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Pre-pregnancy maternal obesity in Greece: A case–control analysis

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ABSTRACT

Background—aims: Pre-pregnancy obesity may cause significant health implications for both mother and neonate. Our study aims to investigate the association between pre-pregnancy Body Mass Index and the risk for cesarean section, admission to Neonatal Intensive Care Unit, macrosomia and preterm delivery, in a Mediterranean country.
Study design: A matched retrospective case control analysis was conducted.
Subjects: The study population included all pregnant women (with known Body Mass Index data) who gave birth in the University Hospital of Patras between 1st of January 2003 and 31st of December 2008.
Outcome measures: Cases were defined as obese (338) or overweight (826) women.
Results: Overweight and obese women were at higher risk for cesarean section, NICU admission and preterm delivery ($\chi^2(2) = 36.877$, $p < 0.001$, χ^2 Imes and Burke (2014) $= 6.586$, $p = 0.037$ and χ^2 Imes and Burke (2014) $= 7.227$, $p = 0.027$ respectively). Neonatal mean birthweight was higher among obese and overweight women ($p < 0.0001$).
Conclusions: Both obese and overweight pregnancies should be considered as high risk pregnancies, due to more frequent adverse pregnancy outcomes (cesarean delivery, preterm delivery and NICU admission).
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1. Introduction

Obesity is a pandemic in the 21st century. According to World Health Organization, more than 1.9 billion adults were overweight and obese in 2008, and according to estimates, obese adults will surpass 1.12 billion in 2030 (20% of adult population worldwide). This increase in obesity rates, will be more rapid in developing countries [1].

Obesity has been recognized as a risk factor for metabolic syndrome, diabetes mellitus, coronary heart disease, thromboembolism, obstructive sleep apnea, cancer (colon, breast, cervical) and depression [2].

Pre-pregnancy obesity varies worldwide from 1.8% to 25.3%. In USA, it ranges from 18.5% to 38.3% [3]. In Europe, it is estimated that one in five pregnant women is obese [4]. Central, Eastern and Southern Europe come first in prevalence of overweight and obesity [5]. Maternal BMI was found to increase over the years, in Europe; however, its prevalence differs between different countries [6].

During the last decade, obesity in Mediterranean countries rise in an alarming rate [7]. In Eastern Mediterranean, the obesity rates in women are among the highest worldwide (35–75%) [8]. INMA study in Spain and RHEA study in Greece found that overweight and obese mothers reached 18% and 8%, respectively, in Spain and 20% and 11%, respectively, in Greece [5].

Pregnancies by obese women, are at high risk for adverse outcomes in both mother and neonate. More precisely, maternal obesity has been associated with maternal comorbidities (gestational diabetes, preeclampsia, thromboembolism), delivery complications (preterm delivery, trauma, cesarean delivery, placental pathological lesions) [9] and neonatal comorbidities (macrosomia, low Apgar score, NICU admission) [10].

To our knowledge, there are very few studies focusing on pregnancies in Mediterranean population, investigating pregnancy outcome in overweight and obese women. The aim of this study, therefore, was to evaluate the effect of pre-pregnancy obesity, on the mode of delivery, preterm delivery and neonatal morbidity in a Mediterranean country.

2. Materials and methods

2.1. Study population

We conducted a retrospective case control study, in the region of Western Greece, which is a distinct geographical area with a population of 680,000 inhabitants containing Patras City as a capital and many surrounding rural communities. All available data from University Hospital of Patras (UHP) which is the largest hospital in Western Greece, serving more than 500,000 people, was used. From 2003 to 2008, 39,648

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deliveries occurred in Western Greece [11]. All deliveries of living neonates between 1st January 2003 and 31st December 2008, which took place in Department of Obstetrics (UHP), were included in our study. Fetal and perinatal losses were excluded.

In our analysis, case group included any pregnant woman of the Department of Obstetrics, whose BMI before pregnancy was equal or over 25. Control group included any pregnant woman, whose BMI was between 18.5 and 24.99 before pregnancy. Controls were selected according to maternal age, maternal residence and the date of the labor.

In our analysis, cases (obese or overweight women) were compared to controls in four categories:

a. Mode of delivery (cesarean section vs vaginal delivery)
b. Neonatal Intensive Care Unit (NICU) admission
c. Mean birthweight—macrosomia
d. Preterm delivery (<37 weeks)

Women with diabetes mellitus (type 1, 2 or pregnancy induced) and hypertension disorders were excluded.

2.2. Data collection

Data were collected from hospital records, based on obstetric and neonatal notes. Women's weight and height were measured in the first visit in the Department of Obstetrics (between 4 and 12 weeks) by an experienced nurse. Pregnant women were recommended to undergo a glucose tolerance test (planned in the outpatient Department) between 24 and 26 weeks of gestation (or earlier if there was a medical history of diabetes mellitus). In every monthly visit, blood pressure was measured. Urine analysis to check for proteinuria was made in the first visit and every month thereafter until delivery.

