

# Body mass index and gestational weight gain in two selected Medical Officer of Health areas in the Gampaha District

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## Abstract

### Objective:

To describe gestational weight gain pattern according to the body mass index (BMI) categories.

### Methods:

This is a descriptive study conducted in two Medical Officer of Health areas of the Gampaha District. Pregnant women were recruited on or before 16 weeks of gestation and followed up until delivery. Maternal weight was measured at the booking visit, during the second trimester and at delivery. Inadequate and excessive weight gain were defined as weight gain below and above the Institute of Medicine (IOM) 2009 recommendations for the BMI categories as well as Ministry of Health (MoH) recommendations.

### Results:

Two hundred and forty seven (30%) of the women were underweight, 432(52%) were normal weight and 131(18%) overweight and obese. According to the Asian BMI classification, 338(41 %) were normal weight and 225(29%) were overweight and obese. Total mean weight gain for the sample was 10.6(SD 3.3) kg and mean rate of gestational weight gain was 0.27(SD 0.08) kg/week. Mean weight gain during second trimester was 6.7(SD 2.7) kg and during third trimester 3.9(SD 2.2) kg. Mean gestational weight gain and rate of weight gain per week was higher among underweight women. Of the 710, 404(57%) women gained less and 62(8.7%) more weight, than recommended by the IOM, whereas 108(15%) gained more weight by MoH standards.

### Conclusions:

One third of the women were underweight and mean gestational weight gain and rate of weight gain per week were higher amongst them. More than half of the women gained less weight than recommended.

**Key Words** – Body mass index, gestation, pregnancy, weight gain

## Introduction

Gestational weight gain is crucial for both maternal and fetal pregnancy outcomes. Inadequate weight gain during pregnancy is a major maternal health problem in developing countries. Several authors<sup>1-10</sup> had reported inadequate weight gain to be associated with preterm birth, birth weight, low birth weight, small for gestational age and failure to initiate breastfeeding. Excessive weight gain during pregnancy is a public health problem in developed countries. Three studies have reported that the weight gain exceeded more than the recommended range for over 50% of mothers.<sup>11-13</sup> Excessive gestational weight gain too results in both maternal and fetal adverse pregnancy outcomes and delivery complications. Children of mothers who gained more than the recommended weight gain had a greater risk of being overweight at seven years of age<sup>14,15</sup> than for children of mothers who met the weight gain recommendations. Being an overweight child was associated with higher systolic blood pressure in later life.<sup>14</sup>

The effects of gestational weight gain on pregnancy outcome depend on the woman's pre-pregnancy body mass index (BMI).<sup>16</sup> The Institute of Medicine (IOM) released new guidelines<sup>17</sup> for gestational weight gain in

2009 which is shown in Table 1. According to these, optimal levels for gestational weight gain were based on the maternal BMI status. Pregnancy weight gain within the IOM recommendations were observed to be associated with better outcomes.<sup>18</sup> The data on gestational weight gain pattern are not available in Sri Lanka. Therefore the objective of this study was to describe gestational weight gain pattern according to the BMI categories.

## Methods

This is a descriptive component of a cohort study which was carried out in two Medical Officer of Health (MOH) areas namely Ja-ela and Ragama in the Gampaha District which cover both urban and rural areas. Both these MOH areas conduct 36 antenatal clinics per month. The study was conducted between May 2001 to April 2002. All pregnant mothers eligible to participate in the study were recruited from the antenatal clinics on or before 16 weeks of gestation and followed up until delivery. Exclusion criteria were age <15 years, pre-existing diabetes mellitus and hypertension and multiple pregnancies. Details of this study have been published elsewhere.<sup>19</sup>

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Maternal weight was measured at the booking visit, during the second trimester and at delivery. The technique of measurement was standardized and the weighing machines in the clinics were calibrated regularly using a known weight. BMI was determined based on the weight and height measurements of the first antenatal clinic visit. Inadequate and excessive weight gain based on the BMI categories were defined separately according to both the IOM and the Ministry of Health standards.<sup>20</sup>

Data were analysed for the total sample and women with normal pregnancy outcome separately. Normal pregnancy outcome was defined as those pregnancies which were not associated with maternal complications during pregnancy in terms of ante partum haemorrhage, pregnancy induced hypertension, eclampsia and gestational diabetes mellitus and those which did not end up in fetal death, preterm delivery and caesarean deliveries.

