



ORIGINAL

Gestational Weight Gain Among Pregnant Women in the Mexico–US Border City of Tijuana, Mexico

Ganancia Excesiva de Peso Gestacional entre Mujeres Embarazadas en la Ciudad Fronteriza de Tijuana, México

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Abstract

Background. Excess of gestational weight gain is a risk factor for short and long term health implications for women and their offspring. The aim of this study was to assess the prevalence of excess of gestational weight gain (EGWG) among pregnant women attending the social security system, and to assess the factors associated with it.

Methods. The inclusion criteria for this study were women attending immediate puerperium, older than 18yo with a single delivery, and delivery of a live, single birth, mothers who sought prenatal visits at or before the 20th week of gestation with a minimum of 8 total visits, and who had a baseline weight measure before pregnancy. Categorization of BMI was done according to WHO classification and EGWG was assessed by using the Institute of Medicine guidelines. Associations between EGWG and maternal and new-born variables were assessed by odds ratio and Chi-squared test.

Results. A total of 438 women were included. The overall prevalence of EGWG was 43%, and a higher prevalence was observed in higher BMI subgroups. Significant dependence was found between EGWG and new-born weight categories and after stratification of macrosomic vs non-macrosomic delivery (OR=2.2 (CI_{95%}=1.2-4.2). Further, an association was found between EGWG and threatened abortion (7.7%).

Conclusions. A very high prevalence (43%) of EGWG with a higher likelihood of having macrosomic new-borns was found. Additionally, an association was found between EGWG and threatened abortion.

Keywords

Gestational weight gain; threatened abortion; macrosomic deliveries; Tijuana, Mexico-US border

Resumen

Antecedentes. La ganancia excesiva de peso gestacional es un factor de riesgo a corto y a largo término con implicaciones para las mujeres y sus hijos. El objetivo de este estudio fue valorar la prevalencia de la ganancia excesiva de peso gestacional (GEPG) entre mujeres que se atienden en el sistema de seguridad social y valorar los factores asociados.

Métodos. Los criterios de inclusión fueron mujeres que se atendieron en el puerperio inmediato, mayores de 18 años, con parto único, producto vivo, y que antes de la semana 20 de embarazo tuvieron atención pre-natal un mínimo de ocho visitas, y a quienes tenían la medición del peso previo al embarazo. Las categorías del índice de masa corporal fueron de acuerdo a los criterios de la OMS y la GEPG se estimó de acuerdo a las guías del Instituto de Medicina de los EEUU. Las asociaciones entre la GEPG y las variables maternas y las del recién nacido se realizaron por medio de la Chi cuadrada y el Odds Ratio.

Resultados. Se incluyeron un total de 438 mujeres. La prevalencia de GEPG fue de 43% y se observó una mayor prevalencia en los grupos de IMC más altos. Se observó asociación significativa entre GEPG y las categorías de peso al nacimiento y después de la estratificación de producto macrosómico vs no



macrosómico (OR=2.2 (CI95%=1.2-4.2). Además se observó asociación entre GEPG y amenaza de aborto (7.7%).

Conclusión. Se observó una muy alta prevalencia de GEPG (43%), y una mayor probabilidad de productos macrosómicos. Asimismo, se observó una asociación entre la GEPG y la amenaza de aborto.

Palabras clave

Ganancia de peso gestacional; amenaza de aborto; macrosomía; Frontera México Americana

Background

Excessive gestational weight gain (EGWG) has short-, medium-, and long-term health implications for women and their children⁽¹⁾. Physiological weight gain occurs during pregnancy; this weight gain is reported as GWG and is considered normal and healthy both for the mother and the foetus; GWG is influenced by maternal and placental metabolic changes⁽²⁾. However, several epidemiological studies have shown that obesity, overweight, and EGWG in women are associated with increased risks of macrosomic deliveries⁽³⁻⁵⁾, shoulder dystocia, meconium aspiration, neonatal hypoglycaemia⁽⁶⁾, caesarean deliveries⁽⁵⁻⁷⁾, gestational diabetes^(8,9), postpartum weight retention^(10,11), pre-eclampsia^(5,11), cardiometabolic sequelae⁽¹²⁾, and fetal and infant death⁽¹³⁾.

Furthermore, excessive maternal weight gain has been linked to an increased risk of childhood obesity and other components of metabolic syndrome⁽¹³⁾. The Institute of Medicine (IOM) reviewed GWG standards in 2009 and recommended that women with higher pregestational BMI should have lower GWG, particularly those with an initial pregnancy BMI of 30 kg/m² or more⁽¹³⁾. In Mexico, in 2012 the standards of care for pregnant women were reviewed regarding gestational weight gain; however, guidelines were published as recently as 2016⁽¹⁴⁾.

The current IOM recommendations for GWG are as follows: low-weight women (BMI < 18.5 kg/m²): weight gain of 13–18 kg; normal-weight women (BMI = 18.5–24.9 kg/m²): 11–16 kg; overweight women (BMI = 25.0–29.9 kg/m²): 7–11 kg; and obese women (BMI > 30 kg/m²): 5–9 kg⁽¹³⁾. However, the Centers for Disease Control and Prevention reported an EGWG prevalence of 47.5% across 46 US states, New York City, and the District of Columbia during



2012–2013; they also reported that only 32.1% of pregnant women met the IOM recommendations⁽¹⁵⁾.

