Evaluation of maternal weight gain during pregnancy and its association with birth weight in Isfahan city

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Abstract: Introduction: One of the most important changes in pregnancy is maternal weight gain. As today there are inconsistent views of how much weight gain is optimal, this matter is frequently discussed and surveyed. A few studies have been performed about pregnancy weight gain and correlation with birth weight in Iran. So, the aim of this study was appointment of maternal weight gain in pregnancy and correlation with infant birth weight. **Method and material:** This was a descriptive-analytic cross sectional study. Data was gathered by recording on paper. They were elicited and recorded through family health files. Pregnancy weight gain was obtained by 225 mother files that were referred health centre, using hierarchical-step cluster sampling. Data were analyzed through SPSS software, defining significant level at $P < 0.05$. **Result:** Mean of weight gain was 11.73 kg during pregnancy .Moreover, mean of birth weight was 3193 gr while approximately 7.11% of them were LBW and 6.22% were more than 4000gr. Mean BMI was25.3 kg/m^2 in study group. Pre-pregnancy BMI and pregnancy weight gain was significantly correlated with birth weight gain, through computing Pearson's correlation coefficient. **Discussion:** Although mean of weight gain in pregnancy was about optimal value, there was established that noticeable percent of mothers with impotence and normal weight couldn't optimally gain recommended weight In BMI subgroup. In spite of considerable percent of mothers diagnosed with overweight and obese had weight gain more than standard goal, there were direct significant association between pregnancy weight gains with infant birth weight.
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1. Introduction

Pregnancy is one of the most crucial periods in the life of mother and fetus. It has health are social importance for individual, family and society. Mother health and illness, during this period, affect not any her lifestyle but also fetus health condition and his/her destiny in future. There are various factors influencing mother and fetus health among which good nutrition is a one of them. Pregnant women are so prove to malnutrition due to considerable metabolic, physical and hormone changes that increase their nutritional needs. In fact, efficient growth and development of fetus and fulfilling his needs depends closely on mother nutrition. It's also up to receive enough nutritious materials (1). If mother doesn't have good nutrition during pregnancy, irreversible changes happens in fetus (2). Studies show that mother good nutrition, before and during this time causes to lessen babies death more than the influence of nutrition in newborn period (3).

Mother weight gain in pregnancy is one of reliable criteria for assessing nutrition (4). Recommended weight gain has developed considerably in recent decades (5, 6). But different researchers prove that this weight gain can't be the same for all women groups. So, American Institute of Medicine suggested determining pregnancy weight gain increase on the basis of BMI. 12.5 – 18, 11.5-16, 7 – 11.5 and less than 7 kilograms of weight gain are recommended for, in turn, thin, normal, overweight and obese women in accordance with this institute suggestion (7).

Weight gain less than recommended rates may lead to preterm pregnancy, natural deficits in fetus and low birth weight (LBW) in babies. Weight gain more than recommended figures can also result in bearing babies with high weight, C/S risk, hypertension during this period, preeclampsia, and diabetes in pregnancy and bleeding during delivery (8-10). Researchers believe that there are challenging obstacles against gaining recommended weight these

days (11). Therefore, pregnant women in any body weight conditions should have enough weight gain in accordance weigh their BMI.

As proved in many projects, weight at the birth time is one of the main factors for determining survival possibility, physical and cerebral growth. It is also the indication of intrauterine growth (12). As a matter of fact, this is an important index which shows community health situation (13). The weight at birth time not only depends on nutrition, general health, pregnancy cares and mother's social context, but also natural fetus's development process is significant (14). Normal weight of a baby from 2500 to 4000 grams and any one was born out of this range must face with many problems.

The baby having weight less than 2500 grams at birth time is defined as LBW in accordance with International standards (15). LBW is one of the major reasons of mortality among babies and breast-fed ones (16). It can also lead to some serious problems such as decrease life expectancy increase infectious and respiratory diseases, hypothermia, anemia, retinopathy, blindness, auditory sense defect, mental retardation, cerebral paralysis, chronic lung failure, chromosome disturbances, body extremities malformation, nutrition and care problems (17). LBW is a hot issue in material and childhood health among developed and developing states. 16% of the whole births are LBW babies annually which results in death of 70% of children in some countries. Mortality rate of babies whose weight is less than 2500 and 1500 grams are, in turn, 40 and 200 times more than those ones being heavier than 2.5 kilograms (18).

