Research Article

A Population-Based Study on Gestational Weight Gain according to Body Mass Index in the Southeast of Brazil

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Gestational weight gain (GWG) may interfere in perinatal outcomes and also cause future problems throughout woman's life. The aim of this population-based study is to evaluate the GWG in Campinas city, southeast of Brazil. A total of 1052 women, who delivered in the three major maternity hospitals in Campinas, were interviewed during postpartum period. The general average of GWG was 13.08 ± 6.08. Of total women, 13.6% were obese and 24.6% were overweight and, in these groups, 55.9% and 53.7%, respectively, exceeded GWG according to the Institute of Medicine recommendations. 6.2% of total women had low body mass index (BMI) and 35.5% in this group had insufficient GWG. Overweight and obese women had a higher risk of excessive GWG and delivery by c-section. The c-section rate was 58.9% and increased according to GWG. Prematurity was more prevalent first in obese and then in low BMI women. Considering the high BMI in women in reproductive age, it is necessary to take effective guidelines about lifestyle and nutritional orientation in order to help women reach adequate GWG. All of them could improve prenatal outcomes and women's heath as a whole.

1. Introduction

Obesity is considered as one of the major public health problems in the world and is considered as an epidemic in developed countries and low income countries. Every year at least 2.6 million of deaths by obesity and overweight occur. It is known that a person with obesity or overweight has higher risk of dyslipidemia, diabetes mellitus (DM), and hypertension [1, 2]. In Brazil, the Health Ministry shows that 48% of women have higher weight than recommended. In São Paulo state it represents 48.6% of women with overweight [3].

During gestational period some women can exceed the weight gain recommended for pregnancy. It is estimated that 50% of women in infertility age are overweight or obese and 18% of women get pregnant with high body mass index (BMI), overweight, or obese [4]. According to World Health Organization (WHO) the prevalence of obesity during pregnancy is from 1.8% to 25.3%. The obesity during pregnancy increases maternal-fetal morbidity and it is related

to many complications due to high risk pregnancy and delivery outcomes [3]. In public health services in Brazil, the majority of pregnant women do not have the expected range recommended for weight gain during pregnancy [5–9].

Several maternal complications occur due to overweight and obesity, including gestational diabetes, pregnancy induced hypertension and preeclampsia, and high rates of c-section, all of them associated with longer hospitalization [10–15].

Pregnancy is a period in which women need a special care. Clinical trials have suggested a lifestyle change such as nutritional adequacy and physical activities programs to be adequate with the weight gain during pregnancy, prevention of excess weight gain, and weight retention in postpartum period [16–18]. Public health strategies involve gym classes as well as diet orientation during prenatal care which are important to support women to achieve the weight gain recommended during pregnancy and so avoid complications [18].

The aim of this study was to evaluate the gestational weight gain and this association with perinatal outcomes in one of the biggest cities in southeast of Brazil (Campinas city, São Paulo state).

2. Materials and Methods

A population-based study was approved by University of Campinas (UNICAMP) ethical committee (by the number 991/2011). Women were interviewed in immediate postpartum period in three major maternity hospitals in Campinas city, São Paulo, Brazil. According to health insurance each maternity hospital was as follows: public health service (Maternity A), private health service (Maternity B), and public and private health service (Maternity C). The data was assessed on immediate postpartum period, so every woman was at least primiparous.

The sample size was calculated in order to obtain a representative population of pregnant women in Campinas city, SP, Brazil. According to DATASUS/SISPRENATAL (*Sistema de Acompanhamento do Programa de Humanização no Pré-Natal e Nascimento*) database of 2010, birth rate of a single pregnancy by Campinas citizen was 14,693. For sample size calculation the highest vulnerability possible was assumed based on the prevalence of delivery per year in Campinas, level of significance of 5% and sampling error of 3%, resulting $n = 995$. There were three centers (maternities) including Maternity A (number of deliveries/year = 2002), Maternity B (number of deliveries/year = 1286), and Maternity C (number of deliveries/year = 6800), total of $n = 12.423$ deliveries. Considering this total the three centers represent 16.1%, 10.4%, and 54.7%, respectively.

The data collection was from November, 2011, to August, 2013. The inclusion criteria were as follows: women in immediate postpartum with live newborn and habitant in Campinas city. Women with multiple pregnancies, reading and communication difficulties, and any other condition that could interfere in the interview were excluded. Every woman included in this study signed a consent form. For data collection it was used a checklist to verify the inclusion criteria. The women included answered a questionnaire with socio-demographics and biometric characteristics.

