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Original article

## Effects of gestational weight gain on pregnancy complications

*Les effets du gain de poids sur les complications de grossesse*

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### Abstract

**Introduction and objective.** – Gestational weight gain (GWG) has been reported to be associated with pregnancy outcomes. The aim of this study was to evaluate the effects of GWG on maternal and birth complications.

**Materials and methods.** – A prospective and longitudinal cohort study was conducted among pregnant women who had attended antenatal centers in Constantine, Algeria, between 2013 and 2015. Two hundred pregnant women aged 19 to 41 years old were followed for 9 months of pregnancy. They underwent body weight measurement during routine examination at first, second and third trimester. GWG was categorized as below, within or above the Institute of Medicine (IOM) (2009) recommendations. Data included age and parity. Pregnancy outcomes were analyzed in relation to GWG.

**Results.** – Mean GWG was  $8.9 \pm 5.4$  kg. Among all subjects, only 27.5% of women had gained the recommended amount of weight, with 48.5% gaining less than recommended, and 24.0% gaining more than recommended by the IOM. High birth weight was significantly more frequent in women with excessive weight gain, compared to those with normal gain (27.1% vs 14.5%,  $P=0.04$ ). The percentage of low birth infants was statistically very high in pregnant women with excessive weight gain, compared to women with normal gain (14.6% vs 3.6%,  $P=0.04$ ). The risk of gestational hypertension increased with excessive GWG ( $P<0.01$ ).

**Conclusion.** – The pregnancy and birth outcomes depend on the women's gestational weight gain.

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**Keywords:** Gestational weight gain; Gestational hypertension; Macrosomia; Low birth weight

### Résumé

**Introduction et objectifs.** – Le gain de poids durant la grossesse (GPG) peut être associé aux issues de la grossesse. L'objectif de cette étude était d'évaluer les effets du GPG sur les complications maternelles et néonatales.

**Patientes et méthodes.** – Une étude prospective et longitudinale était menée auprès des femmes enceintes ayant fréquenté les centres de consultation prénataux de Constantine, Algérie, entre 2013 et 2015. Deux cents femmes enceintes âgées de 19 à 41 ans étaient suivies durant les neuf mois de leur grossesse. Leur poids était mesuré lors des examens de routine au premier, deuxième et troisième trimestre. Le GPG était classé comme inférieur, conforme ou supérieur aux recommandations 2009 de l'Institut de médecine (IOM). Les données incluaient l'âge et la parité. Les issues de la grossesse étaient analysées en relation avec le GPG.

**Résultats.** – Le gain de poids moyen était de  $8,9 \pm 5,4$  kg. Seulement 27,5 % femmes prenaient du poids selon les recommandations, 48,5 % ne prenaient pas assez de poids et 24,0 % en prenaient trop. Un poids élevé des nouveaux-nés à la naissance était plus fréquent lorsque les mères avaient eu un GPG excessif versus celles qui avaient eu un GPG normal ( $p=0,04$ ). La proportion de nouveaux-nés de faible poids à la naissance était plus élevée s'ils étaient issus de mères ayant eu un GPG excessif versus celles qui avaient eu un GPG normal (14,6 % vs 3,6 %,  $p=0,04$ ). Le risque d'hypertension artérielle gestationnelle augmentait en cas de GPG excessif ( $p<0,01$ ).

**Conclusion.** – Les issues maternelles et néonatales de la grossesse dépendent du GPG des mères.

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**Mots clés :** Gain de poids gestationnel ; Hypertension gestationnelle ; Macrosomie ; Faible poids à la naissance

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## 1. Introduction

Gestational weight gain (GWG) is a unique and complex biological phenomenon and is one of the factors that support normal fetal growth and development. Research indicates that suboptimal GWG, whether excessive or inadequate, is associated with a series of maternal and neonatal complications and even life-threatening diseases [1,2]. Several studies have shown that maternal excessive GWG was associated with increased risks of pregnancy-induced hypertension, gestational diabetes mellitus (GDM), caesarean delivery and large infant for gestational age, and maternal inadequate GWG was associated with increased risks of low birth weight and small infant for gestational age [3,4].

In 2009, the Institute of Medicine (IOM) [5] published new recommendations regarding GWG. These guidelines state that healthy women who have a normal weight for their height (BMI 18.5–24.9) should gain 11.5–16 kg during pregnancy. Overweight women (BMI 25–29.9) should gain 7–11.5 kg and obese women (BMI greater than 30) should only put on 5–9 kg. It is also recommended to gain between 0.5 and 2 kg during the first trimester [6]. In the second and the third trimesters, underweight women should gain 0.5 kg each week of pregnancy, normal women 0.4 kg/week, overweight women 0.3 kg/week and obese women 0.2 kg/week [5].

