197(5):251-258.
15. Ali TB, Abidin KZ. Relationship of periodontal disease to pre-term low birth weight infants in a selected population--a prospective study. Community Dent Health. 2012; 29(1):100-105.
16. Davenport ES, Williams CE, Sterne JA, Murad S, Sivapathasundram V, Curtis MA. Maternal periodontal disease and preterm low birthweight: case-control study. J Dent Res. 2002;81(5):313-318.
17. Offenbacher S, JaredHL, O′Reilly PG, Wells SR, Salvi GE, Lawrence HP et al. Potential pathogenic mechanism of periodontitis pregnancy complications. Ann Perriodontol 1998; 3:233-250.
18. Jeffcoat MK, Guers NC, Reddy MS, Cliver SP, Goldenberg RL, Hauth JC. Periodontal infection and preterm birth: results of a prospective study. J Am Dent Assoc 2001; 132:875-880.
19. Silk H, Douglass AB, Douglass JM, Silk L. Oral health during pregnancy. Am Physician 2008; 77:1139-1144.
20. Haake SK, Newman MG, Nisengard RJ, Sanz M: Periodontal microbiology. Clinical Periodontology. Edited by: Newman MG, Takei HH, Carranza FA. 2002, Philadelphia: Saunders, 96-112.
21. Nair PNR: Pathogenesis of apical periodontitis and the causes of endodontic failures. Crit Rev Oral Biol Med. 2004, 15: 348-381.
22. Škrinjarić I. Prevencija oralnih bolesti u djece: U: Bralić I. i sur. Prevencija bolesti u dječjoj dobi. Medicinska naklada. Zagreb, 2014. str. 412-431.
23. World Health Organization. Preterm birth. Fact sheet. Reviewed November 2016. http://www.who.int/mediacentre/factsheets/fs363/en/ (pristup 10. 1. 2017).
24. Mardešić D., Benjak V. Nedonošče. U: Mardešić D. i sur. Pedijatrija. Školska knjiga; Zagreb, 2016. str. 389-397.
25. Crispi F, Bijnens B, Figueras F, Bartrons J, Eixarch E, Le Noble F et al. Fetal growth restriction results in remodeled and less efficient hearts in children. Circulation 2010; 121 (22): 2427-2436.
26. Barker DJ. Human growth and cardiovascular disease. Nestle Nutr Work-shop Ser Pediatr program 2008; 61:21-38.
27. Mitchell RN, Schoen FJ. Atherosclerosis. U: Kumar V, Abbas AK,Fausto N, Aster JC, (ur.). Robbins & Cotran Pathologic Basis of Disease, 8 izd. Philadephia: WB Saunders; 2010. str. 1020-35.
28. Al-Ghamdi A, Jiman-Fatani AA, El-Banna H. Role of Chlamidia pneumoniae, helicobacter pylori and cytomegalovirus in coronary artery disease. Pak J Pharm Sci 2011; 24(2):95-101.
29. Bearfield C, Davenport ES, Sivapathasandarem V, Allaker RP. Possible association between amniotic fluid micro-organism infection and microflora in the mouth. BJOG. 2002; 109:527-533.
30. Dunlop AL, Mulle JG, Ferranti EP, Edwards S, Dunn AB, Corwin EJ. The Maternal Microbiome and Pregnancy Outcomes that Impact Infant Health: A Review. Advances in neonatal care: official journal of the National Association of Neonatal Nurses. 2015;15(6):377-385. doi:10.1097/ANC.0000000000000218.

31. Boggess KA, Urlaub DM, Moos MK, Polinkovsky M, El-Khorazaty J, Lorenz C. Knowledge and beliefs regarding oral health among pregnant women. J Am Dent Assoc 2011; 142(11):1275-1282.
32. Glaziou Philippe. Samsize. Computer sample size and power. Version 06.2003. Dostupno s URL: http://sampsize.sourceforge.net/ (pristup 10.1.2017).
33. WHO. Child growth standards. WHO Anthro (version 3.2.2., January 2011) http://www.who.int/childgrowth/software/en/
34. World Health Organization. BMI-for - age BOYS. Birth to 5 years (percentiles) Dostupno s URL: http://www.who.int/childgrowth/standards/cht_bfa_boys_p_0_5.pdf?ua=1 (pristup 10. 1. 2017).
