

# Obesity doubled the incidence of preeclampsia but did not worsen the complications of this pathology in pregnant women at the Llano Hospital, at Corrientes, Argentina

## Abstract

**Objectives:** To evaluate the impact of obesity on the incidence and complications of preeclampsia (PE).

**Material and methods:** Database of 19,699 deliveries. The incidence of PE and its complications was analyzed in relation to body mass index (BMI). Qualitative variables are expressed as percentages and were analyzed with Pearson's chi square; the quantitative ones as mean and SD, and were compared with Student's test and Anova. Differences <0.05 were considered significant. SPSS 20 was used.

**Results:** 703 patients had PE (3.6%); BMI: Mean 23.7±5.8; Classification by BMI: Underweight: 9.2%; Normal: 62.9%; Overweight: 17.4%; Obesity: 10.6%; Incidence of PE according to BMI: Low weight: 2.5%; Normal: 2.9%; Overweight: 5.1%; Obesity: 6.0% (p<.0001). Incidence in the variables studied in pregnant women without and with PE were: 3rd trimester hemorrhage: 1 vs 1.4%; premature rupture of membranes (PROM) 10.7 vs 5.9%\*; intrauterine growth restriction (IUGR) 3.2 vs 10.1%\*; anemia 30 vs 31.2%; previous hypertension (HTN) 2.1 vs 7.2%\*; intrauterine mortality 1.8 vs 2.6%; Low Apgar 2.5 vs 4.0%\*; preterm 8.6 vs 21.7%\*; neonatal death 0.5 vs 1.1%; nulliparous 32.6 vs 47.4%\*; smoking 12.1 vs 14.4%; multiple pregnancy 1.5 vs 4.6%\*; underweight 6.8 vs 22.9%\*; age: 25±6 vs 26±7years\*; usual weight 57.8±11.5 vs 63±14 kg\*; gestational age by Capurro 38.6±2.4 vs 37.6±2.8\*; newborn weight 3274±572 vs 2957±793\*; feets 2±2.4 vs 1.9±2.5; deliveries 1.8±2.1 vs 1.7±2.3 (0.003) and total days of hospitalization 7±20 vs 9.6±23 (0.007), respectively. (\*p<.0001)

Incidence in the variables studied according to BMI in patients without PE: comparing low weight, normal weight, overweight and obesity, significant differences were obtained in PROM, IUGR, previous HTN, low Apgar, nulliparity, low weight of the newborn (RN), gestational age, pregnant age, pregnancies and number of births. The obese women were older and had a greater number of births; but except for the incidence of previous HTN and low Apgar that exceeded those of normal weight, in the rest there was improvement in the weight of the RN, in PROM, IUGR and in anemia as the BMI of the pregnant women increased. Incidence in the variables studied according to BMI in patients with PE: comparing low weight, normal weight, overweight and obesity, significant differences were obtained in PROM, IUGR, nulliparity, low birth weight, pregnant age, pregnant weight, pregnancies and number of births. The EPs with obesity were older, heavier, and had a greater number of pregnancies and births. However, it can be seen that as we go from underweight, normal weight, overweight and obesity, the incidence of: RPM is 15.2; 7.3; 3.4 and 1.7, of RCIU 22.2; 8.9; 12 and 6, and the NB's weight increases: 2687± 802; 2903± 740; 2985± 814 and 3174± 858 respectively.

**Conclusions:** Obesity (10% pregnant women) presented an incidence of PE of 6% vs 2.9% in those of normal weight. Patients with PE compared to normal patients had more perinatal complications except for PROM. Obesity, beyond increasing the incidence of PE, in no case worsened the complications of this pathology.

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## Introduction

Pregnancy is one of the periods of greatest nutritional vulnerability. Maternal overweight and obesity are the most common high-risk obstetric condition and are associated with gestational diabetes, hypertensive disorders, and macrosomia of the newborn, among other perinatal complications.<sup>1-3</sup> Obesity is directly related to PE, with the risk increasing linearly with the increase in BMI.<sup>4</sup> A systematic review showed that for every increase of 5 to 7 kg/m<sup>2</sup>, the risk of preeclampsia

doubled.<sup>5</sup> Weight gained before, during and after pregnancy not only affects the ongoing pregnancy, but is also the primary contributor to the future development of obesity in women.<sup>6</sup> Nutritional status and weight gain vary with height and nutritional status prior to pregnancy.

