Journal of Health Researches. 2012; 1(1): 1-10.
http://jhr.ssu.ac.ir

Original

Weight Gain During Pregnancy and Birth Weight Outcome In Pregnant Women, Tabriz, Iran

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Received: 12/15/2011 Accepted: 4/3/2012

Abstract

Introduction: The aim of this study was to investigate weight gain during pregnancy and birth weight in rural regions of Tabriz, a province in the northwest of Iran.

Materials & Methods: A cross-sectional study was conducted using routinely collected data of pregnant mothers from rural health centers. Eight health centers were randomly selected in rural areas of Tabriz. Totally, 874 women aged 24.86±5.08 years with singleton term that regularly attended health centers for prenatal care and delivered between 2002 and 2007 entered the study. The data on pre-pregnancy weight, height, total weight gain during pregnancy, mother's age, parity, newborn's birth weight, mother's education and working status were extracted from the health records. The women were categorized based on their pre-pregnancy body mass index (BMI) as underweight, normal weight, overweight and obese. Pregnancy weight gain was compared with new (2009) and old (1990) recommendations of Institute of Medicine (IOM).

Results: 86.1% of underweight and 77.7% of normal weight pregnant women gained weight during their pregnancy below the lower limits of recommended ranges. While weight gain in none of the underweight pregnant women was more than the new IOM recommendations, 1.1% of normal weight, 17.8% of overweight and 36.4% of obese women gained weight more than the upper limits of the new IOM recommendations.

Conclusion: The results of this study indicate that according to IOM guidelines, most of Iranian rural pregnant women gain weight during pregnancy less than minimum recommendations.

***Keywords*:** Rural Health Services; Pregnancy Outcome; Infant, Low Birth Weight; Obesity; Weight Gain

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Introduction

Pregnancy is the clinical situation with at least two patients, the mother and the fetus. Mothers need to gain adequate weight so that they and their babies reach to optimum sizes posing no risk. Low birth weight (LBW) as a significant public health problem accounts for 15.5% of all live births in developing countries. Most of low birth weight infants (72%) are born in Asia. However, there are large differences among WHO Asian regions and its sub-regions. Eight percent of these births occur in the eastern Mediterranean region, including Iran [1].

Low pre-pregnancy body mass index (BMI) is one of the strongest predictors for LBW and abnormal gestational weight gain pattern may further complicate the pregnancy outcomes. LBW defined as birth weight less than 2500 grams is associated with a range of postnatal adverse consequences [2]. Many studies have consistently demonstrated a linear relationship between the pattern of maternal weight gain and birth weight, and maternal poor weight gain may be one of the most important preventable risks for LBW [2]. Almost all women regardless of being either underweight or overweight before their pregnancy, may be at risk for acquiring unusual weight gain pattern and delivering LBW infants[3]. Considerable evidence suggests that maternal BMI before and gestational weight gain during pregnancy as a mother nutritional status account for the majority of poor pregnancy outcomes [4]. Trends in pregnancy weight gain within the recommended ranges of Institute of Medicine (IOM) seem to be associated with better outcome than those outside of these ranges [5-7].

Almost two decades have passed since IOM guidelines first became available to know how much weight women should gain during pregnancy [8]. Although, in the first revision of this guideline less weight gain for obese pregnant women has been emphasized [8], many women in developing countries still gain weight less than recommended range.

Despite the recognized association between pregnancy outcome and pre-pregnancy weight and weight gain during pregnancy, to our knowledge, no study has been published addressing this issue in Tabriz, a city in the northwest of Iran. This study, therefore, aimed to investigate pregnancy weight gain in relation to newborn's birth weight in a population of pregnant women who regularly attended the rural health centers for prenatal care in Tabriz.

Materials & Method

This cross-sectional study was carried out by analyzing routinely collected data from

rural health centers for 874 pregnant women from 8 randomly selected health centers in Tabriz, a northwestern province of Iran. All women who attended these health centers monthly for prenatal care and delivered between 2002 and 2007 were included in study.