35. World Health Organization. BMI-for - age GIRLS. Birth to 5 years (percentiles) Dostupno s URL: http://www.who.int/childgrowth/standards/cht_bfa_girls_p_0_5.pdf?ua=1 (pristup 10. 1. 2017)
36. Baylor College of medicine. USDA/ARS Children's Nutrition Research Center, Houston, Texas. Age-based Pediatric Blood Pressure Reference Charts. Dostupno s URL: https://www.bcm.edu/bodycomplab/Flashapps/BPVAgeChartpage.html (dostupno 10. 1. 2017).
37. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The Fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents. Pediatrics 2004; 114 (2 Suppl 4 th Report) 555-576. (dostupno 10. 1. 2017).
38. Rosamond W, Flegal K, Friday G, Furie K, Go A, Greenlund K et al: Heart disease and stroke, statistics-2007 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation 2007; 115-e 69-e171.
39. Friedewald VE, Kornman KS, Beck JD, Genco R, Goldfine A, Libby P et al: The American Journal Cardiology and Journal of Peridontology editor's consensus: peridontitis and atherosclerotic cardiovascular disease. J. Peridontol 2009; 80:1021-32.
40. Paraskevas S, Huizinga JD, Loos BG. A systemic review and meta-analyses on C reactive proten in relation to periodontitis. J Clin Periodontol 2008; 35: 277-90.
41. Humphrey Li, Fu R, Buckley DI, Freeman M, helfand M. Peridontal disease and coronary heart disease incidence: a systemic review and meta-analyses. J Gen Inter Med 2008; 23:2079-86.
42. Tonetti MS, D'Aiuto F, Nihali L, Donald A, Storry C, Parkae M et al: Treatment of peridontitis and endothelial function. N Engl J Med 2007: 356:911-20.
43. Pizzo G, La Cara M, Conti Nibali M, Guiglia R. Peridontitis and preterm delivery. A review of the literature. Minerva. Stomatol 2005; 54:1-14.
44. Srinivas SK, Sammel MD, Stamilio DM, Cothier B, Jeffcoat MK; Perry S et al: Peridontal disease and adverse pregnancy outcome: Is there an association? Am J Obstet Gynecol 2009; 200:497-e491-98.
45. Meqa et al: Periodontal disease, preterm delivery and preterm low gestational mass. Acta stomatol Croat. 2017; 51(1):33-40. DOI: 10.15644/asc51/1/4.
46. Mesihović-Dinarević S:"Prevention of Cardiovascular Disease from an Early Age", Journal of Cardiovascular Disease/Diagnosis, 2017; S:3, vol 5, issue 3, DOI: 10.4172/2329-9517.1000268, p 2-5.
47. Berenson GS, Blonde CV, Faris RP: Cardiovascular disease risk factor variable during the first year of life. American Journal of Disease in Children, 1979; 133:1049-1057.
48. Berenson GS, Srinivasan SR, Mac D et al: Risk factors in early life as predictors of adult heart disease: The Bogalusa heart study, Am.J.Med.Sci.1989; 298:141-151.

49. Geer JC, McGill, He Strong JP: The fine structure of human atherosclerotic lesions, An. J. Pathol. 1961; 38:263-9.
50. Dhuper S, Buddhe S, Patel S. Managing Cardiovascular Risk in Overweight Children and Adolescents. Paediatric Drugs, 2013, 15(3):181-90. doi: 10.1007/s40272-013-0011-y
51. Berenson GS, Srinivasan SR, Bao, Newman WP, III, Tracy RE, Wattigney WA. Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa Heart Study. N Engl J Med 1998; 338:1650–6.
52. Vt H, T M, T S, Nisha V A, A A. Dental considerations in pregnancy-a critical review on the oral care. J Clin Diagn Res. 2013;7 (5):948-53.
53. Offenbacher S, Katz V, Fertik G et al. Periodontal infection as a possible risk factor for preterm low birth weight. J Periodontol. 1996 ; 67 (10 Suppl):1103-13.
54. Soroye M, Ayanbadejo P, Savage K, Oluwole A. Association between periodontal disease and pregnancy outcomes. Odontostomatol Trop. 2015; 38 (152):5-16.