Different anthropometric indicators have been used to estimate maternal nutritional status.<sup>7,8</sup> This assessment can be carried out before pregnancy, through the calculation of the BMI, or during it, through the BMI corrected for gestational age. BMI is considered one

of the simplest and most effective tools in the general population.<sup>9,10</sup> In 1995, the World Health Organization (WHO) redefined the levels to consider different nutritional states (malnutrition, normal, pre-obese, and obese).<sup>11,12</sup> The importance of maternal nutrition in the evolution of pregnancy has been widely demonstrated and the continuous increase in the prevalence of obesity around the world has been considered a global epidemic and one of the most relevant threats to health.<sup>3,4,13-15</sup> According to the WHO criteria, the prevalence of obesity during pregnancy varies from 1.8 to 15.3%.<sup>16</sup>

Regardless of the age of the pregnant woman, overweight and obesity increase the risks of preeclampsia, preterm birth, induction of labor, cesarean section, macrosomia, and admission of the newborn to the Neonatal Intensive Care Unit (NICU).<sup>15,17</sup>

The objective of the present study was to evaluate the impact of obesity on the incidence and complications of PE.

## Material and methods

A retrospective analysis was carried out on a database of 19,699 consecutive births evaluated during the period November 1998 to April 2013. The incidence of PE and its complications was analyzed in relation to BMI.

To evaluate nutritional status, BMI was used, calculated with the weight/height squared ratio, at the first consultation.

According to the WHO, malnutrition was defined as a BMI <18.5, normal 18.5 to 24.9, overweight 25.0 to 29.9 and obesity ≥30.0.

According to the BMI at the 1st consultation, pregnant women were classified as underweight, normal weight, overweight and obese.

Blood pressure was determined with the pregnant woman sitting, with her bare arm resting on a hard surface, with the cuff at the same level as the left atrium of the heart.

Regarding the statistical analysis, the qualitative variables were expressed as percentages and were compared using Pearson's chi square, while the quantitative variables were presented as mean ± standard deviation and were compared with the Student and Anova tests. All differences < 0.05 were considered significant. IBM SPSS 20 software was used.

## Results

Of the total of 19,699 deliveries, PE developed in 703 (3.6%). The mean BMI was: 23.7±5.8; and according to BMI they were classified as: Low weight: 9.2%; Normal: 62.9%; Overweight: 17.4% and Obesity: 10.6% with an incidence of PE according to BMI of 2.5%; 2.9%; 5.1% and 6.0%, respectively (p<.0001).

The history and incidence of obstetric complications in pregnant women without and with PE are detailed in Table 1. Those with PE had a different clinical and obstetric profile, with a higher incidence of PROM and longer hospital stay.

The incidence of perinatal complications in pregnant women without and with PE is presented in Table 2. The gestational age and weight of the newborn were lower in pregnant women with PE, with a higher incidence of perinatal events.

**Table 1** Background obstetric and complications in patients without and with PE

Variable	Without PE	With PE	P
Age (years)	25±6	26±7	0.001
Usual weight (kg)	57.8±11.5	63±14	<0.0001
Gestation	2±2.4	1.9±2.5	NS
Births	1.8±2.1	1.7±2.3	0.037
Nulliparous	32.6	47.4	<0.0001
Previous hypertension	2.1	7.2	<0.0001
Smoking	12.1	14.4	NS
Multiple pregnancy	1.5	4.6	<0.0001
Hemorrhage 3rd trimester	1.0	1.4	NS
PROM	10.7	5.9	<0.0001
Anemia	30	31.2	NS
Total days of maternal hospitalization	7±20	9.6±23	0.007

**Table 2** Perinatal complications in patients without and with PE

Variables	Without PE	With PE	P
EG x Capurro (weeks)	38.6±2.4	37.6±2.8	<0.0001
RN weight (mg)	3274±572	2957±793	<0.0001
IUGR (%)	3.2	10.1	<0.0001
Fetus death (%)	1.8	2.6	NS
Low Apgar (%)	2.5	4.0	0.011
Preterm (%)	8.6	21.7	<0.0001
Neonate death (%)	0.5	1.1	0.064
Underweight (%)	6.8	22.9	<0.0001

In patients without PE, the incidence of the variables studied in the low weight, normal weight, overweight and obesity groups was statistically different in PROM, IUGR, previous HTN, low Apgar, nulliparity, low RN weight, gestational age, pregnant age, pregnancies and number of births. (Tables 3 and 4) The obese women were older

and had a greater number of births; but except for the incidence of previous HTN and low Apgar that exceeded those of normal weight, in the rest there was improvement in the weight of the RN, in PROM, IUGR and in anemia as the BMI of the pregnant women increased.

