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Gestational weight gain by pre-pregnancy BMI

Przyrost masy ciała kobiet ciężarnych w zależności od wartości BMI w okresie przedkoncepcyjnym

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Summary

Introduction. Appropriate gestational weight gain is necessary for good pregnancy outcomes. Apart from the increasing problem of overweight and obesity among women of reproductive age, excessive maternal weight gain during pregnancy is an additional alarming problem.

Aim. The aim of the study was to assess gestational weight gain depending on pre-pregnancy BMI (Body Mass Index).

Material and methods. This study was covered among 471 women giving birth at the Department and Clinic of Obstetrics, Gynaecology and Oncology, 2nd Faculty of Medicine, Medical University of Warsaw. The gestational weight gain criteria were adopted according to recommendations of the Institute of Medicine of the National Academy of Sciences (USA). The data for this study was collected using a survey questionnaire, supplemented with data from patients' records.

Results. The study showed that most women (48%) achieved gestational weight gain above the recommended values; 37.8% of them reached the recommended weight gain during pregnancy, and gestational weight gain below recommendations occurred among 14.2% women. A statistically significant correlation ($p < 0.01$) between the BMI of women before pregnancy and the weight gain during pregnancy was observed. Excessive weight gain during pregnancy to a large extent concerned women with overweight and obesity before pregnancy (60.5%).

Conclusions. Together with increasing pre-pregnancy BMI, the percentage of women with gestational weight gain above the recommended values rises, and the percentage of women with gestational weight gain below the recommended values diminishes.

Key words: pregnant women, body weight, pregnancy complications

Streszczenie

Wstęp. Odpowiedni przyrost masy ciała kobiet ciężarnych jest czynnikiem wpływającym na prawidłowy przebieg ciąży i stan zdrowia noworodka. Oprócz narastającego problemu nadwagi i otyłości wśród kobiet w wieku rozrodczym dodatkowo niepokoi fakt nadmiernego przyrostu masy ciała w okresie ciąży.

Cel pracy. Celem badania była ocena przyrostu masy ciała kobiet ciężarnych w zależności od wartości BMI (Body Mass Index) w okresie przed zajściem w ciążę.

Materiał i metody. Badanie przeprowadzono wśród 471 kobiet rodzących w Katedrze i Klinice Położnictwa Chorób Kobiecych i Ginekologii Onkologicznej II Wydziału Lekarskiego Warszawskiego Uniwersytetu Medycznego. Kryteria przyrostu masy ciała ciężarnych przyjęto według zaleceń Institute of Medicine of the National Academy of Sciences. Dane do badań zostały zebrane metodą ankiety bezpośredniej, uzupełnione o dane z dokumentacji szpitalnej.

Wyniki. Wykazano, iż najwięcej pacjentek (48%) osiągnęło w okresie ciąży przyrost masy ciała powyżej rekomendowanych wartości, 37,8% przyrost prawidłowy, a 14,2% pacjentek uzyskało przyrost masy ciała niższy od zaleceń. Stwierdzono istotną statystycznie zależność ($p < 0,01$) między BMI kobiet przed zajściem w ciążę a przyrostem masy ciała podczas ciąży. Nadmierny przyrost masy ciała w okresie ciąży w największym stopniu dotyczył kobiet z nadwagą i otyłością przed zajściem w ciążę (60,5%).

Wnioski. Wraz ze wzrostem BMI w okresie przedkoncepcyjnym rośnie odsetek kobiet o nadmiernym przyroście masy ciała podczas ciąży, a maleje odsetek kobiet o przyroście niespełniającym zaleceń.

Słowa kluczowe: kobiety ciężarne, masa ciała, powikłania ciąży

INTRODUCTION

The body weight of women before pregnancy and its correct increase during the pregnancy are important factors for an optimum development of the fetus and successful outcome of the pregnancy. Both the women who were too thin before becoming pregnant and those with excessive body weight are classified as pregnant women with an increased pregnancy risk (1-4). Low body weight is connected with increased risk of low birth weight and premature birth (5-7). Overweight and obesity before the pregnancy increase the probability of pregnancy-induced hypertension, pre-eclampsia condition, gestational diabetes, cesarean delivery, as well as macrosomy and lower Apgar scores of the newborns (3, 8-14). Children of mothers with excessive body weights are burdened with the risk of becoming overweight already in the first year of their lives (8, 15, 16).

