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Pregestational obesity – risk factor for preeclampsia

Pregestacijska debljina – čimbenik rizika za preeklampsiju

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Summary

Aim: The aim of the study was to determine pregestational and gestational obesity as risk factors for the occurrence of preeclampsia using body mass index (BMI), as the first research in the East Croatian region.

Material and methods: This clinical study included 55 pregnant women with preeclampsia and a control group of 50 pregnant women without preeclampsia with measurement pregestational and gestational weight and body mass index.

Results: The mean body weight of preeclampsia women was 88.195 kg; by median, the mean body weight of control women was 77.030 kg. In women with preeclampsia, the mean gestational weight gain was 15.709 kg; in the control group, the mean gestational weight gain was 14.760 kg, whereas testing yielded no statistically significant differences in the mean weight gain between the preeclampsia women with the control group. The mean BMI in the group of women with preeclampsia was 32.235 kg/m^2; in the control group, the mean BMI was 27.766 kg/m^2. T-test yielded a statistically significant difference in the mean BMI between the preeclampsia group and control group of women with a normal course of pregnancy.

Conclusion: In our study, we found that women with preeclampsia had significantly higher BMI values at conception as compared to the group of pregnant women with a normal course of pregnancy, suggesting the increased pregestational BMI to be a risk factor for developing preeclampsia in pregnancy.

Key words: obesity, preeclampsia, body mass index

Sažetak

Cilj istraživanja je proučiti pregestacijsku i gestacijsku debljinu kao čimbenika rizika nastanka preeklampsije koristeći indeks tjelesne mase (ITM). Klinička studija uključila je 55 trudnica s preeklampsijom i 50 trudnica bez preeklampsije s mjerenjem pregestacijskog i gestacijskog ITM. Srednja vrijednost tjelesne težine u preeklamptičnih trudnica iznosila je 88,195 kg, a u kontrolnoj skupini 77,030 kg. Kod žena s preeklampsijom, srednja vrijednost gestacijske debljine je bila 15,709 kg, dok je u kontrolnoj skupini bila 14,760 kg, gdje testirana vrijednost nije pokazala statističku značajnost između žena s preeklampsijom u odnosu na kontrolnu skupinu. Srednja vrijednost ITM u preeklamptičnih trudnica iznosi 32,235 kg/m^2, a u kontrolnoj skupini ITM je iznosila 27,766 kg/m^2, što je statistički značajno.

U ovom istraživanju, dokazan je značajno viši prekoncepcijski ITM u preeklamptičnih trudnica, nego u skupini zdravih trudnica, što sugerira povišeni pregestacijski ITM čimbenikom rizika nastanka preeklamspije.

Ključne riječi: debljina, preeklampsija, indeks tjelesne mase

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Introduction

Preeclampsia, characterized by hypertension and proteinuria during pregnancy, currently is the leading cause of maternal mortality (15% – 20% in industrialized countries), acute and chronic morbidity, and overall perinatal mortality and morbidity. Definitive phenotype of the maternal multiorgan preeclampsia syndrome is known to be modulated by the maternal preexistent cardiovascular and metabolic state. Currently, identification of women at risk of developing preeclampsia is a major problem, as it is still based on epidemiological and clinical factors. Preeclampsia is more frequently found in nulliparae, multiple pregnancies, pregnant women with chronic hypertension and/or renal disease, pregnant women with a history of preeclampsia in previous pregnancies, pregnant women of extreme age groups (< 20 and > 40), adipose pregnant women, pregnant women with gestational diabetes, pregnant women with pregestational diabetes mellitus, those with thrombophilia, gestational trophoblastic disease, women undergoing methods of assisted reproduction, women suffering from autoimmune diseases, and low birth weight women.[1-4] Obesity is a major risk factor for metabolic and cardiovascular comorbidity and a risk factor for perinatal complications and infertility, including preeclampsia.[5,6] The aim of the study was to determine pregestational and gestational obesity as risk factors for the occurrence of preeclampsia using body mass index (BMI), as the first research in the East Croatian region.

