

Is the U.S. Institute of Medicine Recommendation for Gestational Weight Gain Suitable for Thai Singleton Pregnant Women?

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Objective: To compare the gestational weight gain of healthy Thai singleton pregnant women with the U.S. Institute of Medicine (IOM) recommendation.

Material and Method: One thousand eight hundred forty nine medical records of uncomplicated singleton pregnant women who delivered at Siriraj Hospital between January 2007 and November 2010 were reviewed. All subjects were divided into four subgroups according to their pre-pregnancy body mass index (BMI): underweight (<18.5 kg/m²), normal weight (18.5-24.9 kg/m²), overweight (25.0-29.9 kg/m²), and obese group (≥30 kg/m²). Their baseline characteristics and gestational weight gain were collected and reported. One-way analysis of variance test was used to compare continuous data and Chi-squared test was used to compare discrete data among groups.

Results: Mean gestational weight gain of normal weight, underweight, overweight, and obese women were 14.2±4.7 kg, 14.1±4.3 kg, 12.4±4.7 kg, and 10.8±4.3 kg and gestational weight gain between 25th to 75th percentile were 11.0 to 17.0 kg, 11.0 to 16.5 kg, 10.0 to 15.0 kg, and 8.0 to 13.0 kg for pregnant women with pre-pregnancy normal weight, underweight, overweight and obesity respectively. Significant difference of maternal age, gestational weight gain, neonatal birth weight, and parity were found among groups ($p < 0.05$). About one-third of pre-pregnancy normal BMI (39.2%), overweight (36.6%), and obese (31.9%) as well as nearly half of pre-pregnancy underweight group (47.6%) gained the appropriate weight based on the U.S.IOM recommendation. About one-third of pre-pregnancy underweight (37.9%) and normal BMI group (30.6%) gained less than the recommendation. Majority of pre-pregnancy overweight (52.3%) and obese (63.8%) group gained more weight than the recommendation.

Conclusion: Although pregnancy outcomes were normal, less than half of Thai pregnant women gained the appropriate weight based on the U.S.IOM recommendation.

Keywords: U.S.IOM recommendation, Gestational weight gain, Thai singleton pregnant women

J Med Assoc Thai 2013; 96 (1): 1-6

Full text. e-Journal: <http://jmat.mat.or.th>

Gestational weight gain means the amount of weight gain during pregnancy⁽¹⁾. It is a factor that could predict various obstetric outcomes⁽²⁾. For instance, on one hand, poor gestational weight gain increases risk of preterm birth and fetal growth restriction^(3,4). On the other hand, excessive gestational weight gain can lead to many obstetric complications, such as pregnancy induced hypertension, gestational diabetes, and risk of cesarean section^(5,6).

Pre-pregnancy body mass index (BMI) is also an important factor that could prognosticate pregnancy

outcomes such as fetal macrosomia, gestational diabetes, and pregnancy induced hypertension in overweight or obese women and preterm delivery and delivery of low birth weight infants in underweight women^(7,8).

In 1990, the U.S. Institute of Medicine (U.S.IOM) recommended appropriate gestational weight gain according to pre-pregnancy BMI⁽⁹⁾ and re-examination of this guideline occurred in 2009⁽¹⁰⁾. According to this guideline, not only benefits for the baby but also maternal wellbeing were concerned. They recommended that pregnant women should gain their weight 12.5 to 18 kg, 11.5 to 16 kg, 7 to 11.5 kg and 5 to 9 kg in pregnant women whose pre-pregnancy BMI were underweight (<18.5 kg/m²), normal weight (18.5-24.9 kg/m²), overweight (25.0-29.9 kg/m²), and obesity (≥30 kg/m²), respectively. Better pregnancy

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outcomes were shown in those who gained their weight within the range of this recommendation.

In Thailand, the authors also use U.S.IOM recommendation for the gestational weight gain since there was no study about the recommendation for gestational weight gain in a Thai population. However, there is a question whether the U.S.IOM recommendation is suitable for Thai singleton pregnant women. The purpose of this study is to compare a pattern of gestational weight gain of normal Thai singleton pregnant women with the U.S.IOM recommendation.

