

# Outcome of Pregnancy and Maternal Weight in Women Living in Coastal and Continental Croatia

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## ABSTRACT

*Pregnancy outcomes are under the influence of maternal characteristics and environmental factors, diet being the most important. The benefits of the Mediterranean diet on all health indicators, including pregnancy, are well documented, placing at the top of the world's healthiest diets. The aim was to investigate whether pregnant women living in the Mediterranean part of Croatia have better pregnancy outcomes in comparison to women living in the continental region. Observational longitudinal study was conducted in two Croatia's regions: continental (city of Osijek and surrounding area) and coastal (city of Split and surrounding area). Even though women for the coastal region gained more weight during pregnancy ( $p=0.048$ ) and prolonged gestation ( $p<0.001$ ), maternal nutritional status has a higher influence on offspring's nutritional status at delivery among women from the continental region. The incidence of pregnancy disorders ( $p<0.001$ ) is higher among women from the continental region. Maternal weight prior to delivery was associated with caesarean section in both regions. Despite an unfavorable maternal nutritional status, both prior and during gestation and prolonged gestation, offspring's nutritional status is better in the Mediterranean part of Croatia.*

**Key words:** Mediterranean diet, food patterns, pregnancy outcomes, pre-pregnancy obesity, Croatia

## Introduction

The quality of a pregnant woman's diet is of special concern concerning that pregnancy is considered as the critical window in a child's future life, mainly health risks. Even though pregnancy is thought to positively influence women's diet for the better, the reports from all around the world are inconsistent<sup>1</sup>. However, diet influences pregnancy outcomes by 30%, which is more than any other determinant (such as baby's gender)<sup>2</sup>.

The quality of a pregnant women's diet is significantly influenced by her socioeconomic and lifestyle characteristics. Primiparous women show a high motivation to improve their nutritional habits<sup>3</sup>.

Additionally, several characteristics of a woman prior to pregnancy or in early pregnancy are related to pregnancy outcomes and pregnancy must be considered. These include a woman's age, pre-pregnancy weight (expressed as body mass index – BMI) and weight gain during pregnancy<sup>3</sup>.

One of the most common high-risk obstetric situations is obesity before pregnancy<sup>3,4</sup>. For example, the estimates for U.S. women of childbearing age (20 - 39 years old) show that 32% are obese with an additional 24% overweight<sup>5</sup>. Even moderate overweight is a risk factor for gestational diabetes and hypertensive disorders of pregnancy, and the risk is higher in subjects with overt obesity. A higher risk of cesarean deliveries and macrosomia are related to maternal overweight, increases maternal and fetal morbidity. In addition, long-term complications such as worsening of maternal obesity and development of obesity in the infant can be observed<sup>3,4</sup>. Weight gained during pregnancy and retained in the postpartum period has importance for a woman's lifetime risk of obesity, and may increase her subsequent risk of chronic diseases<sup>6</sup>. Women of advanced (35 years old) and high (40 years old) maternal age are exposed to a higher risk of a number of obstetric complications and interventions, an increase in type II diabetes and hypertension, maternal mortality, as well as an adverse impact on gestational age and birth weight of a child<sup>3</sup>. Women's choices, from timing the preg-

nancy to dietary habits and food choices are strongly influenced by social and educational background<sup>1,7</sup>.

Younger women, of lower education, low income, from rural areas, with more children and higher pre-pregnancy BMI, have diets of lower quality during pregnancy, while on the other side primiparous women show a high motivation to improve their nutritional habits<sup>1</sup>. In the last few decades, women are more focused on their academic achievements and careers<sup>7</sup>, which is evident from the increase in the average age of primiparous women in developed and developing countries. Dietary pattern is significantly influenced by income, which is especially the case for a healthy diet<sup>8</sup>. The energy density of foods and energy cost are in an inverse relationship<sup>9</sup>. The consumption of less healthy diets that are characterized by high energy density and palatability are led by economic constraints<sup>9</sup>. An additional aspect is the higher prevalence of overweight and obesity conditions in pregnant women of low socioeconomic status and low education level<sup>3</sup>.