55. Turton M, Africa CWJ. Further evidence for periodontal disease as a risk indicator for adverse pregnancy outcomes. Int Dent J. 2017; 67(3):148-56. doi: 10.1111/idj.12274.
56. Govindaraju P, Venugopal S, Shivakumar MA, Sethuraman S, Ramaiah SK, Mukundan S. Maternal periodontal disease and preterm birth: A case-control study. J Indian Soc Periodontol. 2015;19(5):512-5. doi: 10.4103/0972-124X.164751.
57. American College of Obstretricians and Gynecologists. Oral health care during pregnancy and through the lifespan. Committee Opinion No.569. Obstet Gynecol. 2013; 122:417-22.
58. Reza Karimi M1, Hamissi JH, Naeini SR, Karimi M. The Relation Between Maternal Periodontal Status and Preterm and Low Birth Weight Infants in Iran: A Case Control Study. Glob J Health Sci. 2015;8(5):184-8. doi: 10.5539/gjhs.v8n5p184.
59. Boggess KA, Edelstein BL. Oral health in women during preconception and pregnancy: implications for birth outcomes and infant oral health. Matern Child Health J. 2006;10 (5 Suppl):S169-74.
60. World Health Organization. Oral health. Key facts. 2018. (pristupljeno 15.1.2019) Dostupno na: https://www.who.int/news-room/fact-sheets/detail/oral-health
61. NSW Ministry of Health. Oral Health 2020: A Strategic Framework for Dental Health in NSW. 2014. (pristupljeno 15. 1. 2019) Dostupno na: https://www.health.nsw.gov.au/oralhealth/Publications/progress-on-oral-health-2020.pdf
62. Bale BF, Doneen AL, Vigerust DJ. High-risk periodontal pathogens contribute to the pathogenesis of atherosclerosis. Postgrad Med J. 2017;93(1098):215-20. doi: 10.1136/postgradmedj-2016-134279.
63. Karami S, Ghobadi N, Pakravan A, Dabirian M, Sobouti F. Periodontal Diseases and Possible Future Cardiovascular Events, Are they Related? An Overview. J. Pediatr. Rev. 2018; 6 (1): 44-8. doi: 10.5812/jpr.11144
64. Dörfer C, Benz C, Aida J, Campard G. The relationship of oral health with general health and NCDs: a brief review. Int Dent J. 2017; 67(Suppl 2):14-8. doi: 10.1111/idj.12360.
65. Munz M, Willenborg C, Richter GM et al. A genome-wide association study identifies nucleotide variants at SIGLEC5 and DEFA1A3 as risk loci for periodontitis. Hum Mol Genet. 2017. 26(3): 2577-88. doi: 10.1093/hmg/ddx151.
66. Friedewald VE, Kornman KS, Beck JD et al. American Journal of Cardiology; Journal of Periodontology. The American Journal of Cardiology and Journal of Periodontology editors' consensus: periodontitis and atherosclerotic cardiovascular disease. J Periodontol. 2009 ; 80(7):1021-32. doi: 10.1902/jop.2009.097001

67. Boggess KA, Edelstein BL. Oral health in women during preconception and pregnancy: implications for birth outcomes and infant oral health. Matern Child Health J. 2006;10 (5 Suppl):S169-74.
68. Horton AL, Boggess KA. Periodontal disease and preterm birth. Obstet Gynecol Clin North Am. 2012;39(1):17-23, vii. doi: 10.1016/j.ogc.2011.12.008.
69. Mardešić D. i Benjak V. Nedonošče. In: Mardešić D. i sur., editors. Pedijatrija. osmo prerađeno i dopunjeno izdanje. Zagreb: Školska knjiga.; 2016. str. 389-90.
70. Crispi F, Bijnens B, Figueras F et al. Fetal growth restriction results in remodeled and less efficient hearts in children. Circulation. 2010; 121 (22): 2427-36. doi: 10.1161 Circulation, AHA. 110.937995.
71. Atherosclerosis. 2015 Feb;238(2):380-7. doi: 10.1016/j.atherosclerosis.2014.12.029. Epub 2014 Dec 24. Intima media thickness measurement in children: A statement from the Association for European Paediatric Cardiology (AEPC) Working Group on Cardiovascular Prevention endorsed by the Association for European Paediatric Cardiology