Material and Method

A retrospective study was performed after ethical approval from the Siriraj Institutional Board Review (SIRB). Inpatient medical records of Thai singleton pregnant women who delivered at Siriraj tertiary hospital between January 2007 and November 2010 were enrolled.

Inclusion criteria were Term Thai singleton pregnant women who had normal pregnancy outcomes, which were defined as 1) spontaneous vaginal delivery between 37 and 42 weeks' gestation, 2) neonatal birth weight was between 2,500 and 4,000 g, 3) had no medical or obstetric complications during their pregnancy and had full record of pre-pregnancy weight. Gestational age was calculated from LMP if they had regular menstruation or by early ultrasound examination before 20 weeks' gestation in cases with uncertain LMP or inappropriate fundal height. Pre-pregnancy weight was obtained by self-reported or pre-conceptional documentation. Maternal body weight on the day of admission for delivery was measured to the nearest 0.1 kg by using standard digital scales. Incomplete recordable data were excluded. All subjects were divided into 4 groups according to IOM 2009⁽¹⁰⁾. These were BMI <18.5 kg/m², 18.5-24.9 kg/m², 25.0-29.9kg/m², and ≥30 kg/m² for the underweight, normal weight, overweight, and obese groups, respectively.

The data of maternal age, pre-pregnancy weight, maternal height, gestational weight gain and neonatal birth weight and parity were recorded. SPSS version 14 was used for statistical analysis. Mean, standard deviation, range, percentile, and percentage were used to analyze. One-way analysis of variance test was used to compare continuous data and Chi-squared test was used to compare discrete data among groups. P-value of less than 0.05 was considered to be statistically significant difference.

Results

One thousand eight hundred forty nine inpatient medical records that reached our inclusion criteria were collected and divided into four subgroups according to pre-pregnancy BMI. These were 435, 1,083, 262, and 69 in-patient charts for pre-pregnancy underweight, normal weight, overweight, and obesity, respectively.

Table 1 revealed characteristics of the study population. One-way ANOVA test was used to compare mean age, pre-pregnancy BMI, gestational weight gain, and neonatal birth weight among groups while Chi-squared test was used to compare parity among groups. Mean age of pre-pregnancy underweight, normal weight, overweight, and obese groups were 25.1±5.8, 27.2±5.7, 28.0±6.1, and 28.1±6.3 years old, respectively and mean pre-pregnancy BMI were 17.3±0.9, 21.0±1.7, 26.8±1.4, and 32.1±1.8 kg/m², respectively. Mean gestational weight gain in the pre-pregnancy underweight, normal weight, overweight, and obese groups were 14.1±4.3, 14.2±4.7, 12.4±4.7, and 10.8±4.3 kg, respectively. Besides mean infant birth weight were 3,024.8±293.5, 3,109.0±313.5, 3,188.8±324.4, and 3,224.6±307.0 g, respectively. In addition, the majority of pre-pregnancy underweight and normal weight groups were nulliparous (62.3% and 51.2%, respectively), while the majority of the pre-pregnancy overweight and obese groups had ever given birth (65.6% and 60.9%, respectively).

Significant difference was found among all variables. The data showed that pre-pregnancy underweight pregnant women were significantly younger than other groups (p<0.05). Regarding to gestational weight gain, pre-pregnancy overweight and obese groups had lower weight gain than underweight and normal pre-pregnancy BMI groups (p<0.05) while there was no difference in gestational weight gain between underweight and normal pre-pregnancy BMI groups (p>0.05). Moreover, neonatal birth weight of pre-pregnancy underweight groups was found to be smallest while normal pre-pregnancy BMI groups were in the middle and the highest neonatal birth weight belonged to pre-pregnancy overweight and obese groups (p<0.05).