Additional information regarding the maternal medical and obstetrical history was derived from women's files as well. Specifically, demographic data (age, ethnic group, marital status, and contact details), medical history data (height and pre-pregnancy BMI, comorbidities, if any), obstetrical history (gravida, parity, complications in previous pregnancies either pre- or postnatal, and contraception methods) were documented. Furthermore, gestational age at delivery, mode of delivery and indications for cesarean section or assisted vaginal delivery, as well as neonatal data (birthweight, sex, NICU admission, perinatal mortality and morbidity rates) were recorded.

2.3. Definitions

According to World Health Organization, maternal BMI was categorized into three groups: less than 18.5 kg/m^2 (Underweight), 18.5–24.99 kg/m^2 (Normal), 25–29.99 kg/m^2 (Overweight), greater or equal to 30 kg/m^2 (Obese). Obesity was subcategorized into three subgroups: 30–34.99 kg/m^2 Obesity class I, 35–39.99 kg/m^2 Obesity class II, greater or equal to 40 Obesity class III—morbid obesity. Delivery of a living neonate in Greece includes the delivery of any fetus equal or over 23 weeks of gestation. Full term neonates were defined as neonates born at 37^{+0}–40^{+6} weeks of gestation. Preterm delivery is a delivery of a preterm neonate less than or equal to 36^{+6} weeks. Macrosomic neonates were those whose weight was equal or greater to 4000 g.

Emergency Cesarean Section was defined as any cesarean section that was performed for fetal distress, maternal reasons (e.g. preeclampsia, respiratory problems) or obstetrical reasons (e.g. placental abruption).

Assisted Vaginal Delivery was defined as any instrumental delivery (use of vacuum, forceps or both).

Neonatal Intensive Care Unit admission includes the admission of the neonate in the Unit, during the first 28 days of life.

Maternal residency was categorized into 4 groups: A. Cities – Capitals ≥100,000 population, B. Cities with population between 100,000–5000, C. Towns & Villages ≤5000 population and D. Islands.

2.4. Statistical analysis

For data analysis the numerical parameters were imported into Microsoft Excel 2010 and subsequently transferred to the Windows Statistical Package for Social Sciences (SPSS) 21.0 for statistical processing. Initially, we used descriptive and frequency statistics. Our study divided in three groups, where the statistical analysis was conducted: among the obese, the overweight (cases) and the women of normal BMI (controls). The differences among the obtained groups were determined by applying the Kruskal – Wallis test, a non-parametric method that is a non-parametric equivalent of a oneway analysis of variance, but unlike ANOVA does not assume a normal distribution of the residuals. Baseline characteristics were analyzed using either two-sample t tests or Wilcoxon rank sum tests for continuous data, and Chi-squared tests or Fisher's exact tests for categorical data were conducted after testing for normality. A significance level of 5% was used throughout the analysis. The incidence rates of adverse events were compared with the use of Fisher's exact tests.

3. Results

3.1. Population of the study

Between 1st January 2003 and 31st December 2008, 8293 birth records were recorded in the Department of Obstetrics in University General Hospital of Patras. Of those, 2536 were excluded for missing data (incomplete files). Additionally, 208 records were excluded as they referred to stillbirths, terminations of pregnancy and missed miscarriages. Finally 5549 pregnancies were included in our analysis. A case – control analysis was conducted (Table 2). There were 1164 cases included in the study (338 obese and 826 overweight), matched to 2328 controls (676 and 1652 women with normal BMI, respectively). Each obese case was matched to two controls (2:1 study) and each overweight case to four controls, according to age, region and year of delivery. Maternal and neonatal characteristics are presented in Table 1.

3.2. Mode of delivery

The risk of obese women, having cesarean section, was higher, compared to controls ($\chi^2(2) = 36{,}877$, $p < 0.001$). Emergency cesarean section, in women who undergone a cesarean section or assisted vaginal delivery in women who delivered vaginally, did not differ between cases and controls (data not shown). When women with diabetes mellitus and hypertension were excluded, obese subjects remained at increased risk of deliver by cesarean section compared to controls.

3.3. NICU admission

Offspring of obese mothers were at a times increased risk of NICU admission, compared to offspring of subjects with normal BMI ($\chi^2(2) = 6.586$, $p = 0.037$).

3.4. Mean birthweight

Neonatal mean birthweight in the obese group was higher compared to mean birthweight of neonates in the control group [3142 ± 645.81, 2993 ± 664.14 respectively, $p < 0.0001$].

3.5. Preterm delivery

The risk of preterm delivery (<37 weeks) was increased in the obese group, compared to controls ($\chi^2(2) = 7.227$, $p = 0.027$).

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