The traditional Mediterranean diet is characterized by a high intake of healthy and functional food such as olive oil, fruits, vegetables, legumes, nuts, and whole-grain products; a moderate intake of fish; and only small amounts of red and processed meat<sup>10</sup>. Benefits of daily intake of Mediterranean diet are cardiovascular diseases prevention, reversion of metabolic syndrome, prevention of invasion of breast cancer, prostate and colorectal cancer, prevention of the age related cognitive decline, and even a protective roll in asthma among children<sup>11</sup>. Other studies revealed some pattern of dietary habits, with the predominant shift toward higher consumption of meat, pasta and cakes that are characteristic for continental dietary pattern. However, urbanization and globalization led to progressive loss of the traditional Mediterranean diet pattern, mainly due to the widespread dissemination of the Western-type economy, life-style, technology-driven culture, as well as the globalisation of food production, availability, and consumption, with consequent homogenization of food culture and behaviours<sup>11</sup>. These unfavourable changes have also been reported for Croatia's coastal region in the study „1001 Dalmatian study“<sup>12</sup>.

The hypothesis in this study is that women from the coastal region (Dalmatia), characterized with the Mediterranean lifestyle have more favorable pregnancy outcomes in comparison to women from the continental region (Slavonija and Baranja), characterized with completely the opposite eating habits. The hypothesis is based on the difference in the diet and the lifestyle in these two geographically and economically distinct regions of Croatia. Therefore, the main aim was to determine the difference in pregnancy outcomes between women living in the Mediterranean region and those in the continental part of Croatia. These differences have never been analyzed in the context of pregnancy outcomes.

## Materials and Methods

The observational longitudinal study was conducted in two of Croatia's regions: continental (Eastern Croatia, city of Osijek and surrounding area) and coastal (Dalmatia, city of Split and surrounding area). Women were recruited in the first 12 weeks of pregnancy and followed throughout the pregnancy, with the final data collection done at 6 weeks postpartum.

The study included two sets of pregnant women who were followed throughout the pregnancy. The first group of women consisted of women from the continental part of Croatia, the city of Osijek, and the surrounding area and consisted of 251 pregnant women, enrolled during one-year period, and monitored (throughout gestation to labor) from 2016 till the end of 2017. A total of 29 women were excluded for forced abortion, preterm labor, newborn death, twin pregnancy, and lack of data. Dropout rate was 11.6%. An overall number of pregnant women were 222. The study was approved by the Ethical committee of Medical Faculty of Osijek city; informed consent was obtained for all participating pregnant women. The recruitment was done at two general gynecologist offices. The recruited population is by all demographic and socio-economic characteristics representative for the overall population of pregnant women from the encompassed area, and present 14.8% of the total population of pregnant women for the study period.

The second group of women came from the coastal part of Croatia, the city of Split, and the surrounding area, and consisted of 367 pregnant women enrolled during a five-month period, from October 2016 till February 2017. The recruitment was done at the Ob/Gyn Department, Split hospital city in the coastal region. The recruited population is by all demographic and socio-economic characteristics representative for the overall population of pregnant women from the encompassed area, and present 20.7% of the total population of pregnant women for the study period. The study was approved by the Ethical committee of the Split hospital, the city of the coastal region (No. 2181-147-01/06/J.B.-16-2; June 30, 2016); informed consent was obtained for all participating pregnant women.

Study-specific questionnaire was developed. The questionnaire included questions on the basic socio-economic characteristics (age, education level, incomes), and anthropometric data (pre-pregnancy weight, height). The data on pregnancy outcome (including the length of gestation, pregnancy weight gain, delivery modus, birth weight, and length) was collected 6 weeks postpartum, in person (gynecologist visit), or by telephone (interview). Incidence of disorders of pregnancy was followed throughout the gestation and included gestational diabetes, pregnancy hypertension, proteinuria, preeclampsia, and edemas.

All selected candidates' body weight was recorded (Seca, UK) with an accuracy of  $\pm 0,1$ kg. Height was measured barefoot/without wearing shoes, with head position in the Frankfurt plane. Accuracy was determined to be

+/- 0,1cm, which is in accordance with and a standard part of this scale.