Table 2 showed characteristics of gestational weight gain in the study population differentiated by pre-pregnancy BMI. Median of each category was 14, 14, 11.8, and 10 kg, respectively. When using hypothesis that pregnant women should gain their weight appropriately at least 50%, appropriate gestational weight gain in each group (25th-75th

Table 1. Characteristics of the study population classified by pre-pregnancy BMI (n = 1,849)

	Normal weight (n = 1,083) mean±SD (range)	Underweight (n = 435) mean±SD (range)	Overweight (n = 262) mean±SD (range)	Obesity (n = 69) mean±SD (range)	p-value*
Age (years)	27.2±5.7 (13-44)	25.1±5.8 (14-42)	28.0±6.1 (15-44)	28.1±6.3 (17-40)	<0.001**
Pre-pregnancy BMI (kg/m ²)	21.0±1.7 (18.5-24.9)	17.3±0.9 (14.1-18.4)	26.8±1.4 (25.0-29.9)	32.1±1.8 (30.0-37.9)	<0.001**
Gestational weight gain (kg)	14.2±4.7 (2-31)	14.1±4.3 (5-30.3)	12.4±4.7 (0.4-32)	10.8±4.3 (3.3-27)	<0.001**
Neonatal birth weight (g)	3,109.0±313.5 (2,500-4,000)	3,024.8±293.5 (2,500-3,930)	3,188.8±324.4 (2,540-3,990)	3,224.6±307.0 (2,510-3,990)	<0.001**
Parity, n (%)					
0	555 (51.2)	271 (62.3)	90 (34.4)	27 (39.1)	<0.001***
≥1	528 (48.8)	164 (37.7)	172 (65.6)	42 (60.9)	

* p<0.05 was considered to be statistical significance

** One way ANOVA test

*** Chi-squared test

percentile) of our population should be 11 to 16.5 kg, 11 to 17 kg, 10 to 15 kg, and 8 to 13 kg in pre-pregnancy underweight, normal weight, overweight, and obese group, respectively.

Comparison with the standard U.S.IOM recommendation for total maternal weight gain during pregnancy, as shown in Table 3, about one-third of pre-pregnancy normal weight (39.2%), overweight (36.6%), and obese (31.9%) pregnant women gained their weight within the recommendation. Thirty-six percent of women with normal pre-pregnancy weight had suboptimal weight gain, whereas another 30.3% gained weight over the recommendation. Nearly half of pre-pregnancy underweight pregnant women (47.6%) gained their weight appropriately and about one-third of this group gained their weight less than the recommendation. In addition, majority of pre-pregnancy overweight and obese pregnant women gained their weight over the recommendation (52.3% and 63.8%, respectively).

Discussion

To achieve the goal of pregnancy, obstetricians have to take care of both maternal and fetal well-being. Appropriate gestational weight gain is one aspect that brings about to good maternal and fetal outcomes. According to a new guideline for gestational weight gain described by U.S.IOM in 2009, appropriate gestational weight gain has been recommended by different categories of pre-pregnancy BMI⁽¹⁰⁾. Even though many countries tried to report a new recommendation of their own gestational weight gain^(2,6,11), U.S.IOM recommendation was still proved to be the most acceptable guideline for gestational weight.

In the present study, significant difference between characteristics of each group was found. Pre-pregnancy overweight and obese group who started with higher weight had a larger infant than the other groups (p<0.001). Previous studies supported that maternal pre-pregnancy BMI was correlated with neonatal birth weight⁽¹²⁻¹⁴⁾. Regard to parity, higher parity was found in mothers with pre-pregnancy overweight and obesity. This may be explained by the accumulation of postpartum weight retention from their previous pregnancy corporate with an increase of weight due to their behavior themselves^(15,16).

Focusing on maternal weight gain between 25th and 75th percentile, majority of Thai pregnant women increased their weight in range of 11.0 to 17, 11.0 to 16.5, 10.0 to 15.0, and 8.0 to 13.0 kg in normal

Table 2. Gestational weight gain of the study population differentiated by pre-pregnancy BMI

	Normal weight (n = 1,083)	Underweight (n = 435)	Overweight (n = 262)	Obesity (n = 69)
10 th percentile (kg)	9.01	9.01	7.0	5.5
25 th percentile (kg)	1.00	1.00	10.0	8.0
50 th percentile (kg)	14.00	14.00	11.8	10.0
75 th percentile (kg)	17.00	16.50	15.0	13.0
90 th percentile (kg)	20.00	20.00	19.0	16.0