In the present Iranian rural health care system, if a woman doesn't continue her attendance at the public health center, she will be followed up actively by trained health workers. Also, these health workers must identify all of the pregnant women in rural areas and cover them under prenatal health care program. In all rural health centers, information about a mother's age, parity, level of education, employment and smoking status is routinely gathered by health workers using a standard questionnaire. Moreover, weight is measured monthly by health workers using a balanced-beam scale to the nearest 0.1 kg while women are required to take off their shoes and wear light clothes; height is also measured at the first prenatal care visit.

In the rural areas of Iran, many of the pregnancies are unplanned; consequently, in reality prenatal care in rural health centers begins mostly after pregnancy. Due to very slight weight gain during first and second months of pregnancy [9] and difficulty of knowing women's weight before pregnancy in rural areas, first weight measurement of pregnant women who attended the health centers before their second month of pregnancy was considered as pre-pregnancy weight in this study.

The pregnant women were grouped based on their pre-pregnancy BMI [weight (kg) / height² (m)] according to the categories developed by the World Health Organization (WHO) and new guidelines of IOM for total pregnancy weight gain. Recommended ranges of total weight gain in pregnant women by pre-pregnancy BMI (in kg/m²) for underweight (<18.5), normal weight (18.5-24.9), overweight (25-29.9) and obese (≥30) women are 13-18, 11.5-16, 7-11.5 and 5-9 kg, respectively [8].

After delivery in maternity hospital, a document including information about condition of delivery and newborn's weight is given to the mother and then she gives it to the health center.

In this study, the subjects were also categorized according to the current classification for education: illiterate (no schooling), elementary (less than 5 years schooling), intermediate (5-12 years schooling) and highly educated (more than 12 years schooling). The participants were classified as either unemployed (housewives) or employed. The Ethic Committee of the Tabriz University of Medical Sciences approved the study.

Comparison of prevalence of weight gain below, within and above the IOM cut-offs regarding pre-pregnancy BMI, education, parity and age were made by χ^2. Comparison of pregnancy weight gain and newborn's birth

weight in women with different levels of pre-pregnancy BMI, education, parity and age were carried out by analysis of covariance. Using logistic regression analyses, we calculated odds ratios (ORs) with 95% confidence intervals to examine the predictive effect of variables studied on risk for LBW. We used multinomial logistic regression models to estimate odds ratio (ORs) with 95% confidence intervals to assess associations between gestational weight gain and pre-pregnancy BMI and other covariates. The P–value less than 0.05 was considered as the level of significance.

Results

Characteristics of the pregnant women in this study are shown in Table 1. In comparison to older women, insufficient pregnancy weight gain was higher among younger women while excessive pregnancy weight gain was prevalent in older women (Table 2).

Analysis of covariance showed that the mean adjusted pregnancy weight gain in different levels of pre-pregnancy BMI, education and parity was significant (Table 3). Women with lowest pre-pregnancy BMI (BMI <19.8 kg/m2) were at higher risk of delivering a LBW infant as compared with other BMI groups (Table 4). These results indicated that pre-pregnancy BMI was significantly associated with excessive and insufficient weight gain during pregnancy and consequently low or high birth weight. Although mean weight gain was lower among obese women compared to normal and overweight women, they were at higher risk of exceeding the IOM range for their pre-pregnancy BMI category (Table 5). Compared to lean women (pre-pregnancy BMI <19.8 kg/m2), normal and overweight pregnant women had 66% and 77% lower risk of delivering LBW infant, respectively. After adjusting for potential confounders, we found that for each unit increase in weight gain during pregnancy, the risk of LBW decreased by 16%. Using logistic regression analysis, we found a nearly two-fold higher risk of LBW among girls compared to boys (Table 6).

Table 3) Total pregnancy weight gain regarding prepregnancy body mass index, education, age and parity in the study population (analysis of covariance).*

Weight gain	Number	Unadjusted	Adjusted
Prepregnancy BMI			
<19.8	72	9.42±0.25	8.93±0.37
19.8-26	466	9.11±0.11	9.07±0.20
26.1-29	163	8.42±0.20	8.76±0.26
>29	173	8.11±0.20	8.61±0.27†

Table 3) Total pregnancy weight gain regarding prepregnancy body mass index, education, age and parity in the study population(Continue)