**Table 3** Background obstetric and complications in patients without PE according to BMI

Variable	Without PE				P
	Underweight	Normal	Overweight	Obesity	
Age (years)	22.5±5	24.4±6	27.4±7	28±7	<0.0001
Usual weight (kg)	44.2±4.2	54.2±6	67.5±7	76.5±15.3	<0.0001
Gestations	1.5±1.9	1.8±2.3	2.7±2.7	2.8±2.4	<0.0001
Delivery	1.3±1.8	1.6±2	2.5±2.3	2.5±2.3	<0.0001
Nulliparous (%)	43.5	36.2	21.5	19.2	<0.0001
Previous HTN (%)	0.8	1.1	3-6	6.5	<0.0001
Smoking (%)	13.4	12.2	11.8	10.4	NS
Multiple pregnancy (%)	1.0	1.6	1.3	1.8	NS
3rd trimester hemorrhage (%)	1.1	0.9	1.3	0.8	NS
PROM (%)	11	11.2	10.2	8.6	0.008
Anemia (%)	33.3	30.7	28.1	25.4	<0.0001
Maternal hospitalization (days)	6±18.9	6.8±19.8	7±19.9	8.6±22.4	0.019

**Table 4** Perinatal complications in patients without PE according to BMI

Variables	Without PE				P
	Underweight	Normal	Overweight	Obesity	
EG x Capurro (weeks)	38.4±2.4	38.6±2.2	38.6±2.5	38.5±3	0.010
RN weight (mg)	3111±566	3243±553	3376±595	3438±593	<0.0001
IUGR (%)	6.9	3.0	2.4	1.6	<0.0001
Fetus death (%)	1.5	1.8	1.9	2.0	NS
Low Apgar (%)	2.3	2.4	2.2	3.7	0.003
Preterm (%)	10.3	8.5	8.4	8.2	NS
Neonate death (%)	0.6	0.5	0.5	0.7	NS
Underweight (%)	9.6	7.0	6.2	4.1	<0.0001

On the contrary, in patients with PE, the incidence of the variables studied in the low weight, normal weight, overweight and obesity groups was statistically different in PROM, IUGR, nulliparity, low birth weight, pregnant age, pregnant weight, pregnancies and number of births. (Tables 5 and 6) The PE with obesity were older, heavier and

had a greater number of pregnancies and births. However, it can be observed that as we go from low weight, normal weight, overweight and obesity, the incidence of: PROM and IUGR decreases, while the weight of the RN increases.

**Table 5** Background obstetric and complications in patients with PE according to BMI

Variables	With PE				P
	Underweight	Normal	Overweight	Obesity	
Age (years)	21±5	24.5±7	28±7	29.5±7.3	0.001
Usual weight (kg)	44.4±3.6	55.5±6.4	68.6±6.6	84±12.7	<0.0001
Gestations	0.6±1.2	1.5±2.2	2.5±2.7	2.9±2.8	<0.0001
Delivery	0.5±1.1	1.2±2.0	2.2±2.5	2.5±2.6	<0.0001
Nulliparous (%)	69.6	56.7	33.7	31.5	<0.0001
Previous HTN (%)	4.4	5.0	9.7	11.2	0.059
Smoking (%)	3.1	16.9	14.6	10.4	NS
Multiple pregnancy (%)	4.3	6.4	2.3	2.4	NS
3rd trimester hemorrhage (%)	2.2	0.8	2.3	1.7	NS
PROM (%)	15.2	7.3	3.4	1.7	0.003
Anemia (%)	34.8	33.8	28.6	26.1	NS
Total days of maternal hospitalization (days)	11±24	10±23	9±21	9±22	NS