Table 3. Comparison between the U.S.IOM recommendation and actual gestational weight gain of this study population

	Study population (n = 1,849)			
	U.S.IOM recommendation for gestational weight gain			
	Normal weight (11.5-16 kg) (n = 1,083)	Underweight (12.5-18 kg) (n = 435)	Overweight (7.5-11 kg) (n = 262)	Obesity (5-9 kg) (n = 69)
Under the recommendation, n (%)	331 (30.6)	165 (37.9)	29 (11.1)	3 (4.3)
Appropriate to recommendation, n (%)	424 (39.2)	207 (47.6)	96 (36.6)	22 (31.9)
Over the recommendation, n (%)	328 (30.3)	63 (14.5)	137 (52.3)	44 (63.8)

weight, underweight, overweight, and obese group, respectively. This showed a similar weight gain as recommended by U.S.IOM 2009⁽¹⁰⁾, which was 12.5 to 18 and 11.5 to 16 kg in underweight and normal weight group, respectively. As a result, we assumed that U.S.IOM recommendation could be provided in daily practice for these groups of Thai pregnant women. On the contrary, overweight and obese pregnant women who had normal pregnancy outcome in the present study gained their weight much more than U.S.IOM recommendation, 10 to 15 and 8 to 13 kg versus 7.5 to 11 and 5 to 9 kg, respectively. Although U.S.IOM recommendation for weight gain was approved to be benefit for good pregnancy outcome, this recommendation should be considered in Thai population since it may effect to both the mother and the neonate immediately after birth and in the future. Further study in this issue for Thai pregnant women should be progressed.

Moreover, although the present study population was differentiated according to different pre-pregnancy BMI, which was the same as the U.S.IOM, less than half of all populations (31.9-47.6%) could gain their weight as the recommendation. However, this was similar to many previous studies⁽¹⁶⁻¹⁸⁾. About two third of underweight and normal weight groups had their weight gain outside the U.S.IOM recommendation. This could be explained by different body structures between the Thai and US population. Besides, many factors were not included in the present study, for example, number of antenatal care

visit⁽¹⁶⁾, socioeconomic status⁽¹⁶⁾, education⁽¹⁹⁾ and nutrition^(20,21) during pregnancy. They all could affect gestational weight gain during pregnancy and should be considered in the Thai population.

Similar to previous studies^(16,22), more than half of both overweight and obese groups in the present study gained their weight much more than the U.S.IOM recommendation. It may be explained by the US pregnant women getting better advice for weight controlling while Thai pregnant women had not⁽²³⁻²⁵⁾. Well-designed system of nutritional and weight gain advice during pregnancy should be developed and launched in the Thai pregnancy care system.

Conclusion

The U.S. Institute of Medicine recommendation for gestational weight gain is not suitable for Thai singleton pregnant women. Most of Thai singleton pregnant women with normal pregnancy outcome had their weight gain outside the IOM recommendation, especially in the pre-pregnancy overweight and obese groups. There is a need for Thailand to develop new recommendation based on their own population data.

Acknowledgement

This research was supported by Siriraj grant for research development.

Potential conflicts of interest

None.

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การเพิ่มน้ำหนักตัวขณะตั้งครรภ์ตามคำแนะนำของ *Institute of Medicine* แห่งสหรัฐอเมริกาเหมาะสมกับสตรีตั้งครรภ์ไทยหรือไม่?

วิทยา ธิฐาพันธ์, ตรีภพ เลิศบรรณพงษ์, สุพิชฌาย์ พิมเสน

ภูมิหลัง: คำแนะนำเกี่ยวกับการเพิ่มน้ำหนักขณะตั้งครรภ์ที่ใช้กันอยู่ในประเทศไทยอ้างอิงตามคำแนะนำของ *Institute of Medicine* แห่งสหรัฐอเมริกาเนื่องจากยังไม่มีคำแนะนำของประเทศไทยเอง แต่จนถึงปัจจุบันยังไม่เคยมีการศึกษาว่าคำแนะนำดังกล่าวเหมาะสมกับสตรีตั้งครรภ์ชาวไทยหรือไม่