The guidelines have been validated by several studies demonstrating that weight gain in accordance with the guidelines is associated with optimal birth weight and obstetric outcomes. Women gaining either above or below IOM guidelines have higher risks of many adverse outcomes [7,8]. Despite these guidelines, over 55% of obese women gain more than the recommended amount [6].

GWG is not linear over the course of pregnancy. It starts slowly in the first trimester and increases more consistently in the second and third trimesters [9]. The ability to identify women at risk for excessive or inadequate GWG allows for weight management interventions. However, understanding the associations of GWG with possible pregnancy complications is complex, as a broad range of factors [10,11]. Moreover, most of the previous studies examining the association of excessive or inadequate GWG with unfavorable pregnancy outcomes were mainly conducted in developed countries [12,13].

In Algeria, this is the first study on studying weight gain in pregnant women. We do not have any previous data on the effects of GWG on maternal and birth complications. Therefore, our study assessed each trimester and total GWG in pregnant women with the aim of evaluating the effects of GWG on maternal and birth outcomes.

## 2. Materials and methods

We conducted a prospective and longitudinal cohort study. We followed for 9 months a cohort of Algerian pregnant women, aged 19 to 41 years old, residing in the city of Constantine, Algeria. Among all women who presented to prenatal consultation centers, only 200 pregnant women were accepted to participate in the study. They were recruited at three different

sites; at maternities, antenatal centers and private gynecologists, from December 2013 to December 2015. The participants were recruited and followed up longitudinally, once at the end of each trimester of pregnancy. The trimesters were defined as first (less than 16 weeks of amenorrhea), second (16–28 weeks of amenorrhea) and third (29–41 weeks of amenorrhea).

Women were eligible for participation if they entered prenatal care before the 16th week of amenorrhea (the end of the first trimester of pregnancy), aged 18 years old and more and were healthy and mentally competent. We excluded women refusing to participate in the study, women with missing information on pre-pregnancy weight (in order to calculate pre-pregnancy BMI and weight gain), known diabetes, hypertension and anemia before pregnancy. Potentially eligible women were given an informational letter explaining the study and its objectives and requesting their participation. A signed consent was obtained from each study participant.

Demographic characteristics of the pregnant women included: age, parity, pre-pregnancy weight and height, pre-pregnancy BMI, weight gain at the end of the first, second and third trimester of pregnancy and total GWG. Maternal complications evaluated included anemia, gestational hypertension, gestational diabetes, pregnancy term (preterm < 37 weeks of amenorrhea and after term > 42 weeks of amenorrhea) and cesarean delivery. Gestational hypertension was defined according to the Canadian Hypertension Society as a diastolic blood pressure > 90 mmHg on at least two measurements [14]. Birth complications evaluated included macrosomia (defined as birth weight  $\geq$  4000 g) and low birth weight (defined as birth weight < 2500 g). These information were obtained by face to face interview with each pregnant woman.

Weight and height were measured according to a standard protocol [15,16]. Pre-pregnancy weight was measured when the pregnant woman consulted at the early first trimester. During pregnancy, weight was measured at the end of each trimester (first, second and third) by using an electronic weighing balance Seca to the nearest 0.1 kg and weight gain of each pregnancy trimester was calculated by subtracting the previous trimester weight from the current trimester weight. Height was measured in centimetres using a Seca toise, with a length of 2 m graduated in centimeters and with a precision of 0.1 cm. Pregnant women were asked to maintain an upright and erect posture with her feet together and the back of her heels touching the pole of the anthropometer. The height was measured when the horizontal headpiece was lowered onto the women's head.

Pre-pregnancy body mass index (BMI) was calculated using a pre-pregnancy weight and height. Pre-pregnancy BMI was computed as weight (kg) divided by square of measured height (m). We categorized women's pre-pregnancy weight according to the World Health Organization (WHO) standards [16]. Weight gain (in kg) at each prenatal visit (at the end of the first, second and third trimesters) and total GWG were collected. We used the 2009 IOM guidelines on GWG to categorize women's weight gain as below, within or above recommended [17]. These guidelines have also been adopted by Health Canada [18].

Statistical analyses were performed using Stat View software version 5 (Abacus Concepts<sup>TM</sup>, Berkeley, USA) and SPSS.

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