### Results

The total number recruited to the study was 885. Fifty six mothers were excluded from the analysis due to multiple pregnancies (10) and fetal deaths (46). Of the remaining 829 mothers, 247 (30%) had a BMI of <18.5 kg/m<sup>2</sup>, 432 (52%) between 18.5–24.9 kg/m<sup>2</sup>, 114 (14%) between 25.0 – 29.9 kg/m<sup>2</sup> and 17 (2%) ≥30 kg/m<sup>2</sup>. For 19 (2.3%), the BMI values were missing. The corresponding values according to Asian BMI categories were 247 (30%) for <18.5 kg/m<sup>2</sup>, 338 (41%) between 18.5–22.9 kg/m<sup>2</sup>, 179 (21.6%) between 23.0 – 27.4 kg/m<sup>2</sup> and 46 (5.5%) ≥27.5 kg/m<sup>2</sup>.

For the assessment of weight gain, 119 (14.4%) mothers had to be excluded from the analysis due to non availability of weight measurements at the first antenatal visit or at the last assessment. Therefore the final sample included in the analysis of weight gain was 710.

Total mean weight gain for the sample was 10.6 (SD 3.3) kg and mean rate of gestational weight gain was 0.27 (SD 0.08) kg/week. Mean weight gain during second trimester was 6.7 (SD 2.7) kg and during third trimester 3.9 (SD 2.2) kg.

Of the 710, 404 (57%) mothers gained less and 62 (8.7%) gained more weight, than that recommended by the IOM 2009 guidelines (Table 2). However, according to the Ministry of Health weight gain classification 15% (108) had excessive weight gain. It was also observed that 67% (n=140) of underweight and 61% (n=237) of normal weight women, had inadequate weight gain according to the both classifications. Five percent (n=19) of normal weight and 29% (n=29) of overweight women has had excessive weight gain according to the IMO standards, which was 11% (n=44) and 43% (n=43) according to the Ministry of Health standards respectively.

The highest rate of weight gain per week was observed among underweight women which showed a gradual decrease through normal weight to overweight category (Table 2). A similar trend was observed among mothers who underwent a normal pregnancy (Table 3) and when the BMI status was categorized according to Asian standards (Table 4).

**Table 1 – Institute of Medicine (IOM) of the National Academies and Ministry of Health (MoH) recommendations for total weight gain during pregnancy, by pre pregnancy BMI**

Pre pregnancy BMI (kg/m <sup>2</sup> )	Rate of weight gain 2 <sup>nd</sup> and 3 <sup>rd</sup> trimester (lbs/week)	IOM standard Total weight gain (kg)	MoH standard Total weight gain (kg)
Under-weight	<18.5	1.0 (1.0 – 1.3)	12.5 – 16.0
Normal weight	18.5 – 24.9	1.0 (0.8 – 1.0)	11.5 – 14.0
Over-weight	25.0 – 29.9	0.6 (0.5 – 0.7)	7.0 – 9.5
Obese (all classes)	≥30.0	0.5 (0.4 – 0.6)	5.0 – 8.0

Source: Adopted from the Institute of Medicine of the National Academies and WHO

**Table 2 – Gestational weight gain pattern in the total sample IOM and Ministry of Health (MoH) standard, by pre pregnancy BMI**

Pre pregnancy BMI (kg/m <sup>2</sup> )	IOM standard			MoH standard			Weight gain (kg)	Weight gain per week (kg)
	Inade-quate weight gain	Normal weight gain	Excess weight gain	Inade-quate weight gain	Normal weight gain	Excess weight gain		
	n	n	n	n	n	n	Mean (SD)	Mean (SD)
Underweight <18.5 (n=210)	140 (67%)	66 (31%)	4 (2%)	140 (67%)	59 (28%)	11 (5%)	11.2 (3.2)	0.28 (0.08)
Normal weight 18.5 – 24.9 (n=386)	237 (61%)	130 (34%)	19 (5%)	237 (61%)	105 (27%)	44 (11%)	10.6 (3.2)	0.27 (0.08)
Overweight 25.0 – 29.9 (n=101)	26 (25.7%)	46 (45.5%)	29 (28.7%)	26 (25.7%)	32 (31.7%)	43 (42.6%)	9.2 (3.4)	0.23 (0.08)
Obese ≥30.0 (n=13)	1 (7.7%)	2 (15.4%)	10 (77%)	2 (15%)	1 (7.7%)	10 (77%)	10.8 (3.1)	0.27 (0.08)