Apart from pre-pregnancy body weight, an equally important factor is the appropriate weight gain during pregnancy. This gain is considered as the best measure of the correct nutrition of a pregnant woman (15, 17). In the US, where the number of pregnant women with obesity established during the first obstetrical consultation is dramatically increasing, the experts stress that the body weight gain during pregnancy should be dependent on the body weight in the period before the pregnancy (8, 11, 18-22). The recommendations regarding gestational weight gain elaborated by the Institute of Medicine in the US are closely related to the women's BMI before the pregnancy. The above recommendations were updated in 2009 by introducing, among others, an upper limit on the body weight gain for women who were obese before the pregnancy. However, as emphasized by experts, due to the lack of sufficient scientific data, the recommendations do not include yet the body weight gain in the various degrees of obesity (tab. 1) (23, 24). The recommended body weight gain decreases with increasing pre-pregnancy BMI of the women. The strictest values apply to women with obesity. The experts are of the opinion that energetic stocks of obese women ensure correct development of the fetus, and there is no need to increase them during the pregnancy (4). Hence the gestational weight gain among this group of women should cover mainly the mass of the fetus body, the placenta and the amniotic liquid (16, 20-21).

A separate problem connected with excessive weight gain during pregnancy are difficulties in returning to the original body weight after birth, and development of future obesity (8, 14, 18, 21, 22, 25).

Table 1. Recommendations of the Institute of Medicine of the National Academy of Sciences (USA) concerning gestational weight gain.

Pre-pregnancy BMI [kg/m^2]	Nutrition status	Recommended gestational weight gain [kg]
< 18.5	Underweight	12.5-18.0
18.5-24.9	Correct body weight	11.5-16.0
25.0-29.9	Overweight	7.0-11.5
≥ 30.0	Obesity	5.0-9.0

AIM OF THE STUDY

The aim of the study was to assess the gestational weight gain compared to the body weight of the women before pregnancy, and its impact on the course of pregnancy.

MATERIAL AND METHODS

The study was carried out among 511 pregnant women who had reported for birth at the Department Clinic of Obstetrics, Gynaecology and Oncology, 2nd Faculty of Medicine, Medical University of Warsaw, in the period from April 2005 until March 2007. The data on the patients' characteristics, their health status before pregnancy, body weight gain during pregnancy and pregnancy course were collected using a survey questionnaire. The data on pregnancy duration and type of birth, as well as newborns' data, was collected from the hospital documentation. The analysis of results excluded women in multiple pregnancies, women with premature births, women who had suffered from diabetes before pregnancy, women with hypertension diagnosed before pregnancy, and women with anemia before pregnancy. Eventually, the study covered 471 patients aged 16-48. Pre-pregnancy body weights of women and gestational weight gains were determined according to American criteria, elaborated by the Institute of Medicine of the National Academy of Sciences (tab. 1) (23). The body weight gain during pregnancy represented the difference between the body weight of a woman before the pregnancy (body weight declared by the women) and the body weight measured during the last medical consultation, which was adopted as the body weight around birth. Due to the survey-based character of the study, the pre-pregnancy body weights of the patients and the body weight gains during pregnancy were determined with the accuracy up to full kilograms. Because of the small number of obese women, for the purpose of analyzing the results, they were joined together in one group, including women with excessive body weight (BMI ≥ 25). The recommendations concerning body weight gain adopted for the women in this group were the same as for overweight women. The statistical analysis of the results was carried out using the χ^2 test. The results recognized as statistically significant were those with $p < 0.05$.

RESULTS

The study covered 47 (10%) women with underweight before pregnancy (BMI < 18.5), 343 (72.8%) women with correct body weight (BMI 18.5-24.9), and 81 (17.2%) women with excessive body weight (BMI ≥ 25). A statistically significant correlation ($p < 0.01$) between the BMI of women before pregnancy and gestational weight gains was observed. The study

showed that the percentage of women with excessive gestational body weight gain increases together with increasing pre-pregnancy BMI, while the percentage of women not meeting the recommendations increases (tab. 2).