Data of height and body weight was recorded and Body Mass Index (BMI) was calculated. According to classification recommendations<sup>13</sup>, the women were placed into one of the following categories: malnourished, normal weight, increased body mass or obese. The women were additionally classified into age categories: younger, middle age or older, again according to the recommendations<sup>13</sup>. The women's change in weight was monitored and recorded during the entire gestational period. The weight difference measured from the beginning of gestation to immediately before delivery was recorded and compared with the standardized recommendations.<sup>13</sup> (Table 6)

Ponderal index (PI) is used to determine the frequency of disproportional fetal growth (PI<2.32 or PI>2.85), and was calculated for each child based on the formula: PI=(BW in g/BL3 in cm)x100<sup>14</sup>. Statistical analysis was done with statistical software tool Statistica 13.0 (StatSoft, Tulsa, Oklahoma, USA), at a significance level of p=0.05. Normality of data distribution was tested by the nonparametric Kolmogorov-Smirnov test for the comparison of medians and arithmetic mean, and histograms plotting. T-test for independent and dependent variables, and Pearson's test to calculate correlation coefficients were used.

## Results

Women from the coastal region are older (30.7±4.9 in comparison to 29.0±4.9 years, p<0.001), have higher weight prior delivery (82.3±13.1 kg in comparison to 79.8±11.6 kg, p=0.020) and have gained more weight during pregnancy (15.3±5.4 vs 14.5±4.4 kg, p=0.048) in comparison to women from the continental region (Table 1). In addition, their offspring have higher birthweight (not statistically significantly different) and length (p<0.001) in comparison to offspring in the continental region.

However, when PI was observed (Table 1), offspring of women from the continental region had higher PI (2.75±0.24) in comparison to women from the coastal region (2.68±0.27, p=0.002). Additionally, disproportional growth (based on PI value) (Table 2) is more frequent in the continental than in the coastal region (p=0.047).

Maternal nutritional status observed as weight prior and during gestation has higher influence on offspring's nutritional status at delivery (Table 3) among women from the continental region (r=0.308 for pre-pregnancy weight, r=0.403 for weight prior delivery and r=0.243 for pregnancy weight gain) in comparison to women from the coastal region.

Pregnant women from the continental region had higher incidence of pregnancy disorders (32.4% in comparison to 13.9%, p<0.001) in comparison to women from the coastal region (Table 2) but prolonged gestation was more frequent among women from the coastal region (34.6% with gestation of 41 weeks or longer in comparison to 9.9%, p<0.001).

The stronger effect of maternal weight on the incidence of pregnancy disorders was stronger in the continental region (p<0.001 for pre and gestational weight, Table 4), while lower parity was found to be important determinant among women from the coastal region (p=0.020). As expected incidence of disorders of pregnancy significantly affect offspring's nutritional status at birth in both groups of women (Table 4), but interestingly offspring's of women who developed pregnancy disorders during gestation in the continental region had higher PI (2.80 vs 2.72, p=0.031), which was lower in the coastal region (2.60 vs 2.69, p=0.023).

Even though no difference was found in the delivery modus, i.e. caesarean delivery frequency between the two regions (29.1% in the coastal vs 24.3% in the continental region, p=0.210), in both groups maternal weight prior delivery was associated with caesarean section (Table 5). Interestingly, likelihood of caesarean delivery is higher

**TABLE 1**  
COMPARISON OF OBSERVED CHARACTERISTICS BETWEEN PREGNANT WOMEN FROM THE COASTAL AND THE CONTINENTAL REGION

	Mean 1	Mean 2	t-value	SD 1	SD 2	p
Maternal age (years)	29.0	30.7	-4.051	4.9	4.9	<0.001*
Number of pregnancies	1.7	1.8	-0.775	0.8	1.0	0.439
Pre-pregnancy weight (kg)	65.3	67.0	-1.599	11.8	12.7	0.110
Weight prior delivery (kg)	79.8	82.3	-2.329	11.6	13.1	0.020*
Weight gain during pregnancy (kg)	14.5	15.3	-1.986	4.4	5.4	0.048*
Birth weight (g)	3477.9	3529.8	-1.150	478.7	557.2	0.251
Birth length (cm)	50.2	50.8	-3.867	2.0	2.1	<0.001*
Ponderal Index	2.75	2.68	3.169	0.24	0.27	0.002*

1 – continental region, 2 – coastal region, SD – standard deviation, T – test for independent samples, \*p<0.05