Material and methods

This clinical study included 55 pregnant women with preeclampsia and a control group of 50 pregnant women without this complication with measurement pregestational and gestational weight and body mass index. The study was approved by the Ethics Committee of Osijek University Hospital Center, a tertiary healthcare facility in Eastern Croatia, a predominantly rural area traditionally using non-Mediterranean and rather unhealthy dietary habits with all forms of pork as the main food, which is associated with a high cardiovascular and cerebrovascular morbidity as a major public health problem. Study group women were diagnosed with preeclampsia (blood pressure measurements on at least two occasions at minimum 4-h interval ≥ 140/90 mm Hg, and with positive proteinuria after 20th week of gestation, > 3 g/L during 24 hours). Control group women were gestational age-matched to study group women (> 20th week of gestation) and had a normal course of pregnancy. Research data relate only to pregnancy weight and weight gained during pregnancy. Women with mental retardation and minors were not included in the study. Prior to entering the study, all women were explained the purpose, protocol and objectives of the study. The selected descriptive statistics parameters were determined for the variables denoting particular characteristics of study subjects and the Shapiro-Wilks test was used because of the relatively small number of study subjects, whereas t-test and Levene test were employed in cases where the hypothesis of normal distribution was confirmed.

Besides these, χ^2-test was used on testing the hypothesis, while differences were considered statistically significant at the level of $p < 0.05$. Data were prepared by using the Microsoft Excel table calculator, while the SPSS (Statistical Package for the Social Science) and Statistics software was used on data processing.

Results

The mean body weight of preeclampsia women was 88.195 kg; by median, body weight was ≤ 86 kg in one half and ≥ 86 kg in the other half of these women. The mean body weight of control women was 77.030 kg; by median, body weight was ≤ 77 kg in one half and ≥ 77 kg in the other half of control women. The results of the Shapiro-Wilks test showed normal distribution of the variables analyzed. The Levene test showed different variances of the distributions analyzed (F = 7.174, p = 0.009), whereas the test yielded statistically significant differences in the mean body weight between the groups of preeclampsia women and control women with a normal course of pregnancy (t = 4.097, p = 0.000) (Table 1). In women with preeclampsia, the mean gestational weight gain was 15.709 kg; by median, gestational weight gain was ≤ 15 kg in one half and ≥ 15 kg in the other half of these women. The minimal and maximal gestational weight gain was 5 and 32 kg, respectively, yielding a variation range of 27 kg. In the control group, the mean gestational weight gain was 14.760 kg. The Levene test showed identical variances of the distributions analyzed (F = 0.810, p = 0.370), whereas t-test yielded no statistically significant differences in the mean weight gain between the preeclampsia women with control women with normal course of pregnancy (t = 0.813, p = 0.418) (Table 2).

The mean BMI in the group of women with preeclampsia was 32.235 kg/m2; by median, BMI was ≤ 31.590 kg/m2 in one half and ≥ 31.590 kg/m^2 in the other half of these women. In the control group, the mean BMI was 27.766 kg/m^2. The Levene test showed different variances of the distributions analyzed (F = 9.909, p = 0.002), whereas t-test yielded a statistically significant difference in the mean BMI between the preeclampsia group and control group of women with a normal course of pregnancy (t = 5.164, p = 0.000) (Table 3).

Table 1 Pregestational weight - statistical data in preeclamptic and control groups
Tablica 1. Pregestacijska debljina – statistički podaci u kontrolnim skupina i skupinama preklampsije

Statistical data *Statistički podaci*	Weight */ Težina* (kg) p = 0,000	
	Preeclamptic group *Skupina preklamsije*	Control group *Kontrolna skupina*
Number of cases / *Broj slučajeva*	55	50
Arithmetic middle / *Artimetička sredina*	88.195	77.030
Median / *Prosjek*	86.000	77.000
Minimal values / *Minimalne vrijednosti*	60.000	50.000
Maximal values / *Maksimalne vrijednosti*	126.000	116.000
Over quartil / *Iznad kvartila*	78.000	70.400
Under quartil / *Ispod kvartila*	99.000	82.500
Interquartil / *Međukvartil*	21.000	12.100
Standard deviation / *Standardna devijacija*	16.171	11.556

Table 2 Gestational growth weight - statistical data in preeclamptic and control groups
Tablica 2. – Gestacijski rast težine - statistički podaci u kontrolnim skupina i skupinama preklamsije