The women with the lowest BMI exceeded the recommended body weight gain on average by 26%, the women with correct body weight – by 29%, while the women with excessive pre-pregnancy body weight – by as much as 57%.

All in all, among the women covered by the study, the greatest number of patients (48%) reached body weight gain during pregnancy above the recommended values, 37.8% – gain within the recommended range, and 14.2% patients reached body weight gain below the recommended values (tab. 3).

Table 2. Characteristics of women depending on pre-pregnancy BMI and depending on gestational weight gain.

Pre-pregnancy BMI [kg/m^2]	Gestational weight gain						
	below recommended values		compliant with recommendations		above recommended values		average [kg]
	number of patients	percentage of women [%]	number of patients	percentage of women [%]	number of patients	percentage of women [%]	
< 18.5	12	25.5	18	38.3	17	36.2	16.6
18.5-24.9	52	15.2	131	38.2	160	46.6	16.4
≥ 25	3	3.7	29	35.8	49	60.5	15.0

Table 3. Selected factors with potential influence on gestational body weight gain.

	Patients with weight gain below the recommendation		Patients with weight gain within the recommendation		Patients with weight gain above the recommendation	
	number of patients	percentage of women [%]	number of patients	percentage of women [%]	number of patients	percentage of women [%]
Total number of patients	67	14.2	178	37.8	226	48.0
Age [years]: – 16-35 – 36-44	 61 6	 91.0 9.0	 170 8	 95.5 4.5	 212 14	 93.9 6.2
Education: – university – high school – elementary/vocational school	 29 30 8	 43.3 44.8 11.9	 83 64 31	 46.6 36.0 17.4	 79 108 39	 35.0 47.8 17.2
Pregnancies: – first birth – multiple births	 34 33	 50.8 49.2	 81 97	 45.5 54.5	 125 101	 55.3 44.7
Type of birth: – natural – Cesarean section	 59 8	 88.1 11.9	 140 38	 78.7 21.3	 188 38	 83.2 16.8
Persistent vomiting during pregnancy	2	3.0	6	3.4	5	2.2
Smoking during pregnancy	12	17.9	23	12.9	55	24.3
Alcohol intake during pregnancy: – once a week – sporadically – none	 1 24 42	 1.5 35.8 62.7	 1 74 103	 0.5 41.6 57.9	 6 74 146	 2.7 32.7 64.6
Gestational diabetes	2	3.0	4	2.3	9	4.0
Gestational anemia	15	22.4	39	21.9	29	12.8
Intake of vitamin and mineral preparations by pregnant women	47	70.1	131	73.6	168	74.3
Number of newborns with low body weight at birth (< 2500 g)	3	4.5	1	0.5	1	0.4
Number of newborns with macrosomy (> 4000 g)	2	3	11	6.2	44	19.5

The study analyzed selected factors that could have influenced the women's body weight gain during pregnancy. The above factors included: age, education, number of pregnancies, drinking, smoking, persistent vomiting during the whole pregnancy, and intake of complex vitamin and mineral preparations. As only isolated cases of drinking alcohol in quantities exceeding one portion of alcoholic beverage consumed sporadically were revealed, this factor was excluded from further analysis of the results. 19.1% women admitted smoking in various periods of the pregnancy. No statistically significant correlation between smoking and gestational body weight gain was shown. Persistent vomiting during the whole pregnancy occurred in 2.8% patients. As vomiting was found most often in patients with correct body weight gain (3.4%), it seems they did not have a decisive influence on gestational body weight gain. However, due to the small number of women affected by this factor, the statistical analysis was not carried out. No statistically significant correlations were noted between body weight gain during pregnancy and age, education, number of pregnancies, or intake of complex vitamin and mineral preparations.

The study analyzed also the frequency of gestational diabetes, gestational anemia, cesarean delivery, low and high birth weight, and the general health status of newborns depending on gestational weight gain. Gestational diabetes occurred in 3.2% patients. The greatest percentage of women with diabetes (4%) was observed among patients with body weight gain exceeding the recommended values, the least (2.3%) among patients with correct body weight gain. In view of the small number of women with diabetes, the statistical analysis was not carried out. Gestational anemia occurred in 17.6% patients. The study showed that anemia risk was the lowest among patients with body weight gain above the norm ($p < 0.05$). Births by cesarean section constituted 17.8% of all births. No statistical correlation was observed between body weight gain during pregnancy and the type of birth. Low birth weight at was found in 5 newborns. Among them, 3 newborns came from mothers with too low body weight gains. Macrosomy occurred in 12.1% newborns. The frequency of macrosomy increased together with increasing gestational body weight gains ($p < 0.0001$). The average body weight at birth and average Apgar score of the newborns are presented in figures 1 and 2, respectively.