**TABLE 2**

COMPARISON OF PONDERAL INDEX (PI), INCIDENCE OF PREGNANCY DISORDERS AND GESTATION BETWEEN THE COASTAL AND THE CONTINENTAL REGION

	Continental region n (%)	Coastal region n (%)	p
Ponderal Index			
<2.32	4 (1.8)	18 (5.1)	0.047*
Normal	148 (66.7)	261 (74.1)	
>2.85	70 (31.5)	74 (20.8)	
Pregnancy disorders			
Yes	72 (32.4)	50 (13.9)	<0.001*
No	150 (67.6)	311 (86.1)	
Gestation			
< 37 <sup>th</sup> week	16 (7.2)	15 (4.2)	<0.001*
37 <sup>+1</sup> – 40 <sup>+6</sup> week	184 (82.9)	221 (61.2)	
≥ 41 <sup>th</sup> week	22 (9.9)	125 (34.6)	

Fischer’s Exact Test, \*p<0.05

among the second parity women from the continental region, and primiparae in the coastal region (the results are not shown).

**Discussion**

Diet during pregnancy is one of the most important external, environmental factors affecting the growth and development of the fetus<sup>1</sup>, and the Mediterranean diet has consistently shown beneficial effects on maternal<sup>15</sup> and offspring outcome measures<sup>10</sup>. However, the trend of low adherence to the Mediterranean diet has been found among pregnant women from Portugal<sup>15</sup>, Greece<sup>10</sup>, Italy<sup>16</sup>, and Spain<sup>17,18</sup>.

Low adherence to the Mediterranean diet is related to higher pre-pregnancy weight<sup>10</sup> and higher gestational

weight gain<sup>16,18</sup>. Our results show the same adverse changes among women from the coastal region of Croatia who gained more weight during gestation and their offspring have higher birth weight and length in comparison to pregnant women from the continental region.

Both pre-pregnancy BMI and excessive gestational weight gain were found to correlate with a higher probability of weight retention, especially in consecutive pregnancies<sup>19,20</sup>, the trend confirmed for women from the coastal region. Higher parity was observed among women from the coastal region (17.8% with 3 or more pregnancies in comparison to 14.4% in the continental region), and they also had higher pre-pregnancy weight and higher gestational weight gain in comparison to women from the continental region. However, when disproportional fetal growth was observed (as PI), the results showed that offspring of women from the continental region had higher average PI and disproportional growth was more frequent than in the coastal region. A study by Saunders et al.<sup>21</sup> found a slightly decreased risk of fetal growth restriction among underweight and normal-weight women who had higher compliance with the Mediterranean diet. However, the effect of the Mediterranean diet was found insignificant when the whole population was observed<sup>21</sup>.

Beneficial effects of the Mediterranean diet on fetal growth restriction were found in Spain but not in Greece<sup>22</sup> underlining the differences in the Mediterranean diet principles across regions. Fat content (and its dietary source), as one of the main characteristics of the Mediterranean diet, can be used to distinguish variations in the Mediterranean diet principle across geographic regions<sup>23</sup>. In Greece, the Mediterranean diet is rich in fats, while in South Italy and South France the content of fat in the Mediterranean diet is relatively low<sup>24,25</sup>. A Cochrane systematic review that included randomized controlled trials found only a modest effect of the Mediterranean diet or its components on the cardiovascular risk factors reduction, which could be due to the methodological differences and design limitations of the published studies<sup>28</sup>.

Large regional differences in the diet across Croatia’s regions were reported by Jelinić et al.<sup>26</sup>. One-quarter of

**TABLE 3**

CORRELATION COEFFICIENTS BETWEEN OFFSPRING’S NUTRITIONAL STATUS AT DELIVERY AND MATERNAL NUTRITIONAL STATUS FOR TWO REGIONS

	Continental region			Coastal region		
	Birth weight (g)	Birth length (cm)	Ponderal Index	Birth weight (g)	Birth length (cm)	Ponderal Index
Number of pregnancies	0.221	0.169	0.201	0.133	0.110	0.102
Gestation (weeks)	0.332	0.358	0.343	0.407	0.436	0.165
Pre-pregnancy weight (kg)	0.308	0.187	0.227	0.185	0.135	0.124
Weight prior delivery (kg)	0.403	0.251	0.294	0.232	0.184	0.140
Weight gain during pregnancy (kg)	0.243	0.162	0.171	0.126	0.127	0.138