LBW has been the first reason of death among babies being born in 2002 as WHO's report showed (19). This is not the same round the world so that its range is between 4 to 5 percent in developed and so percent in developing countries (15). As shown in WHO's statistical figures published in 2003, 16 millions (13%) out of 117 millions of babies born in this year, had less weight than 2.5 kilograms. 80% of them lived in developing states (15). This is organization reported that 8 and 10 percent of LBW in Iran, in turn, in 1994 and 1999 (20).

If a baby is born with the weight more than 4 kilograms, it is important as well. Subsequent result of this phenomenon can be discomfort during delivery, genital tract laceration, cesarean possible increase and even hysterectomy (21). The babies having weight more than standard levels may, two times more, die during the first 28 days of their birth. They are also probable to hurt severely at birth time of get obesity in childhood (11).

There are various reasons to conduct this study; Since weight gain is a significant part of pregnant women's mentality and also babies' weight at the birth time is a critical health indicator and assessment of pregnancy cares and few researchers have been done about the relation between weight gain in pregnancy and babies' weight at birth time, present study has been conducted.

2. Materials and Methods

This was an analytical-descriptive and cross-sectional project in which mothers referring to Isfahan health centers participated. Having a baby being born in the year of 2011 and file in file in Isfahan health centers were including criteria in this project. The excluding criteria were also being less than 18 and more than 35 years old, gestational age less than 36 weeks, having abortion, Multiple Pregnancy history, alcohol, cigarette use and any chronic diseases such as diabetes mellitus and hypertension.

The cases were 225 ones being selected through multi-step clustering method. All health centers in Isfahan city were divided into nine clusters and there centers were chosen randomly. The data were collected by information forms. These forms were completed in according to mothers' files in health centers.

Weight gain during pregnancy was measured on the basis of IOM in present study. The recommended weight gain was also accounted in according to BMI before pregnancy period. This suggested amount for thin, normal, overweight and fat mothers with BMI levels, in turn, less than 19.8, 26, between these ranges and more than 29 should be 12.6 – 18, 11.5 – 16, 7 – 11.5 and less than 7 kilograms. The babies with the weight less than 2500, between 2500 to 4000 and more than 4000 grams and generally considered, in turn, as LBW, normal and macrosomia on the basis of IOM.

The legal certificates were given by research department of medical university to conduct this project and cases' data were kept confidential. They analyzed and published totally. The information was interpreted by use central index tests, frequency distribution and Pearson Coefficient in significant level less than 0.05 through SPSS version 17.

3. Findings

The average of cases' age was 26.31± 6.17. 1.33, 11.2, 21.33, 40.89 and 25.33 percent, in turn, illiterate, primary, guidance, high school and academic education level. 31.56 percent were employed and 68.44 percent were also homemakers. 8, 52, 25.78 and 14.22 percent of studied cases were, in turn, thin, normal, overweight and fat women on the basis of BMI. The average of weight gain and other related variables are given in table one.

Table 1: The average of BMI and weight before pregnancy, BMI and the weight of last pregnancy, pregnancy weight gain in studied group

Studied variables	Average	Standard Deviation	Minimum	Maximum
BMI before pregnancy	25.3	4.11	17.14	42.48
Last monitoring of BMI	29.87	4.18	19.1	48.12
Weight before pregnancy	62.18	1.11	43	1.6
Weight of the last care	73.91	11.27	41	11.9

The average of weight gain during pregnancy was 11.73 ± 5.71 kilograms which is given in detail in table 2 in accordance with BMI.

