

## **HEALTH MANAGEMENT OF ORAL AND CARDIOVASCULAR HEALTH OF PREGNANT WOMEN AND NEWBORNS**

*Pregledni znanstveni članak*

*Senka Mesihović Dinarević\*; Anes Jogunčić\*; Jasminka Prguda-Mujic\*; Lutvo Sporišević\*; Vjekoslav Krželj\*; Kristen Sarić\*; Liana Cambj-Sapunar\*; Davor Petrović\*; Berislav Topić\*, Sanja Jurišić\*; Senad Saric\*; Samir Prohic\*; Amila Zukanović\**

### **Abstract**

*Objective: The aim of the report was to sum up all the results from the project that was conducted in three phases during a three-years period, to present the correlation and influence of dietary habits during pregnancy and the cardiovascular development in new-borns. Materials and methods: It was designed as a cohort study, including pregnant women (n=43) selected by random selection from a total number of pregnant women examined in private clinics in Mostar, Sarajevo and Komiža (Croatia). Results: New-borns from mothers with unhealthy eating habits - foods that caused a tooth decay - had significantly higher values of the right carotid artery intima-media thickness (p=0.046). There was a statistically significant difference in the diameter of the descending aorta, with larger diameters in children*

---

\* Academy of Science and Arts of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina, e-mail: dsenka@bih.net.ba

\* Department of Epidemiology, Public Health Institute of Canton Sarajevo, Sarajevo, Bosnia and Herzegovina

\* Eurofarm center polyclinic, Laboratory department, Sarajevo, Bosnia and Herzegovina

\* The Public Institution Health Centre of Sarajevo Canton, Sarajevo, Bosnia and Herzegovina

\* Department of Health Studies, University of Split, Croatia

\* Polyclinic Arbor Vitae dr. Saric, Mostar, Bosnia and Herzegovina,

\* Department of Radiology, University Hospital Split, Split, Croatia

\* Department of Paediatrics, University Hospital Split, Split, Croatia

\* Academy of Science and Arts of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina

\* Faculty of Medicine, University of Mostar, Mostar, Bosnia and Herzegovina,

\* Polyclinic Arbor Vitae dr. Saric, Mostar, Bosnia and Herzegovina

\* Dental Office "Dr Prohic Stomatology 1930"

\* Faculty of Dentistry with Clinics, University of Sarajevo

*whose mothers had poor eating habits ( $p=0.021$ ). New-borns from mothers with fibre-rich, lower-fat eating habits had higher pulmonary artery flow rate ( $p=0.039$ ). Oral health was examined with the Decay-missing-filled index (DMF). Ejection fraction (FS%) was significantly higher in the group of new-borns whose mothers had a larger DMF index ( $p=0.03$ ). **Conclusion:** Dietary habits and oral health during pregnancy significantly affect the diameter of blood vessels and the flow rate.*

*Keywords: oral health, dietary habits, pregnancy, blood vessel.*

## 1. INTRODUCTION

Some studies have shown that oral health and eating habits during pregnancy can affect pregnancy outcomes (1, 2). The higher concentrations of estrogen and progesterone during pregnancy, and poor oral health can induce hyperaemia, edema, and bleeding in periodontal tissues due to (3). The first study conducted by Offenbacher and colleagues in 1996 has shown a potential relationship between maternal periodontal disease and the delivery of preterm/low birth weight infants (4). The studies of HAN YW show that mothers' nutrition and oral health can impact fetal cardiovascular system development, that can lead to slower fetal development, lower birth weight, as well as differences in blood vessel development (5). The study that has been conducted on animal models, has shown that a restricted or unbalanced maternal diet during gestation can influence susceptibility to atherosclerosis, but the correlation between maternal diet during pregnancy in humans and atherogenesis is unknown (6). Due to these previous studies, our team has conducted a study as part of the project: "Cardiovascular disease and Oral Health - The impact of pregnant women's oral health on the cardiovascular health in children" and this was run by the Committee of the Cardiovascular Disease Department of Medical Sciences ASA of Bosnia and Herzegovina. The study was conducted in three phases; the main aims of the first and second phases were to evaluate the relationship between oral health, dietary habits during pregnancy, and the development of the fetal cardiovascular system, specifically coronary and carotid arteries, and to evaluate the correlation of dietary habits and maternal oral health with

gestation age. In phase three, children's and mothers' oral health were examined four years after giving birth.