Weight gain	Number	Unadjusted	Adjusted
Education (y)			
0	145	8.49±0.18	8.36±026‡
<5	215	8.98±0.15	9.02±0.22
5-12	277	8.94±0.14	9.24±0.24
>12	83	9.20±0.25	8.59±0.35
Age			
<19	119	9.08±0.23	8.82±0.38
20-25	395	8.86±0.13	8.70±0.19
25-30	232	8.89±0.16	8.79±0.23
>30	122	8.83±0.19	9.16±0.31
Parity			
0	251	9.02±0.14	8.89±0.23§
1	343	9.02±0.14	9.10±0.22
2	162	8.73±0.21	8.82±0.28
>2	115	8.49±0.21	8.28±0.35§

* Adjusted for the same set of the variable as above.
† P=0.001 different from the three other groups.
‡ P=0.028 different from the three other groups.
§

Table 4) Mean birth weight and percentage of low birth weight in relation to prepregnancy BMI, education, age and parity in the study population.

		Birth weight (g)	Low birth weight (%)
Prepregnancy BMI	Number		
<19.8	72	2837±71.61*	25
19.8-26	457	3209±38.75	7.2
26.1-29	160	3313±49.90	4.4
>29	172	3176±51.95	5.8
Education (y)			
0	145	3214±50.31	9.1
<5	215	3205±43.58	6.6
5-12	277	3135±47.03	7.4
>12	83	3115±68.12	8.4
Age			
<19	119	3113±74.23	6.8
20-25	395	3172±38.00	8.7
25-30	232	3206±43.96	6.6
>30	122	3165±61.04	7.6
Parity			
0	251	3108±44.38	8.5
1	343	3157±43.31	8.3
2	162	3226±54.83	6.8
>2	115	3244±67.99	4.5

* P=0.001 different from the three other groups, mean of birth weight
by analysis of covariance adjusted for the variable as above were compared

Table 5 multinomial logistics regression for gestational weight gain in pregnant women attending rural health centers for prenatal care in Tabriz

Variables	Gestational weight gain			
	Insufficient		Excessive	
	OR (95% CI)	P	OR (95% CI)	P
Age				
<19	0.86(0.36-2.02)	0.73	0.67(0.16-2.83)	0.59
19-25	1.58(0.81-3.06)	0.17	088(0.36-2.13)	0.78
25-30	1.23(0.64-2.34)	0.52	0.76(0.33-1.73)	0.52
>30 (reference)	-	-	-	-
Prepregnancy(BMI)				
Underweight	15.11(5.94-28.40)	0.001	-	-
Normal	7.83(4.60-13.34)	0.001	0.05(0.01-0.16)	0.001
Overweight	0.93(0.51-1.68)	0.81	0.30(0.16-0.56)	0.001
Obese (reference)	-	-	-	-
Parity				
0	0.60(0.27-1.36)	0.22	0.96(0.32-2.84)	0.94
1	0.53(0.26-1.10)	0.09	0.77(0.30-1.94)	0.58
2	0.55(0.26-1.18)	0.12	078(0.31-1.97)	0.61
>2 (reference)	-	-	-	-
Education				
0	1.89(0.88-4.04)	0.09	1.57(0.49-5.06)	0.44
<5	1.10(0.57-2.12)	0.76	1.06(0.37-3.05)	0.90
5-12	1.11(0.60-2.06)	0.73	1.35(0.48-3.78)	0.55
>12(reference)	-	-	-	-

Table 6) Odds ratios (OR) obtained by logistic regression analysis for the association between low birth weight and variables studied in pregnant women attended in rural health care centers Tabriz

	Low birth weight		
	OR	95% CI	P
Age			
<19	-	-	-
19-25	1.66	0.48-5.77	0.41
25-30	1.57	0.38-6.46	0.52
>30	2.51	0.52-12.16	0.25
Prepregnancy(BMI)			
Underweight	-	-	-
Normal	0.34	0.13-0.90	0.03
Overweight	0.23	0.06-0.76	0.01
Obese	0.37	0.12-1.10	0.07
Parity			
0	-	-	-
1	0.91	0.38-2.17	0.83
2	1.08	034-3.12	0.93
>2	0.61	0.15-2.41	0.48
Weight gain	0.84	0.73-0.97	0.02
Education			
0	-	-	-
<5	0.80	0.31-2.10	0.66
5-12	1.00	039-2.58	0.99
>12	1.41	0.43-4.55	0.56
Sex			
Male	-	-	-
Female	1.95	1.01-3.78	0.04