Table 2: Average and Frequency distribution of weight gain in pregnancy on the basis of BMI

BMI	Frequency	Recommended weight gain (Kg)	Average S.D of weight gain (Kg)	Weight gain less than recommended rate (%)	Recommended weight gain rate (%)	Weight gain more than recommended rate (%)
Thin	18	12.5-18	11.12±4.41	11(61.11)	5(27.78)	2(11.11)
Normal	117	11.5-16	13.24±4.34	41(35.04)	64(54.7)	12(10.26)
Overweight	58	7-11.5	12.76±5.13	5(8.62)	16(27.59)	37(63.79)
Fat	32	Less than 7	10.22±7.51	0(0)	7(21.87)	25(78.13)

40.89 percent of cases, in present study, achieved suggested weight gain during pregnancy on the basis of expected amount of BMI before this period. 25.33 and 33.78 percent of women received also, in turn, less than, more than recommended weight gain based on BMI before pregnancy during this period.

The average of babies' weight at birth time was 3195 ± 451 grams in this study. 7.11 percent of the cases had 2500 grams or less. But 86.67 and 6.22 percent of them had also, in turn, normal (2500 – 4000) and higher than normal weight more than 4000 grams.

Pearson Correlation Coefficient showed direct between weight at birth time weigh BMI before pregnancy and weight gain during pregnancy period. The results are shown in table 3.

Table 3: The correlation between weight at birth time and BMI before pregnancy and weight gain pregnancy

	BMI before pregnancy	Weight gain in pregnancy
Baby weight (r)	0.41	0.35
Birth time (p)	0.011	0.014

4. Discussion

8, 52, 25.78 and 14.22 percent of studied cases in this project were, in turn, thin, normal, over weight and fat women, in accordance with BMI before pregnancy. The prevalence of thin women in research is the same as Panahande's study (7) in which 7.9, 45.4, 46.7 of studied cases were, in turn, thin, normal and overweight and fat. Thin women in his study were less than Nemmati's research (22). Nematolahzadeh and his colleagues showed that 60.3 percent of pregnant women had normal BMI before pregnancy (23).

Present study proved that the average of BMI before pregnancy is studied women was 25.3 kilograms per m^2. This figure is the same as Garshasebi's (24), Panahandeh and his colleagues found 26.2 kilograms per m^2 (7).

The average of weight before pregnancy in this project was the same as Ganderson's (25), shapiros' (26) and Roodsavi's studies (27). The average weight before pregnancy in studied cases was 61.84 kilograms in Roodsavi's project. The averages of weights before this period were, in turn, 69.66 and 54.6 kilograms in Delvarianzadeh's and Zohur's studies (28, 29).

The average of weight gain, in this project, was 11.73 kilograms which is similar to Delaram's (30), Banayan's (31) results. The averages of weight gain in these studies were, in turn, 11.5 and 11.4 kilograms. This was less than Garshasebi's study (24) and more than Parahandeh's (7). Soleymanizadeh's (32), Sam's (33) researches. The average of weight gain was 15.5 kilograms in the study was done in Zurich which is more than present study. The reason may be due to nutrition and health differences in these two regions (34). This result is the same as a project conducted in China (35).

The average of weight gain in thin women was less than recommended rate; 61.11 percent of women in this group achieved weight less than recommended

amount and only 27.78 percent of them gained favorite weight gain. The average rates of this variable were 8.6 and 10.86 kilograms in the studied done in Rasht (7) and Birjand cities (4). 66.2 percent of thin women got weight gain less than recommended rate in Sharifzadeh's study (4). One hundred percent of the same group got weight gain less than recommended amount in Khosravi's project (36). However, weight gain was higher than other studies among thin women.

Weight gain in the women with normal BMI was 13.24 kilograms which are more than Sharifzadeh's study in which this rate was 10.59 kilograms (4). Never the less, 35.04 percent of women got weight gain less than recommended amount. This shows that even women's with normal BMI could not achieved the least recommended weight gain. But this was better in this study in comparison with Khosravi's project (36). 60.7% of women with normal weight could gain weight less than recommended rate, in Khosravani's study. In Jozef's study weight increase in pregnancy among 36.5 percent of women with normal BMI was less than IOM standard level (37).