Early prenatal care, the development of a meal plan, and exercise are crucial for avoiding excessive weight gain in pregnant women, thus reducing the risks of obesity, morbidity, and mortality in their offspring⁽¹⁾. A recent systematic review and meta-analysis showed that an intensive lifestyle intervention during pregnancy results in reduced EGWG, decreasing the likelihood of large-for-gestational-age newborns⁽¹⁶⁾.

According to the health authorities of Mexico, approximately 75.6 % of women of reproductive age (between 20 and 49 years) are obese or overweight⁽¹⁷⁾. A study conducted in 2010 found a prevalence of 38% of EGWG applying the IOM recommendations⁽¹⁸⁾. However, based on our literature review, we have not found recent studies investigating the prevalence of EGWG in different regions in Mexico. Thus, this study estimated the prevalence of EGWG among pregnant women residing in Tijuana who attended the Mexican Social Security Institute. In addition, the study assessed the factors and outcomes associated with it.

Methods

Pregnant women who delivered in Hospital #7 between October 1st 2016 to January 31st 2017, in immediate puerperium (first 24 hours after delivery), with a single delivery and live single birth, who started prenatal control between the 6th or 8th weeks of gestation, with a minimum of 8 total visits, including baseline laboratory and weight measurement were included. Women having an abortion, an embryonic pregnancy, or trophoblastic disease, those with incomplete newborn or pregnancy records, and those who gave birth to infants with congenital malformations were excluded. The Ethics Committee of Medical and Psychology Schools of Universidad Autonoma de Baja California provided approval for this study on 25th August, 2016. Prior to patients' discharge, data from the medical records of women in immediate puerperium was retrieved. Any information missing from the medical records was obtained directly from the patient, and patients provided verbal consent.

Data from the medical records was captured using Statistical Package for the Social Sciences (SPSS). BMI was categorised according to the World Health Organization classification, and EGWG was determined using the IOM guidelines⁽¹³⁾. Descriptive statistics were calculated for numerical variables and were assessed for normality using the Shapiro–Wilks test. The prevalence of EGWG was estimated in analyses stratified by BMI categories and



neonatal weight categories. Associations between EGWG and maternal and newborn variables were assessed using binomial or multinomial regression analysis. The variables included in the analyses were smoking history, alcohol and drug use, hypertension, diabetes mellitus, gestational diabetes, preeclampsia and other diseases in previous pregnancies, number of pregnancies, miscarriages, presence of sexually transmitted diseases, BMI category, threatened miscarriage, type of delivery, premature rupture of membranes, preterm premature rupture of membranes, amniotic fluid, birth weight, and neonatal complications. An independent sample t test was used for the comparison of means between patients with EGWG and those without EGWG; for the comparison of means among more than two groups (i.e., BMI categories), we used one-factor analysis of variance or Kruskal–Wallis H test if the data were not normally distributed.

Results

A total of 438 women were included in this study. The mean GWG was 12.77 kg (SD = 6.33 kg); other descriptive statistics are shown in Table 1.

Table 1. Age, GWG, EGWG, Risk of EGWG, and Macrosomic Delivery by BMI category.

BMI category	N (%)	Age, years mean (SD)	GWG, kg mean (SD)	EGWG, %	Risk of EGWG OR (95% CI) P	EGWG above maximum recommended ^a , kg mean (SD)	Macrosomic delivery, %
Underweight	13 (3)	22 (3.5)	15.2 (5.3)	21.4	0.73 (0.19-2.76) 0.64	4.33 (1.52)	0
Normal	161(37)	25 (5.2)	13.8 (6.2)	29.4	1	5.15 (5.26)	11.2
Overweight	157(36)	26 (5.4)	12.1 (5.4)	47.8	2.22 (1.40-3.52) 0.001	5.46 (4.12)	6.4
Obese	106(24)	29 (5.0)	11.8 (5.9)	59.4	3.55 (2.12-5.95) 0.0001	6.35 (4.46)	14.4
TOTAL	437(100)	25.5 (5.5)	12.4 (6.3)	43.0		5.66 (4.52)	9.9

GWG: Gestational Weight Gain; EGWG: Excess Gestational Weight Gain. ^a Only women with EGWG were included in this analysis.

The GWG means for different BMI categories (shown in Table 1) were inversely proportional to BMI. However, when the IOM criteria⁽¹³⁾ for EGWG were applied, we found an overall prevalence of EGWG of 43%, demonstrating a higher prevalence of EGWG in women



with higher BMI (Table 1; OR = 2.73, 95% CI = 1.81–4.11, for BMI < 24.9 vs BMI > 25). No significant difference was observed in the amount of weight gained above the maximum IOM standards among the BMI categories (Kruskal–Wallis test; $\chi^2_{df=3} = 3.9, p = 0.27$).