The analysis of pregnancy weight gain was based on Institute of Medicine (IOM) recommendations, according to their previous BMI before pregnancy (women with low weight should gain between 12.2 and 18 kg during pregnancy, women with previous adequate weight should gain between 11 and 16 kg, overweight women should gain between 7 and 11.5 kg, and obesity women should gain between 5 and 9 kg [19]). Study participants showed that prepregnancy BMI was calculated based on participants' self-report of prepregnancy weight. Height and final weight were recorded from prenatal charts.

The adequacy of newborn weight to gestational age was evaluated according to Alexander scale and classified as adequate for gestational age (AGA), small for gestational age (SGA), and large for gestational age (LGA). Prematurity rate was defined on gestational age and a newborn classified as <37 weeks was considered as preterm [20].

TABLE 1: Demographic characteristics and prepregnancy weight and BMI data of women in southeast of Brazil.

Variables	$n = 1052$
Age (years)—mean ± SD	27.41 ± 6.32
<19—n (%)	122 (11.6)
20–34—n (%)	771 (73.4)
>35—n (%)	158 (15)
Race—n (%)	
Caucasian	519 (49.5)
Black/brown	518 (49.4)
Others	12 (1.1)
Educational attainment—n (%)*	
Up to grade school	225 (21.5)
Up to high school	615 (58.8)
College university or advanced degree	206 (19.9)
Married or common law—n (%)	989 (94.0)
Planned pregnancy—n (%)	524 (49.8)
Parity—n (%)	
1	498 (47.4)
≥2	553 (52.6)
Gestational age at first prenatal visits—mean ± SD	12.03 ± 5.97
Number of prenatal visits—mean ± SD	8.73 ± 2.37
Prenatal at public health system—n (%)	676 (64.6)
Smoking during pregnancy—n (%)	85 (8.1)
Diabetes mellitus—n (%)	62 (5.9)
Hypertension—n (%)	92 (8.8)
Prepregnancy weight—mean ± SD	67.71 ± 14.23
Prepregnancy BMI**—mean ± SD	25.21 ± 5.07
BMI < 18.5—n (%)	63 (6.16)
BMI ≥ 18.5 < 25—n (%)	568 (55.58)
BMI ≥ 25 < 30—n (%)	252 (24.66)
BMI ≥ 30—n (%)	139 (13.6)

BMI: body mass index; SD: standard deviation; *5 missing data, **29 missing data.

The variables related to population characteristics, gestational weight gain, and adequacy of gestational weight gain according to BMI were described in absolute and relative frequency. Odds ratio (OR) was used with a confidence interval (CI) of 95% to evaluate the excessive weight gain in accordance with their BMI. The significance level assumed was 5% and the statistical analysis was performed by program Epi-info version 5.1.

3. Results

A total of 1052 women were included: 238 (22.60%) were from Maternity A, 217 (20.70%) from Maternity B, and 597 (56.69%) from Maternity C. The different percentages for the three hospitals included in the study were in accordance with the proportion of births by maternity in Campinas city in 2010.

Table 1 describes the sociodemographics population, clinical and obstetrics characteristics, and prepregnancy BMI.

The average weight gain was 13.08 ± 6.08. Regarding the adequacy of weight gain per BMI categories, 55.9% of women with overweight and 53.7% of obese women gained excessive weight during pregnancy. Most of the pregnant
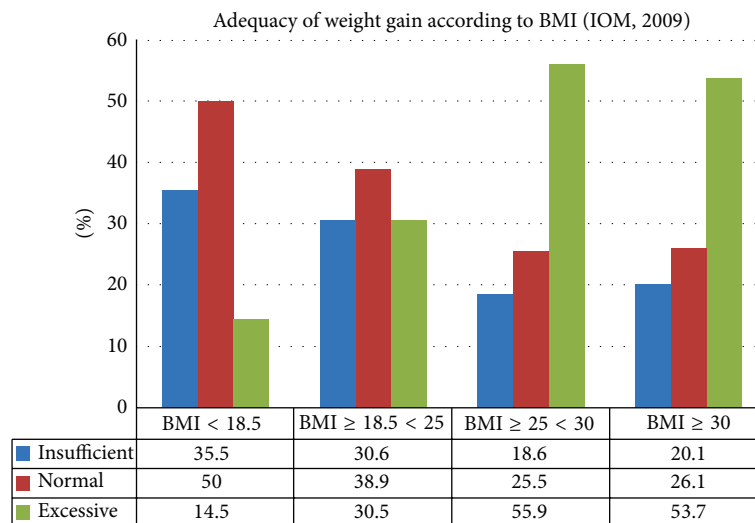
FIGURE 1: Adequacy ranges of weight gain by BMI category according to the recommendations of the Institute of Medicine, 2009, of women in southeast of Brazil. BMI $< 18.8\,\mathrm{kg/m^2}$: between 12.2 and 18 kg; BMI $\geq 18.5 < 25\,\mathrm{kg/m^2}$: between 11 and 16 kg; BMI $\geq 25 < 30\,\mathrm{kg/m^2}$: between 7 and 11.5 kg; BMI $\geq 30\,\mathrm{kg/m^2}$: between 5 and 9 kg (IOM, 2009).