Pearson’s correlation coefficients significant at p<0.05

**TABLE 4**  
COMPARISON OF OBSERVED CHARACTERISTICS OF WOMEN FROM THE TWO REGIONS ON THE BASIS OF GESTOSIS DIAGNOSED DURING GESTATION

	Mean 0	Mean 1	t-value	p	SD 0	SD 1
Continental region						
Number of pregnancies	1.7	1.8	-1.023	0.307	0.7	1.0
Pre-pregnancy weight (kg)	62.7	70.9	-5.094	<0.001*	9.4	14.1
Weight prior delivery (kg)	76.5	86.7	-6.708	<0.001*	9.4	12.8
Weight gain during pregnancy (kg)	13.8	15.9	-3.351	<0.001*	3.8	5.1
Ponderal index	2.72	2.80	-2.171	0.031*	0.24	0.23
Coastal region						
Number of pregnancies	1.8	1.5	2.333	0.020*	1.0	0.7
Pre-pregnancy weight (kg)	66.8	68.7	-1.006	0.315	12.7	12.8
Weight prior delivery (kg)	81.8	85.4	-1.753	0.080	13.2	11.9
Weight gain during pregnancy (kg)	15.1	16.8	-2.139	0.033*	5.1	6.7
Ponderal index	2.69	2.60	2.277	0.023*	0.26	0.31

0 – no pregnancy disorders, 1 – pregnancy disorder(s) present, SD – standard deviation, T – test for independent samples, \*p<0.05

adults have a diet characterized by unhealthy patterns, and the lowest prevalence of such unhealthy dietary pattern was found across the coast and in the city of Zagreb. The authors explained their findings with better socio-economic status and education in the capital and the Mediterranean dietary pattern, still present across the coast<sup>26</sup> despite a significant deterioration in the Mediterranean diet<sup>12</sup>. Pregnant women from the continental region have a diet characterized by a high contribution of fats (more than 35%), high intake of saturated fats, the low contribution of carbohydrates to the total daily energy intake, and low intake of various micronutrients<sup>1</sup>. A study by Kendel Jovanović et al.<sup>27</sup> analyzed the diet quality of middle-aged women from one coastal region (Primorsko-Goranska County) on the basis of the Healthy Eating Index. One

third of women (30.7%) had a poor diet and an additional 66.1% have a diet that needs improvement.

Offspring’s exposure to unfavorable maternal nutritional status, both prior and during gestation, and prolonged gestation did not result in negative outcomes. On the contrary, it seems that pregnant women from the Mediterranean region overcome all the potentially negative effects on offspring’s nutritional status. This seems to be true even in regions with documented deterioration in the Mediterranean diet<sup>12</sup>. This conclusion is additionally substantiated with the correlation analysis showing the higher influence of maternal weight on offspring’s birth weight and higher incidence of pregnancy disorders among pregnant women from the continental region.

**TABLE 5**  
MATERNAL NUTRITIONAL CHARACTERISTICS (OBSERVED AS BODY WEIGHT) ON THE DELIVERY MODUS IN THE TWO REGIONS

	Mean 1	Mean 2	t-value	p	SD 1	SD 2
Continental region						
Pre-pregnancy weight (kg)	64.6	67.7	-1.706	0.089	11.4	12.8
Weight prior delivery (kg)	78.8	82.9	-2.256	0.025*	11.2	12.6
Weight gain during pregnancy (kg)	14.2	15.2	-1.367	0.173	4.4	4.5
Coastal region						
Pre-pregnancy weight (kg)	66.3	68.8	-1.690	0.092	12.0	14.3
Weight prior delivery (kg)	81.2	85.1	-2.573	0.010*	12.4	14.3
Weight gain during pregnancy (kg)	15.0	16.1	-1.767	0.078	5.0	6.3

1 - spontaneous delivery, 2 - caesarean section, SD - standard deviation, T - test for independent samples, \*p<0.05