Significant dependence was found between EGWG and newborn weight categories ($\chi^2_{df=3} = 8.4, p = 0.038$), and in analysis stratified by newborn variables (macrosomic delivery vs non-macrosomic delivery), an association was observed (Table 2).

Table 2. Risk of EGWG on Birth weight, macrosomia, threatened miscarriage.

Birth weight	OR (CI 95%)	p
<2500 g	1.2 (0.5-4.2)	0.65
2500-4000 g	1	
>4000 g	2.2 (1.2–4.2)	0.017
Macrosomia		
> 4000 g	2.2 (1.2–4.2)	0.017
>4000 g adjusted for gestational diabetes and diabetes mellitus type 2	2.1 (1.1-4.1)	0.022
< 4000 g	1	
Threatened miscarriage		
threatened miscarriage	2.2 (1.1–4.5)	0.037
TM adjusted for previous abortion, alcohol abuse, and maternal underweight	2.8 (1.3–6.1)	0.009
No miscarriage	1	

Moreover, 7.7% of patients had a threatened miscarriage (TM) during the pregnancy course, and compared with adequate GWG women with excessive GWG had higher risk of TM, when adjusted for previous abortion, alcohol abuse, and maternal underweight, excessive GWG was associated with an increased risk of TM (Table 2).

Discussion

In this study, we found an overall prevalence of EGWG of 43%, which is significantly higher than the 38% previously reported in Mexico⁽¹⁸⁾. We also found a higher prevalence of EGWG in women with higher BMI (overweight and obesity). Since the prevalence of obesity in women has increased by 5.4% from 2012 to 2016 in Mexico⁽¹⁹⁾, and the higher the BMI the higher the EGWG it might be expected an increase during the following years. No difference was observed in the amount of weight gained above the maximum IOM standards among the



BMI categories. An association was observed between EGWG and macrosomic delivery, which is consistent with previous reports⁽²⁰⁻²²⁾.

An association was observed between EGWG and TM. Because of the cross-sectional study design, a causal effect could not be established. We did not find any association between BMI (BMI > 24.9 kg/m²) and the threat of miscarriage, consistent with the findings of a meta-analysis conducted in 2008⁽²³⁾ and other studies^(24,25).

Contrary to other studies we did not find an association between EGWG and younger maternal age⁽²⁶⁾ low Apgar score⁽²⁷⁾, or preterm birth⁽²⁸⁾. This finding might be attributed to the small sample of patients with those particular conditions and the exclusion of women with abortion.

The limitations of the study include significant recall bias in patients who had missing information from their medical records, especially regarding the date of last menstrual period (used to determine gestational age) and pregestational weight (baseline weight), because these data were self-reported in some cases. Another limitation may be the use of non-standardised scales and weighting techniques among different hospital staff members, without proper weighting in follow-up and prenatal consults. Both weighting and formalised exercise prescription have been shown to lead to reduced GWG and thus a significantly lower prevalence of EGWG⁽²⁹⁾. In addition, the exclusion of women with EGWG who had miscarriages might have led to an underestimation of the prevalence of EGWG. Women with an abortion experience were not assessed because the study only included women with a live newborn child.

However, the strengths of this study are the large number of participants, the fact that this is the second study published specifically regarding the north-western region of México, the unique location of Tijuana as a Mexico–US border city, with the highest prevalence of obesity in children aged 6–11 years⁽¹⁹⁾, and the fact that pregnant women were recruited from the largest and best organised public health institution in Mexico.

Conclusions

This study revealed a very high prevalence of EGWG (43%) among pregnant women residing in Tijuana. Those with EGWG had a higher likelihood of having macrosomic newborns. This study also found an association between EGWG and TM. EGWG was seen more often in patients with pre-pregnancy overweight and obese BMI. No association was observed linking



EGWG to maternal diabetes mellitus, hypertension, drug abuse, alcohol abuse, or underweight BMI.

These results outline the importance of performing close surveillance and care to all pregnant women to prevent EGWG. Women who are overweight or obese might benefit from a more specialized prenatal control.

List of abbreviations

BMI: body mass index

GWG: gestational weight gain

EGWG: excessive gestational weight gain

IOM: Institute of Medicine of the National Academies, USA

TM: threatened miscarriage

Declarations

Ethics approval and consent to participate

The Ethics Committee of Medical and Psychology Schools of Universidad Autonoma de Baja California reviewed and provided approval for this study. Any information missing from the medical records was obtained directly from the patient, and patients provided verbal consent.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.



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Authors' contributions

AJC: design of the study, interpretation of results, writing and reviewing the paper.

AEMN: field work, statistical analysis, interpretation of results, and writing the paper.

PNM: design of the study, field work, interpretation of results, and writing and reviewing the paper.

ISP: design of the study, field work, interpretation of results, and writing the paper.

ACT: field work, interpretation of results, and writing the paper.

MMS: field work, interpretation of results, and writing the paper.

MGD: field work, interpretation of results, and writing the paper.

MBG: design of the study, supervision of the field work, statistical analysis, interpretation of results, and writing and reviewing the paper.

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