The average of weight gain among overweight women was 12.76 kilograms which is more than expected amount. This rate was 10.82 in Birjand (4). This increase over than recommended figure is naturally harmful for mother and her fetus but it is popular in society and against this scientific rule. 63.79 percent of women in this group had more than 7-11.5 kilograms weight gain which is beyond recommended rate and only one third of them attained standard weight. This showed worse result when compared with Sharifzadeh's study result (4). 36.3 percent of overweight cases gained weight more than expected amount.

Weight gain among fat women was 10.22 kilograms which is 3 kilograms over than recommended rate. 78.13 percent of cases, in this category, achieved weight more than expected amount. This was in the study conducted in Tabriz city (36) in which 75 percent of fat women gained weight more than expected rate. It seems that weight increase, in this group, is harder than other categories on the basis of BMI. The results of this study showed that the average of babies' weight at birth time was normal and about 3193 grams. This is so close to Delaram's study (30). He found the average weight of babies 3179 grams at birth time in Shahrekord city. This range was achieved 3008, 3270, 3280 and 3152 grams, in turn, by Zohur In Kerman city (29), Norsalehi (38), Sam in Ramsar city (33) and Khademian in Fasa city (39).

7.11 percent of mothers had babies less than 2500 grams and 86.67 percent of them owned babies with the weight between 2500 to 4000 grams. 6.22 percent of women had kids more than 4000 grams as well. Vaghari's study which is so similar to present study proved that 11.1, 84.1 and 4.8 percent of mothers had, in turn, low birth weight, normal and high birth weight babies (40). In Karimian's study also showed that 11.8 percent of babies had the weight less than 2500 gams (41). Delaram reported 7.3 percent of LBW among studies babies in that project (30). Their findings are the same as present studies. This figure was 19.1 percent in Eghbalian's research (42). But this rate was reported only 6 percent by Shadzi in Isfahan city (43). Garmarudi (15) and Mosayebi (44) showed 4.4 and 7.15 percent of LBW among their studied cases. LBW prevalence in Spain, Syria (46), Thailand (47), and England (48) was, in turn, 5.7, 6.6, 6.2 and 2.8 percent. High birth weight was 3.8 and 3.4 percent, in turn, in Ghanbarie's (21) and the study conducted in Finland (49). These rates were less than present study's results.

The findings in this study proved that there was a significant relation between BMI before pregnancy and weight at birth time (P=0.011, r=0.41). The same relation was seen in Sharifzadeh's (4), Tabandeh's (5) and Zohur's (29) studies. Soleimanzadeh's project's results (3) showed the same conclusions so that babies' weight in fat women was higher than normal and thin ones. Mohanty and, Miletic achieved similar results as well (50, 51). Murakami showed that LBW risk is more possible to happen among women with low BMI (52).

Our research proved the significant relation between weight gain in pregnancy and at birth time (P=0.014, r=0.35). This is the same as Sharifzadeh's study results (4). Delaram proved this relation (30). Tabandeh's (5) and Soleimanzadeh's (32) projects proved the relation as well. The contrast finding was achieved in others studies (29). It might be due to influence important factors over this relation such as maternal age, delivery frequency, and internals between pregnancies, diseases during this period, maternal nutrition and her psychological condition. The same result was attained in Gunderson's research (25). Pregnant and had babies for the first time, whereas in present study, all kinds of pregnant women were monitored. However, existing incomplete charts in health centers was one of the limitations of this project which led to omit those ones and replace other files being completed. At the same time, the data of this research were completed on the basis of information registered in family chart. So, possible faults may be happened.

5. Conclusion

The average of weight gain in pregnancy was 11.73 kilograms in this study which was rather suitable. But details among subgroups about BMI showed that most of thin and normal women could not gain recommended weight as expected. In contrast, overweight and fat mothers gained weight over expected amount. In all, only 40.89 percent of women gained weight before pregnancy on the basis of BMI and the rest of them achieved less or more than IOM's standard. Nevertheless, the results of this project proved the significant and direct relation between BMI before pregnancy and weight gain during this period with babies' weight at birth time. Since being important of these two factors and educating mother about weight gain during pregnancy in accordance with BMI before this time, it's possible to lessen the number of LBW, HBW and their subsequent results in pregnancy.

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