TABLE 2: Weight gain and risk of excessive weight gain according to BMI category (IOM, 2009) of women in southeast of Brazil.

BMI	Mean WG	P value[**]	WG excessive (%)	OR	CI 95%	P[*]
Total sample	13.08 ± 6.08					
BMI < 18.5	13.70 ± 4.25	<0.0001	14.5	0.37	0.17–0.80	0.009
BMI ≥ 18.5 < 25	13.69 ± 5.21		30.5	Reference	—	—
BMI ≥ 25 < 30	12.38 ± 6.29		55.9	2.7	1.05–4.01	<0.0001
BMI ≥ 30	9.57 ± 8.10		53.7	2.62	1.67–4.12	<0.0001

[*]Chi-square; [**]Kruskal-Wallis for mean of weight gain among BMI categories, OR: odds ratio; CI: confidence interval; WG: weight gain.

women with lower BMI presented adequate weight gain; however they had a higher rate (35.5%) of insufficient weight gain. It is important to highlight that those women with adequate prepregnancy BMI showed an equal distribution according to different levels of weight gain during pregnancy (Figure 1). Frequency of hypertension and diabetes was 3.3% and 5% for women with lower weight, respectively, 36.67% and 20% for eutrophic women, 12.5% and 36.6% for women with overweight, and 34.4% and 38.3% for obese women.

The overweight and obese pregnant women showed higher risk to weight gain during pregnancy; otherwise women that started the prenatal care with lower weight had lower risk to an excessive weight gain (Table 2).

The rate of prematurity was higher in obese pregnant women as well as in the underweight pregnant women. However, the newborn weight was correlated to prepregnancy maternal BMI and the newborn weight increases according to maternal weight. Overweight and obese women showed newborns with higher weight at birth (4.5% and 6.9%); on the other hand underweight women showed newborns with <2500 g. The rate of c-section in this population was 58.9% and increases according to GWG (Table 3).

According to their prepregnancy BMI, women with excessive weight gain and obese women had higher chance to have LGA newborn (Table 4).

4. Discussion

This study has shown that, in Campinas, Brazil, the excessive gestational weight gain rate was higher among those women who were overweight (55.9%) and obese (53.7%).

In the USA, more than a quarter of women are overweight and one-third are obese [21]. In a study with Australian women, 47.8% were overweight or obese and 40% of those with overweight and 64% of those with obesity exceeded weight gain during their gestational period [22]. In Brazil, similar results were found in the study done in the northeast; 45.5% of pregnant women exceeded weight gain during gestational period [23]. When it is compared to other countries, the excessive weight gain rate is similar to Brazil. In a study done in Pittsburgh, USA, 47% of women put on weight excessively during pregnancy; among those women with pregestational overweight 26% and 14% of those with obesity put on weight excessively during pregnancy [24].

The high inadequate weight gain percentage during gestational period (35.5% of low weight had insufficient gain and 55.9% and 53.7% among women with overweight and obesity, resp., put on weight excessively) was pretty much similar to those found in study done with 204 pregnant women where 45.5% of those exceeded the gain [23].

TABLE 3: Pregnancy outcomes according to BMI category of women in southeast of Brazil.

Gestational outcomes	Total sample	BMI < 18.5	BMI ≥ 18.5 < 25	BMI ≥ 25 < 30	BMI ≥ 30	P value
Final weight (kg)—mean ± SD	77.39 ± 14.13	60.19 ± 6.40	71.46 ± 8.21	83.12 ± 9.61	99.54 ± 13.8344	<0.0001**
C-section rate—n (%)	619 (58.9)	31 (49.21)	318 (55.99)	159 (63.35)	101 (72.66)	<0.0001*
Gestational age at birth—weeks—mean ± SD	38.10 ± 1.38	38.54 ± 1.59	38.76 ± 1.47	38.85 ± 1.42	38.43 ± 1.81	0.1183**
Prematurity rate <37 weeks—n (%)	58 (5.9)	4 (6.67)	30 (5.55)	9 (3.70)	10 (8.20)	0.0498*
Newborn weight (g)—mean ± SD	3298.12 ± 454.96	3071.87 ± 414.99	3217.57 ± 441.86	3303.10 ± 442.00	3306.66 ± 539.03	0.0003**
Newborn weight (g)—n (%)						
<2500	59 (5.8)	6 (9.68)	34 (6.10)	9 (3.70)	9 (6.98)	<0.0001*
2500–3999	923 (90.7)	56 (90.32)	507 (91.02)	223 (91.77)	111 (86.05)	
≥4000	36 (3.5)	—	16 (2.87)	11 (4.53)	9 (6.98)	

*Chi-square; **Kruskal-Wallis; SD: standard deviation; BMI: body mass index.