วัตถุประสงค์: เพื่อศึกษาเปรียบเทียบการเพิ่มน้ำหนักตัวที่เหมาะสมของสตรีตั้งครรภ์ชาวไทยกับการเพิ่มน้ำหนักตัวที่เหมาะสมของสตรีตั้งครรภ์ที่แนะนำโดย *Institute of Medicine* แห่งสหรัฐอเมริกา

วัสดุและวิธีการ: ทำการศึกษาย้อนหลังจากข้อมูลในเวชระเบียนของสตรีตั้งครรภ์เดี่ยวที่สุขภาพดีและตั้งครรภ์ครบกำหนด คลอดปกติทางช่องคลอดจำนวน 1,849 ฉบับ โดยแบ่งออกเป็น 4 กลุ่ม ตามค่าดัชนีมวลกาย ได้แก่ กลุ่มน้ำหนักน้อยกว่าปกติ (ดัชนีมวลกายน้อยกว่า 18.5 กก./ม.²), กลุ่มน้ำหนักปกติ (ดัชนีมวลกาย 18.5-24.9 กก./ม.²), กลุ่มน้ำหนักมากกว่าปกติ (ดัชนีมวลกาย 25.0-29.9 กก./ม.²) และกลุ่มอ้วน (ดัชนีมวลกายตั้งแต่ 30 กก./ม.² ขึ้นไป) แล้วทำการบันทึกข้อมูลพื้นฐานและน้ำหนักตัวที่เพิ่มขึ้นขณะตั้งครรภ์ เพื่อนำมาวิเคราะห์ต่อไป

ผลการศึกษา: ค่าเฉลี่ยของน้ำหนักตัวที่เพิ่มขึ้น คือ 14.2±4.7 กก., 14.1±4.3 กก., 12.4±4.7 กก. และ 10.8±4.3 กก. และค่าน้ำหนักตัวที่เพิ่มขึ้นระหว่างเปอร์เซ็นต์ไทล์ที่ 25 และ 75 คือ 11.0-17.0 กก., 11.0-16.5 กก., 10.0-15.0 กก., 8.0-13.0 กก. สำหรับสตรีตั้งครรภ์ในกลุ่มน้ำหนักปกติ กลุ่มน้ำหนักน้อยกว่าปกติ กลุ่มน้ำหนักมากกว่าปกติ และกลุ่มอ้วน ตามลำดับ ผลการศึกษาพบว่า ประมาณ 1 ใน 3 ของสตรีตั้งครรภ์ในแต่ละกลุ่มซึ่งประกอบด้วย กลุ่มน้ำหนักปกติ (39.2%), กลุ่มน้ำหนักมากกว่าปกติ (36.6%) และกลุ่มอ้วน (31.9%) รวมทั้งประมาณครึ่งหนึ่งของสตรีตั้งครรภ์กลุ่มน้ำหนักน้อยกว่าปกติ (47.6%) มีการเพิ่มขึ้นของน้ำหนักตัวสอดคล้องกับที่แนะนำโดย *Institute of Medicine* แห่งสหรัฐอเมริกา ในขณะที่ประมาณ 1 ใน 3 ของสตรีกลุ่มน้ำหนักน้อย (37.9%) และสตรีกลุ่มน้ำหนักปกติ (30.6%) มีการเพิ่มของน้ำหนักตัวน้อยกว่าที่แนะนำโดย *Institute of Medicine* นอกจากนี้ยังพบว่าเกินกว่าครึ่งหนึ่งของสตรีกลุ่มน้ำหนักมากกว่าปกติ (52.3%) และกลุ่มอ้วน (63.8%) มีน้ำหนักตัวเพิ่มขึ้นมากกว่าที่แนะนำโดย *Institute of Medicine* แห่งสหรัฐอเมริกา

สรุป: มากกว่าครึ่งหนึ่งของสตรีตั้งครรภ์ชาวไทยมีการเพิ่มน้ำหนักตัวขณะตั้งครรภ์ไม่สอดคล้องกับคำแนะนำของ *Institute of Medicine* แห่งสหรัฐอเมริกา