IOM - Institute of Medicine

**Table 3 – Weight gain pattern in normal pregnancies, by pre pregnancy BMI**

Pre pregnancy BMI (kg/m <sup>2</sup> )	Weight gain (kg) Mean (SD)	95% refer-ence range (kg)	Weight gain (kg per week) Mean (SD)
Underweight < 18.5 n=169	11.4 (3.1)	5.28 – 17.50	0.29 (0.08)
Normal weight 18.5–24.9 n=255	10.5 (3.3)	4.14 – 16.9	0.27 (0.08)
Overweight 25.0 – 29.9 n=59	9.0 (3.2)	2.75 – 15.25	0.23 (0.08)
Obese ≥ 30.0 n=5	12.0 (0.7)	-	0.29 (0.02)

**Table 4 – Gestational weight gain pattern in the total sample, by Asians pre-pregnancy BMI**

Pre pregnancy BMI (kg/m <sup>2</sup> )	Weight gain (kg) Mean (SD)	Weight gain (kg per week) Mean (SD)
Underweight (<18.5) n=210 (29.5%)	11.2 (3.2)	0.28 (0.08)
Normal weight (18.5–22.9) n=307 (43.0%)	10.6 (3.1)	0.27 (0.08)
Overweight (23.0 – 27.4) n=154 (21.7%)	9.8 (3.4)	0.25 (0.09)
Obese (≥27.5) n=39 (5.5%)	10.1 (3.9)	0.26 (0.10)

## Discussion

According to the BMI classification, this study indicates that 30% of the pregnant women were underweight and 54% of them were normal weight and 16% overweight and obese. According to Asian BMI classification 41 % were normal weight and 29% were overweight and obese.

A review article reported that the BMI cut-off points for overweight and obesity of Asian populations are lower than the international BMI cut-off points recommended by the WHO.<sup>21</sup> Because Asian populations were noted to have higher cardiovascular risk factors than Western populations at any BMI level.<sup>21</sup> Wen et al had reported that among the Asian population, significant mortality risks started at BMI  $\geq 25.0$  kg/m<sup>2</sup>, rather than at BMI  $\geq 30.0$  kg/m<sup>2</sup>.<sup>22</sup> The study supported the use of BMI  $\geq 25.0$  kg/m<sup>2</sup> as a new cut-off point for obesity and BMI of 23.0-24.9 kg/m<sup>2</sup> for overweight.<sup>22</sup> Another study had reported that using revised cut points would greatly increase the estimated burden of obesity-related metabolic disorders among South Asians, Chinese and Aboriginals.<sup>21</sup> Therefore, necessity to develop and re-define appropriate BMI cut-off points which are country-specific and ethnic-specific for Asians has also been suggested by some.<sup>23</sup>

We found that 57% women gained less and 8.7% more weight, than recommended by the IOM 2009 guidelines. According to the WHO standard excessive weight gain was 15%. Excessive gestational weight gain is more prevalent than inadequate weight gain in developed countries. One study reported that 30.6% of women gained the recommended amount of weight during pregnancy where as 52.3% gained more weight, and 17.1% less than recommended according to the IOM 1990 guidelines.<sup>11</sup> Olson had reported that only about 33% to 40% of U.S. women gain within IOM recommendations.<sup>18</sup> Another study reported that one third of women gained within the recommended range, 22% gained below, and 45% gained above the range.<sup>13</sup>

The optimal weight gain in women of BMI <18.5 kg/m<sup>2</sup>, 18.5–25 kg/m<sup>2</sup> and 25–29 kg/m<sup>2</sup> in the present study were 5–17 kg; 4–17 kg and 3–15 kg respectively. One study from Sweden reported that the optimal gestational weight gain in women by pre-pregnancy BMI was 4-10 kg for BMI <20 kg/m<sup>2</sup>; 2-10 kg for BMI 20-24.9 kg/m<sup>2</sup>; <9 kg for BMI 25-29.9 kg/m<sup>2</sup>; and <6 kg for BMI of 30 kg/m<sup>2</sup> or more.<sup>24</sup>

We found that the mean weight gain as well as rate of mean weight gain per week were higher among underweight and normal weight women respectively than overweight women. Our findings were consistent with the results reported by several authors.<sup>6,17,25</sup>

Our study has several limitations. We recruited pregnant women on average at 12 weeks of gestation and the weight measurements were made at that point. Ideally it would be better to take pre-pregnancy weight

instead of booking visit for determining gestational weight gain. The sample size was not adequate for determining mean gestational weight gain, 95% reference range for weight gain among normal pregnancies and the proportion of inadequate and excessive weight gain for obese women. As the study was confined to two MOH areas in the Gampaha District, generalizability of the results are to be done cautiously.

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