Statistical data *Statistički podaci*	Gestational growth weight / *Porast gestacijske težine* (kg) p = 0.418	
	Preeclamptic group *Skupina preklamsije*	Control group *Kontrolna skupina*
Number of cases / *Broj slučajeva*	55	50
Arithmetic middle / *Artimetička sredina*	15.709	14.760
Median / *Prosjek*	15.000	14.500
Minimal values / *Minimalne vrijednosti*	5.000	4.000
Maximal values / *Maksimalne vrijednosti*	32.000	30.000
Over quartil / *Iznad kvartila*	10.000	10.000
Under quartil / *Ispod kvartila*	19.000	18.000
Interquartil / *Međukvartil*	9.000	8.000
Standard deviation / *Standardna devijacija*	6.259	5.648

Table 3 Body mass indexes in preeclamptic and control groups
Tablica 3. Indeksi tjelesne mase u kontrolnim skupina i skupinama preklamsije

Statistical data *Statistički podaci*	BMI (kg/m^2) p = 0,000	
	Preeclamptic group *Skupina preklamsije*	Control group *Kontrolna skupina*
Number of cases / *Broj slučajeva*	55	50
Arithmetic middle / *Artimetička sredina*	32.235	27.766
Median / *Prosjek*	31.590	27.365
Minimal values / *Minimalne vrijednosti*	21.960	20.550

Discussion

The rising trend of obesity worldwide is considered to be responsible for the increasing prevalence of preeclampsia, perinatal complications and infertility due to the higher risk of cardiovascular and metabolic disorders.[5,7] The exact mechanism associating obesity or insulin resistance with preeclampsia has not yet been fully elucidated. It may possibly be explained by the increased stress along with hyperdynamic circulation, dyslipidemia, or enhanced cytokine mediated oxidative stress, enhanced sympathetic activity, increased renal sodium resorption, or direct interference of insulin resistance or hyperinsulinism with placentation.[8,9] In their retrospective study, Barden et al. demonstrated that women with preeclampsia had higher BMI and blood pressure levels before pregnancy as compared with normotensive control subjects, suggesting their predisposition to a metabolic syndrome.[10] In Croatia, the relationship of obesity, gestational weight gain and preeclampsia has not yet been studied at national level. Obesity as a risk factor for preeclampsia has also been reported by Sibai et al.[1] In our study, analysis of the mean gestational weight gain yielded similar results, as there was no statistically significant between-group difference (mean gestational weight gain 15.709 ± 6.259 kg in the preeclampsia group and 14.760 ± 5.648 kg in the control group). Statistically significant between-group differences were found in the mean gestational BMI as well as in the mean pregestational BMI values, indicating that increased pregestational BMI posed a risk of developing preeclampsia in pregnancy, which is consistent with the literature reports mentioned above and below. In their retrospective cohort study, Bhattacharya *et al.* followed-up a cohort of nulliparae during a 30-year period. Study women were divided into five groups according to BMI values. The risk of preeclampsia was found to be highest (OR 7.2; 95% CI 4.7, 11.2) in the group of women with morbid obesity (BMI 30-34.9 kg/m^2) and lowest (OR 0.6; 95% CI 0.5, 0.7) in the group of underweight women (BMI < 20 kg/m^2). The rate of pregnancy termination by cesarean section was highest in the group women with morbid obesity (OR 2.8; 95% CI 2.0, 3.9). The risk of delivering a newborn of >4000 g birth weight was also highest in the group of women with morbid obesity (OR 0.5; 95% CI 0.4, 0.6). The authors conclude that elevated BMI is associated with an increased incidence of preeclampsia, gestational hypertension, macrosomia, and pregnancy termination by cesarean section.[11]

Pregnancy complicated by preeclampsia poses a risk of vascular disease (arterial hypertension, stroke, and myocardial infarction) and should definitely stimulate lifestyle modification and avoidance of risk factors. It is considered that conditions comparable to those found in adults with arterial hypertension, obesity or diabetes, primarily systemic inflammatory response, also characterize preeclampsia in young women[12-15] In our study, we found that the women with preeclampsia had significantly higher BMI values at conception as compared to the group of pregnant women with a normal course of pregnancy, suggesting the increased pregestational BMI to be a risk factor for developing preeclampsia in pregnancy.

Conclusion

Therefore, appropriate health education of adipose pregnant women and those with risk factors, along with their identification, is of utmost public health importance to reduce the rate of excessive gestational weight gain, preeclampsia, and associated short-term and long-term comorbidity. However, it should be noted that randomized studies, yet many of them on small samples, found no beneficial effects of dietary (Mediterranean) measures or use of various supplements, e.g., lower salt intake, calcium intake, etc.

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