The fact is that dietary habits are changing. Kolčić et al. revealed rather unsatisfactory Mediterranean diet consumption in the southern coastal area of Croatia – only 23% of participants were classified as being adherent to the Mediterranean diet, with a particularly low percentage among younger participants (12%) compared to the older ones (34%)<sup>28</sup>. Obese and overweight pregnant women are at elevated risk for delivering prematurely<sup>29</sup> and the trend has been previously noted in the population from the continental region<sup>3</sup>. Adherence to the Mediterranean diet showed reduced risk of preterm delivery in overweight and obese pregnant women<sup>21</sup>. Our regional comparison of pregnant women confirms the same trends visible among pregnant women and their offspring from the coastal region. One large observational study conducted in France found strong linear association between maternal pre-pregnancy BMI and the risk of caesarean delivery, the association persistent even after controlling for diagnosis of gestational diabetes, term deliveries ( $\geq 37$  weeks), very short maternal height, primiparity and maternal age  $\geq 35$  years<sup>30</sup>. The same trend was found in a large population study from Finland, especially in women with excessive gestational weight gain<sup>31</sup>. The risk of caesarean delivery is 50% higher in overweight and more than double in obese women when compared with women with normal BMI according to the systematic review and meta-analysis of cohort studies prepared by Poobalan et al.<sup>32</sup>.

The frequency of caesarean delivery did not differ between the two regions and in both weight prior delivery was significant determinant for caesarean section. Cluster analysis on the basis of early pregnancy indicators (in the first trimester) of pregnant women from the continental region found that women with a higher pre-pregnancy BMI have a significantly higher incidence probability for delivering baby of a higher birth weight baby, significantly higher probability for developing pregnancy disorders, and a higher probability of induced or caesarean delivery<sup>3</sup>. Even relatively small absolute number, the overall population coverage in both regions is relatively high; therefore the conclusions drawn can be applied to pregnant women from both regions. However, the study lacks the actual dietary assessment for pregnant women, which would enable the factual test of the hypothesis set.

## REFERENCES

1. BANJARI I, KENJERIĆ D, MANDIĆ ML, GLAVAŠ M, LEKO J, *British Journal of Medicine and Medical Research*, 7 (2015) 145. — 2. BOULPAEP EL, BORON WF, *Medical Physiology* (Elsevier, Saunders, 2006). — 3. BANJARI I, KENJERIĆ D, ŠOLIĆ K, MANDIĆ ML, *Coll Antropol*, 39 (2015) 247. — 4. FLYNN AC, SEED PT, PATEL N, BARR S, BELL R, BRILEY AL, GODFREY KM, NELSON SM, OTENG-NTIM E, ROBINSON SM, SANDERS TA, SATTAR N, WARDLE J, POSTON L, GOFF LM, *Int J Behav Nutr Phys Act*, 13 (2016) 124. doi: 10.1186/s12966-016-0450-2. — 5. WILLIAMS CB, MACKENZIE KC, GAHAGAN S, *Clin Obstet Gynecol*, 57 (2014) 508. — 6. SAGEDAL LR, SANDA B, ØVERBY NC, BERE E, TORSTVEIT MK, LOHNE-SEILER H, HILLESUND ER, PRIPP AH, HENRIKSEN T, VISTAD I, BJOG, 124

The issue of obesity is global; today obesity and overweight condition are considered the number one problem in obstetrics. However, along with maternal characteristics one must consider environmental determinants; diet being the most important one. The results of our study are applicable to a number of countries that have similar dietary characteristics. Diet in the continental region has many characteristics from the traditional Hungarian diet, along with influences from Turks and Austrians. Large regional differences are not exclusive to Croatia; they are visible across the globe but observational studies focused on the regional differences in pregnant women are sparse. These studies are the prerequisite for the development of intervention programs that would gain success measured with improved pregnancy outcomes and healthier start for newborns. Out of many factors which may alter pregnancy outcomes is the diet. In recent years, due to its positive impact on the overall health, as well as pregnancy outcomes, the Mediterranean diet is put in the spotlight.

Limitations of the study: We are aware of the limitation of this study, as the questionnaire does not include data on dietary or eating habits of the participants, e.g. food frequency questionnaire and lifestyle. There are also many other factors which may influence pregnancy outcomes. We have not included other influencing factors such as exercising status/physical activity, working/living conditions, health status etc.