TABLE 4: Association between excessive weight gain and LGA and between prepregnancy BMI and LGA of women in southeast of Brazil.

	LGA—n (%)*	OR (CI 95%)
Adequacy of weight gain		
Excessive weight gain	21 (5.7%)	2.83 (1.19–6.76)
Insufficient weight gain	4 (1.6%)	0.75 (0.22–2.58)
Adequate weight gain	7 (2.1%)	Reference
Prepregnancy BMI		
BMI < 18.5	0 (0%)	—
BMI ≥ 18.5 < 25	15 (2.7%)	Reference
BMI ≥ 25 < 30	10 (4.3%)	1.58 (0.70–3.56)
BMI ≥ 30	9 (7.2%)	2.75 (1.18–6.44)

*Complete data of 992 cases; OR: odds ratio; CI: confidence interval; BMI: body mass index; LGA: large for gestational age.

The level of education is a factor that may be associated with gestational weight gain, reflecting the socioeconomic status of women, because women with lower purchasing power consume more high-calorie food because of its low cost, leading to excess weight gain in pregnancy. In Brazil two studies conducted in southeast and in northeast showed that 46% and 51.8% of women, respectively, had completed more than eight years studied, corresponding to more than grade school [23, 25, 26]. In our study, 58.8% of women had completed high school, followed by 20% of women who had a degree.

Among those women interviewed in this study 56.2% worked during pregnancy, and according to another study conducted in Brazil, 45% of women had job/occupation outside their home [27]. When compared to other countries, Brazil is below the level of occupation in women who had pregnancy; in a study conducted in China 77.6% of women worked outside their home [28].

The relation between multiparity and excessive weight gain in pregnancy is discussed in which 47.4% of women were primiparous. In a study conducted in São Paulo, the authors observed similar data, where 46.2% of women in the sample were primigravidae [25].

Adequate prenatal care should rely on monitoring all stages of pregnancy, such as interventions and counseling about the various phases and complications that pregnancy can cause. However, the quality of prenatal is difficult to measure and evaluate, especially when it is not the central purpose of the study. In this population the average gestational age at initiation of prenatal care was 12.03 ± 5; gestational weeks were considered appropriate to begin prenatal appointments.

These data are suitable for those recommended by WHO, which suggests that the first visits should be held between eight and 12 weeks of gestation and the minimum number of visits is at least four times, and in this study the average number of visits was 8.78 ± 2.24 [29].

In a study conducted in four basic healthcare facilities in the state of Rio de Janeiro, Brazil, it was found that despite the fact that 98.8% of pregnant women received prenatal care, they had high rates of excessive gestational weight gain during pregnancy (39.5) [26]. Smoking was not a prevalent practice and so in a study conducted with 1678 women in Rio de Janeiro only 12% smoked during pregnancy [30]. In a Chinese study 5.3% of pregnant women who were smokers did not smoke during pregnancy [28].

c-section prevalence was 58.9% in the study population, far from the ideal rate which is 15% recommended by the World Health Organization (WHO). In a survey conducted by WHO in 2009, with the countries of Latin America, Brazil took the last position in the practice of c-section, where the country that had the highest rate was Paraguay [31]. However, high rates of c-sections in Brazil represent a national problem

and growing health concern, especially when associated with overweight or obesity.

A meta-analysis of 33 studies found that the risk of c-section increases proportionally with the increase of BMI (overweight and obesity) [32]. A study conducted in Brazil with 1117 women showed a direct relation to prepregnancy BMI and weight gain during pregnancy, where overweight and obese women present a greater risk of c-section delivery [1]. In the United States (Pittsburgh) in a study of 477 women, the rate of c-section was 16% (77 women), and the rate of c-section delivery in women who exceeded the weight gain during pregnancy was 19% (42 women) [24].

This study aimed to describe the gestational weight gain and the characteristics of pregnant women who went to the major maternity hospitals in southeast of Brazil and identify risks associated with prenatal. The main finding of this study was the high rate of overweight and obese BMI pregnancy and exceed GWG in these groups. Both overweight and obesity are considered problems not only in the Brazilian population but also in different regions of the world; it represented a worldwide problem in the obstetric population. Lack of knowledge about the limits of weight gain during pregnancy is limiting factor for women to achieve appropriate weight gain during this phase [22].

Pregnancy is a phase of women's life where they need special health care and so studies show that strategies to promote public health are important to provide changes in lifestyle, mothers diet adjustment, and physical exercises during the prenatal, in an attempt to adjust the weight gain during pregnancy and prevent obstetric risks and retention of postpartum weight, thus improving women's health in the long term [33–37].

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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