Discussion

In this study, 87% of underweight and 78.2% of normal weight pregnant women gained weight below the lower limits of recommended ranges by IOM during their pregnancy; these percentages were more than those reported in the other studies done in Iran, e.g. 50% and 55% [10], 61.7% and 56.6% [11], 60% and 59% [3]. Also, the prevalence of LBW among underweight pregnant women was higher in this study (25%) compared with other studies, for example, 16.7% [10], 8.8% [11] and 12.3% [3]. The results of current study indicated that pre-pregnancy BMI as well as gestational weight gain have independent effects on infant birth weight which is in accordance with previous studies [12, 13]. These findings provide support to have a well-designed program in rural area to balance pre-pregnancy BMI as well as gestational weight gain to decrease the risk of LBW infant.

Iranian Ministry of Health and Medical Education performed a national survey to determinate the prevalence of LBW among Iranian newborns [14]. Different areas in Iran according to the results of this survey and prevalence rate were classified in three groups: high, moderate and low. Tabriz, based on this classification, was among the areas with high prevalence but other regions that their results are mentioned above were among the areas with low or intermediate prevalence. In Iran, rural health centers are obliged to cover all women and children under the age of 5. Thus, many of the heath programs such as vaccination, control of diarrheal disease, prevention of acute respiratory infection and iodine deficiency disorders are being performed effectively, but unfortunately this progress is not seen in prenatal care. The infant birth weight rate proved to be a sensitive indicator for the success or failure of maternal and child health programs monitoring [15]. LBW appears to be one of the important adverse outcomes of an unhealthy pregnancy for this population. It seems in Iran and other developing countries not only health facilitates are not enough for health improvement and better outcome of pregnancy but also high living standards in general should be maintained.

Inadequate weight gain during pregnancy is a well-recognized risk factor for poor infant outcomes such as low birth weight [16]. To have the suitable weight gain during pregnancy, mothers need both intakes of proper nutrients especially macronutrients and an appropriate physical activity level. It seems that Iranian women who live in the rural areas are more active than women who live in the urban areas [11]. An Iranian woman lives in a village simply and meanly; she does not have washing machine, vacuum cleaner and, so, she does most of the housework and hard work such as farming.

In accordance with the findings of other studies [17, 18], our results showed that illiterate and poorly educated pregnant women during pregnancy were at higher risk than highly

educated women for gaining less weight. Also, infants of the lower educated women had a statistically significant lower birth weight than infants of the higher educated women. There is an association between parity and obesity [19]. Parous women retain more of their pregnancy weight, and this is linked to long-term obesity [9]. In this study, by control of age, multi-parous women were heavier than nulli-parous women, and also 87% of overweight and 89.3% of obese pregnant women who gained weight during their pregnancy more than the upper cut-offs in the new IOM recommendations were multi-parous. So, compared with nulli-parous women, it seems that multi-parous women are prone to gaining and consequently retaining weight.

The current study has found an association between maternal age and gestational weight gain. However, we found no significant relationship between maternal age and the likelihood of low birth weight. These findings are in agreement with previous studies [20, 21]. Young pregnant women might have higher nutrient requirements compared to older ones as they are still growing. Our findings indicate that there is a possibility of some physiological adaptations which tend to protect the fetus. However, it must be noticed that young pregnant women are at risk of deprivation of sufficient nutrient supply to fetus [22].

We found an association between birth weight and sex of an infant which was in agreement with the results of recent study [23]. The mean birth weights of male infants were more than female infants. This gender-related difference has been explained by anatomical and physiological factors [24].

This study had some limitations. The pregnant women didn't follow during their pregnancy and there wasn't any information about dietary pattern and physical activity of the subjects. Total gestational weight gain measure was used in the current study which assumed to have constant rate across trimesters. However, the rate of gestational weight gain, especially during the second and third trimesters, is important in determining the birth weight [23].

In conclusion, these findings show that despite integrative health care provided by rural health centers in Iran, prenatal care is still defective. A comprehensive program including nutritional support integrated within social facilities is necessary in the rural areas of Iran to improve health status of pregnant women and prevent the outcomes of unhealthy pregnancy such as having low birth weight (LBW) infants.

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