## Conclusion

This study aimed to examine whether the Mediterranean diet has a beneficial effect on pregnancy outcomes in pregnant women from Croatia. More favorable outcomes were found in women following the Mediterranean diet.

Today's fast-paced lifestyle often results in unfavorable changes in our diet. Sadly, even in some of the Mediterranean countries diet loses traditional characteristics so unique for the Mediterranean diet. Given the fact that healthy diet represents the foundation for a healthy pregnancy, more actions are needed to promote and encourage adoption of healthy diet and optimal weight among pregnant women.

(2017) 111. doi : 10.1111/1471-0528.13863. — 7. DIETL A, CUPISTI S, BECKMANN MW, SCHWAB M, ZOLLNER U, *Geburtshilfe Frauenheilkd*, 75 (2015) 827. doi : 10.1055/s-0035-1546109. — 8. SAULLE R, SEMYONOV L, LA TORRE G, *Nutrients*, 5 (2013) 4566. doi : 10.3390/nu5114566. — 9. DREWNOWSKI A, DARMON N, *J Nutr*, 135 (2005) 900. doi : 10.1093/jn/135.4.900. — 10. CHATZI L, RIFAS-SHIMAN SL, GEORGIU V, JOUNG KE, KOINAKI S, CHALKIADAKI G, MARGIORIS A, SARRI K, VASSILAKI M, VAFEIADI M, KOGEVINAS M, MANTZOROS C, GILLMAN MW, OKEN E, *Pediatr Obes*, 12 (2017) 47. doi : 10.1111/ijpo.12191. — 11. BIAGI C, DI NUNZIO M, BORDONI A, GORI D, LANARI M, *Nutrients*, 11 (2019) 997. doi : 10.3390/nu11050997. — 12. KOLČIĆ I, BILOGLAV Z, ZGAGAL, JOVIĆ AV, CURIĆ I, CURIĆ