## 2. MATERIALS AND METHODS

### *The Summary of results in the first phase, examination of pregnant women eating habits and oral health*

The first phase of research started in 2017 and was completed within 12 months. The second phase lasted for two years (2017-2019). The study was designed to collect data from randomly selected pregnant women visiting the private clinics in Mostar, Sarajevo, and Komiza (Croatia) for their routine examination. The first phase included 43 pregnant women (n=43) from Mostar and Sarajevo in Bosnia and Herzegovina and from Komiza in Croatia who came for the routine gynaecological examination, including the oral health examination, who filled in a questionnaire about their eating habits. In the second phase, newborns children between the ages of 6- to 12-month-old were examined. During the examination, echocardiography was performed including Colour and CW /Continuous wave/ Doppler measuring. The results in the first phase during the oral health examination, 14 out of 40 (35%) reported that tooth repair was the cause for visiting dentists. During the examination, 26 (65.6%) had to repair teeth and only 5 (12.5%) participants had healthy teeth. The average Decay-missing-a filled index (DMF) index had median of 10.50 with interquartile range of 5 to 15.5. The questionnaire on mother's eating habits showed that 19 out of 40 (48.4%) participants consumed dairy products daily, 26 out of 40 (65%) participants consumed fruits at least twice per day; furthermore, 9 out of 40 (22.6%) participants consumed vegetables at least twice per day. The 17 out of 40 (42.5%) participants consumed meat daily, and 18 of 40 (45%) participants consumed meat a few times a week. Once per week, fish meal was consumed by 13 of 40 (33.3%) participants, and 14 of 40 (35.8%) participants did not consume fish at all. Alcohol was consumed by 1 (2.5%) participant, and cigarettes by 2 (5%) participants.

*The Summary of results of the second phase, new-born echocardiography examination, and the correlation with poor oral health habits of mothers*

During the second phase of the study, the new-borns were analysed. New-borns from mothers with poor eating habits had significantly higher values of the right carotid artery intima-media thickness (Table 1,  $p=0.046$ ) and a statistically significant difference in the diameter of descending aorta, with larger diameters in infants from mothers with poor eating habits (Table 1,  $p=0.021$ ) was seen during the study. The flow over AP was higher in infants from mothers with optimal eating habits (Table 1,  $p=0.039$ ) and a positive correlation was found between LVEDs and mothers with poor eating habits (Table 1,  $r=0.415$ ,  $p=0.044$ ), also a significant correlation was shown while examining the teeth on caries in mothers and LVEDs (Table 1,  $p=0.36$ ). A significant correlation was seen in carotid intima-media thickness with nutrition intake on both carotids, whereby the thicker intima was in infants from mothers with poor eating habits - foods that increase developing tooth decay (Table 1,  $r=-0.492$ ;  $p=0.03$ ) [7]. Mothers' poor eating habits negatively correlated with the diameter of children's descending aorta (Table 1,  $r=-0.508$ ,  $p=0.011$ ), meaning the worse the eating habits the smaller the children's diameters of descending aorta (7). Furthermore, paradental disease was directly correlated with diameters of left and right pulmonary arteries, especially segments S3 and S4, which have also been correlated with Flow rate over AP.

### **3. RESULTS**

In our study, the average age of pregnant women was 25 years, ranging from 20 to 32 years. From a total number of pregnancies 90.3% went without any complication. All newborns were born between 36th and 40th gestational week. Third phase results are presented in following parts.

Table 1. Eating habits and echo imaging

Variables	Eating habits		
	Bad eating habits Median (IQ range)	Good eating habits Median (IQ range)	p
CIMT R	0,04(0,03-0,05)	0,03(0,02-0,04)	<b>0,04</b>
CIMT L	0,04(0,03-0,04)	0,03(0,02-0,03)	<b>0,05</b>
Ascending aorta	9,7(9,0-12,0)	9(8,8-9,0)	<b>0,02</b>
Descending aorta	7,5(5,8-8,5)	5,8(5,0-7,0)	<b>0,02</b>
Flow over AP	1,31(1,0-1,4)	1,4(1,4-1,48)	<b>0,03</b>
LVEDs	14,0(12,0-15,3)	12,0(11,0-13,0)	<b>0,04</b>

*\*just significate results shown in this table.*

*The Summary of the third phase results, the follow-up, and examination of oral health in children and mothers four years later*

Out of a total of 43 patients, 14 parents with children responded to the re-examination (follow-up examination after 4 years). All 14 parents filled out the research questionnaire and the dental team examined 14 subjects - children (n=14), and obtained data on 3 determinants of oral health - kep index, gingival index and puff index. Each child's height and weight were measured and the BMI index was calculated. Although the number of respondents is small, statistical data processing was performed, and the mothers' BMI from the baseline was correlated with each determinant of the children's oral health individually at the follow-up examination after 4 years (kep, gi, pufa indices). Also, the proportion of untreated caries in mothers from the baseline was correlated with the determinants of oral health in children at the follow-up examination after 4 years. The results of the non-parametric correlation analysis are presented in table 2.