**Table 6** Perinatal complications in patients with PE according to BMI

Variables	With PE				P
	Underweight	Normal	Overweight	Obesity	
EG x Capurro (weeks)	37.4±2.7	37.6±2.9	37.6±2.8	38±2.5	NS
RN weight (mg)	2687±802	2903±740	2985±814	3174±858	0.001
IUGR (%)	22.2	8.9	12.0	6.0	0.014
Fetus death (%)	2.2	2.0	2.9	4.0	NS
Low Apgar (%)	4.3	3.6	3.5	5.7	NS
Preterm (%)	21.7	24.6	19.4	16.3	NS
Neonate death (%)	0.0	1.7	0.6	0.8	NS
Underweight (%)	43.5	22.3	24	15.3	0.002

## Discussion and Conclusion

Of the total deliveries, 3.6% (703) had PE and of these, 17.4% were overweight and 10.6% obese. Based on this, it was estimated that one in three pregnant women presented to the first consultation overweight/obese. In comparison with data obtained in a study carried out in the region in 2003, a marked difference was observed in terms of the percentages of the population in which overweight and obesity were found, an increase having been confirmed in both groups (8.8% and 9.5% vs. 17.4% and 10.6%, respectively).<sup>18</sup>

In this investigation, the incidence of PE increased according to the increase in BMI, which has been reflected in other investigations where PE occurred 1.6 times more frequently in obese patients and 3.3 in severely obese patients,<sup>19</sup> while the risk of developing PE tripled in obese women (BMI of 30 or more) compared to those of normal weight (BMI of 25 or less), but in super obese women, that risk increased fivefold.<sup>20</sup>

It has long been recognized that high blood pressure during pregnancy produces various harmful effects on the mother, fetus and newborn. Hypertensive disorders encompass a broad spectrum of alterations in many systems, both in the mother and the neonate, and predispose to increased maternal, fetal, and neonatal morbidity and mortality. In the present study, in patients without and with PE the mean gestational age by Capurro was: 38.6±2.4 vs 37.6±2.8 and the weight of the NB: 3274±572 vs 2957±79. Perinatal complications in patients without and with PE coincide with the literature, IUGR 3.2 vs 10.1, intrauterine mortality 1.8 vs 2.6; Low Apgar: 2.5 vs 4.0; preterm 8.6 vs 21.7; neonatal death 0.5 vs 1.1.<sup>9,21-28</sup>

Although it is true that a third of premature births occur due to medical indication as a result of maternal or fetal conditions that put the health of the couple at risk; frequently these conditions correspond to hypertensive disorders or pre-existing chronic pathology, which is more prevalent in obese women.<sup>19</sup> This determines that the risk of prematurity is at least 1.5 times more frequent in obese pregnant women,<sup>21</sup> and in extremely premature babies less than 32 weeks of gestation the risk doubles between severely obese and extremely obese women.<sup>22</sup> In this work we observed that in patients with PE, overweight acted as a protective factor since as we went from low weight, normal weight, overweight and obesity, the incidence of IUGR decreased and the weight of the RN increased. These data are consistent with a recent review on BMI and pregnancy, where compared to mothers with normal BMI, mothers who were overweight or obese had increased odds of gestational diabetes, pregnancy-induced hypertension, PE, cesarean delivery, and hemorrhage. Postpartum, with a significantly increased risk of adverse health for the mother and fetus; However, overweight and obesity acted as a protective factor against low birth

weight, small fetus for gestational age and preterm birth in low-income countries.<sup>29</sup>

Other reviews that include countries from all continents, between 1995 and 2012, found a clear relationship between increasing BMI and the risk of preeclampsia, with pooled risk ratios (RR) for women with obesity and severe obesity of 2.68 (95% CI 2.40 to 3.00) and 3.43 (95% CI 2.59 to 4.55), respectively.<sup>30</sup> They also found that being overweight before pregnancy decreases the risk of low birth weight (less than the 10th percentile) (OR 0.81, 95% CI 0.80–0.83) compared to those of normal weight.<sup>31</sup>

Thus, obesity before pregnancy would decrease the risk of low birth weight, although the effect may be small.<sup>32-34</sup>

One in ten pregnant women presented with obesity at the beginning, with an incidence of PE of 6% vs 2.9% in those of normal weight. Patients with PE compared to normal patients had more perinatal complications except for PROM. Obesity, beyond increasing the incidence of PE, in no case worsened the complications of this pathology.

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## Conflicts of interest

Authors declare that there is no conflicts of interest.

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