- S, SUSAC J, VELAGIĆ V, MATEC L, ZOBİĆ I, ZEDELJ J, STRNAD M, Coll Antropol, 33 (2009) 135. — 13. IOM, Weight Gain During Pregnancy: Reexamining the Guidelines (Institute of Medicine (US) and National Research Council (US) and Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). — 14. ŠEGREGUR J, Gynaecol Perinatol, 18 (2009) 118. — 15. PEREIRA-DA-SILVA L, PINTO E, Acta Med Port, 29 (2016) 658. doi:10.20344/amp.7344. — 16. BERTOLI S, LEONE A, VIGNATI L, VIGNATI L, BEDOGNI G, MARTÍNEZ-GONZÁLEZ MÁ, BES-RASTROLLO, SPADAFRANCA A, VANZULLI A, BATTEZZATI A, Clin Nutr, 34 (2015) 1266. doi:10.1016/j.clnu.2015.10.003. — 17. OLMEDO-REQUENA R, FERNÁNDEZ JG, PRIETO CA, MORENO JM, BUENO-CAVANILLAS A, JIMÉNEZ-MOLEÓN JJ, Public Health Nutrition, 17 (2014) 648. doi:10.1017/S1368980013000657. — 18. SILVA DEL VALLE MA, SÁNCHEZ VILLEGAS A, SERRA MAJEM L, Nutr Hosp, 28 (2013) 654. doi:10.3305/nh.2013.28.3.6377. — 19. CHUNG JG, TAYLOR RS, THOMPSON JMD, ANDERSON NH, DEKKER GA, KENNY LC, MCCOWAN LM, Eur J Obstet Gynecol Reprod Biol, 167 (2013) 149. doi: 10.1016/j.ejogrb.2012.11.020. — 20. CHOI SK, PARKIY, SHIN JC, Reprod Biol Endocrinol, 9 (2011) 6. doi: 10.1186/1477-7827-9-6. — 21. SAUNDERS L, GULDNER L, COSTET N, KADHEL P, ROUGET F, MONFORT C, THOMÉ JP, MULTIGNER L, CORDIER S, Paediatr Perinat Epidemiol, 8 (2014) 235. doi: 10.1111/ppe.12113. — 22. CHATZI L, MENDEZ M, GARCIA R, ROUMELIOTAKI T, IBARLUZEA J, TARDÒN A, AMIANO P, LERTXUNDI A, IÑIGUEZ C, VIOQUE J, KOGEVINAS M, SUNYER J, Br J Nutr, 107 (2012) 135. doi:10.1017/S0007114511002625. — 23. BANJARI I, BAJRAKTAROVIĆ-LABOVIĆ S, MISIR A, HUZJAK B, Timočki medicinski glasnik, 38 (2013) 188. — 24. DE LORGERIL M, Curr Atheroscler Rep, 15 (2013) 370. doi: 10.1007/s11883-013-0370-4. — 25. DI DANIELE N, PETRAMALA L, DI RENZO L, SARLO F, DELLA ROCCA DG, RIZZO M, FONDACARO V, IACO-PINO L, PEPINE CJ, DE LORENZO A, Acta Diabetol, 50 (2013) 409. doi: 10.1007/s00592-012-0445-7. — 26. JELINIĆ JD, PUCARIN-C-VETKOVIĆ J, NOLA IA, SENTA A, MILOSEVIĆ M, KERN J, Coll Antropol, 33 (2009) 31. — 27. KENDEL JOVANOVIĆ G, PAVIČIĆ ŽEŽELJ S, MALATESTINIĆ D, MRAKOVČIĆ ŠUTIĆ I, NADAREVIĆ ŠTEFANAC V, DORČIĆ F, Coll Antropol, 34 (2010) 155. — 28. KOLČIĆ I, RELJA A, GELEMANOVIĆ A, MILJKOVIĆ A, BOBAN K, HAYWARD C, RUDAN I, POLAŠEK O, Croat Med J, 57 (2016) 415. doi: 10.3325/cmj.2016.57.415. — 29. BAETEN JM, BUKUSI EA, LAMBEM, Am J Public Health, 91 (2001) 436. doi: 10.2105/ajph.91.3.436. — 30. BARAU G, ROBILLARD PY, HULSEY TC, DEDECKER F, LAFFITE A, GÉRARDIN P, KAUFFMANN E, BJOG, 113 (2006) 1173. doi: 10.1111/j.1471-0528.2006.01038.x. — 31. RAATIKAINEN K, HEISKANEN N, HEINONEN S, Obesity (Silver Spring), 14 (2006) 165. doi: 10.1038/oby.2006.20. — 32. POOBALAN AS, AUCOTT LS, GURUNG T, SMITH WC, BHATTACHARYA S, Obes Rev, 10 (2009) 28. doi: 10.1111/j.1467-789X.2008.00537.x.

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## **ISHODI TRUDNOĆE I TJELESNA TEŽINA TRUDNICA U KONTINENTALNOJ I MEDITERANSKOJ HRVATSKOJ**

### **SAŽETAK**

Na ishod trudnoće utječu majčinske karakteristike i okolišni čimbenici, od kojih je najvažniji utjecaj prehrane. Dobrobiti mediteranske prehrane na sve indikatore zdravlja, uključujući i trudnoću, su dobro dokumentirane te je plasiraju na vrh svjetskih najzdravijih prehrana. Cilj je bio istražiti imaju li trudnice koje žive u mediteranskom dijelu Hrvatske bolje ishode trudnoće u odnosu na one koje žive u kontinentalnoj Hrvatskoj. Opservacijska longitudinalna studija provedena je u dvjema hrvatskim regijama: kontinentalnoj (grad Osijek i okolica) i primorskoj (grad Split i okolica). Iako su žene u primorskom području više dobile na težini tijekom trudnoće ( $p=0.048$ ) i trudnoća je bila duža ( $p<0.001$ ), nutritivni status majke ima veći utjecaj na stanje uhranjenosti novorođenčeta pri porodu među ženama iz kontinentalnog dijela. Incidencija komplikacija u trudnoći ( $p<0.001$ ) je viša kod žena iz kontinentalnog dijela. Težina majke prije poroda bila je povezana s carskim rezom u obje regije. Usprkos nepovoljnom nutritivnom statusu majke, i prije i tijekom trudnoće te produljene trudnoće, nutritivni status novorođenčeta je bolji u mediteranskoj Hrvatskoj.