Table 2. Correlation of mothers' BMI, K component of the KEP index of mothers and kep, gi and puff indices in children

		kep	pufa	gi	Sig.
Spearman's rho	K	0,299	0	-0,354	p>0,05
	BMI	0	0	0	p>0,05

*kep: cavities/tooth extraction/seal; gi: gingival index; P-pulpal involvement, U-ulceration, F-fistula A-abscess)*  
*BMI-body mass index*

#### 4. DISCUSSION

Using Decay-missing-filled index (DMF index), we have conducted that mothers with poor eating habits also had increased values of DMF index. In our study, there were no children with low birth weight. Eating habits showed direct impact on fetal vascular growth and specifically on intima-media thickening. Sociodemographic factors tend to be significantly related to dietary pattern, suggesting that extra resources may be necessary for disadvantaged mothers in order to be able to purchase more healthy foods, which tend to be more expensive than high-energy foods. Authors are of the opinion that, good eating habits during pregnancy are essential for the future health of the unborn child.

#### 5. CONCLUSION

Based on the results of our study, it was found that poor eating habits impacted the diameter of blood vessels and flow. Unhealthy dietary plans will most probably lead to poor oral health and the presence of periodontitis, which could contribute to the thickening of carotid intima-media. Finally, that mechanism could contribute to the development of atherosclerosis. The limitation of the study is the small sample, and for better confirmation, it is necessary to extend the study and test inference on a larger sample.

##### *What Is Already Known on this Topic:*

Professional specialist assessment of malocclusion involves assessing both objective and subjective factors, but the patient's self-perception and aesthetic perceptions cannot be underestimated. Many occlusal indexes have been established to perform such estimations and categorize treatment need severity, such as the occlusal index, treatment priority index, and dental aesthetic index.

##### *What this Study Adds:*

A better understanding of patients' perception of their malocclusion severity is an essential step in orthodontic treatment planning. It is necessary to measure their aesthetic self-perception and the degree of acceptance of the treatment. This would give the orthodontist information

about the patient's expectations and improve cooperation with patients.

*Authors' Contributions:* Conception and design: SDM, AJ and LSC; Acquisition, analysis and interpretation of data: SS; SJ; DP; SP; AJ and AZ; Drafting the article: SDM, JPM and AJ; Revising it critically for important intellectual content: DP; LS, VK, BT, SJ Approved final version of the manuscript: SDM, AZ and JPM.

*Conflict of Interest:* The authors declare that they have no conflict of interest.

## REFERENCES

1. Gale CR, Jiang B, Robinson SM, Godfrey KM, Law CM, Martyn CN., 2006. Maternal diet during pregnancy and carotid intima–media thickness in children. *Arteriosclerosis, thrombosis, and vascular biology*.
2. Han YW. 2011. Oral health and adverse pregnancy outcomes—what’s next?. *Journal of dental research*.
3. Offenbacher S, Katz V, Fertik G, Collins J, Boyd D, Maynor G, et al., 1996. Periodontal infection as a possible risk factor for preterm low birth weight. *Journal of periodontology*.
4. Senka Mesihovic-Dinarevic et.al., 2022. Cardiovascular diseases and oral health – the impact of pregnant women’s oral health on children’s cardiovascular health. *Academy of Sciences and Arts of Bosnia and Herzegovina, Special Editions, Volume 62, 2022*.
5. Thomas NJ, Middleton PF, Crowther CA., 2008. Oral and dental health care practices in pregnant women in Australia: a postnatal survey. *BMC pregnancy and childbirth*.
6. Togoo RA, Al-Almai B, Al-Hamdi F, Huaylah SH, Althobati M, Alqarni S., 2019. Knowledge of pregnant women about pregnancy gingivitis and children oral health. *European journal of dentistry*.
7. Xiong X, Buekens P, Fraser WD, Beck J, Offenbacher S., 2006. Periodontal disease and adverse pregnancy outcomes: a systematic review. *BJOG: An International Journal of Obstetrics & Gynaecology*.