DISCUSSION

The presented study, as well as studies by other authors, indicates that the body weight gain among more than half pregnant women is outside the limits given in the recommendations (6, 7, 18, 19, 20, 22, 26-28). At the same time, an increased number of pregnant women with body weight gain exceeding the recommended were observed, especially among women with excessive pre-pregnancy body weight. The study confirms that the average body weight gain among women with excessive pre-pregnancy body weight is smaller than among pregnant women with correct pre-pregnancy BMI (3, 6, 17, 27, 29). This phenomenon is positive, but we should keep in mind that the upper limit of the recommended gestational body weight gain is 5-7 kg lower for overweight and obese women than in case of women with correct BMI. Hence the percentage of women with weight gain exceeding the recommended values is greater among women with excessive body

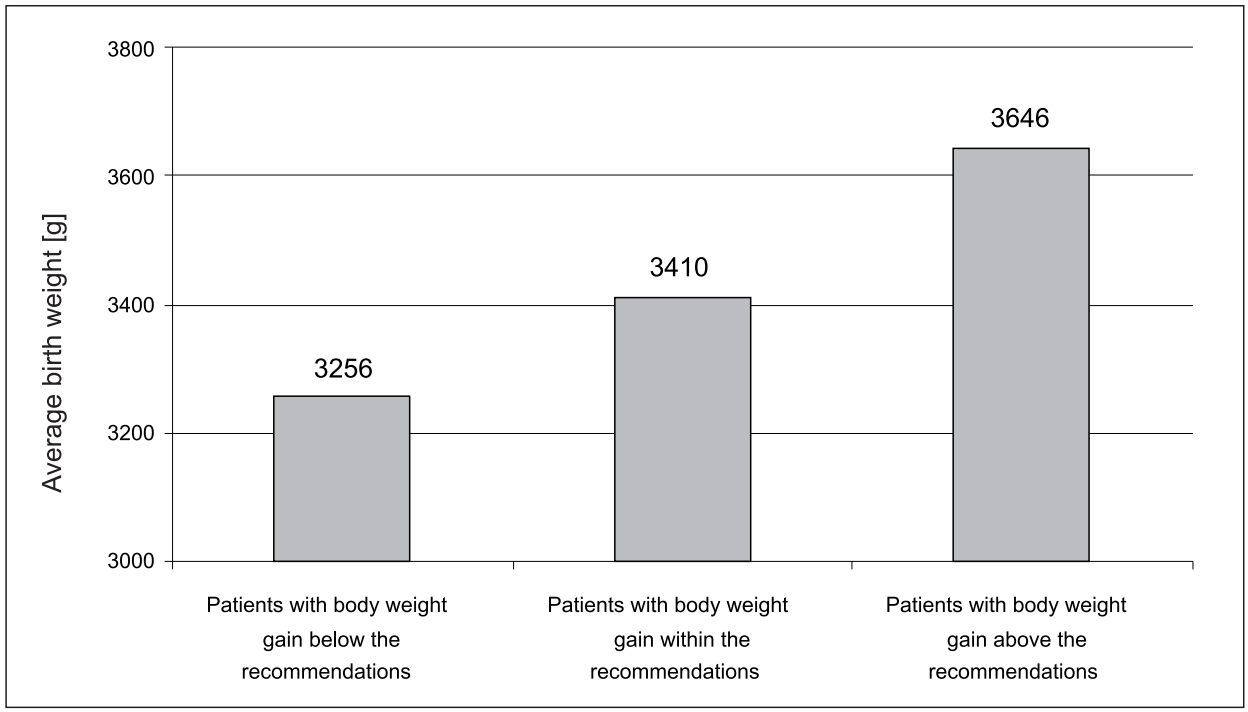

Fig. 1. Comparison of average body weight of newborns depending on gestational weight gain.

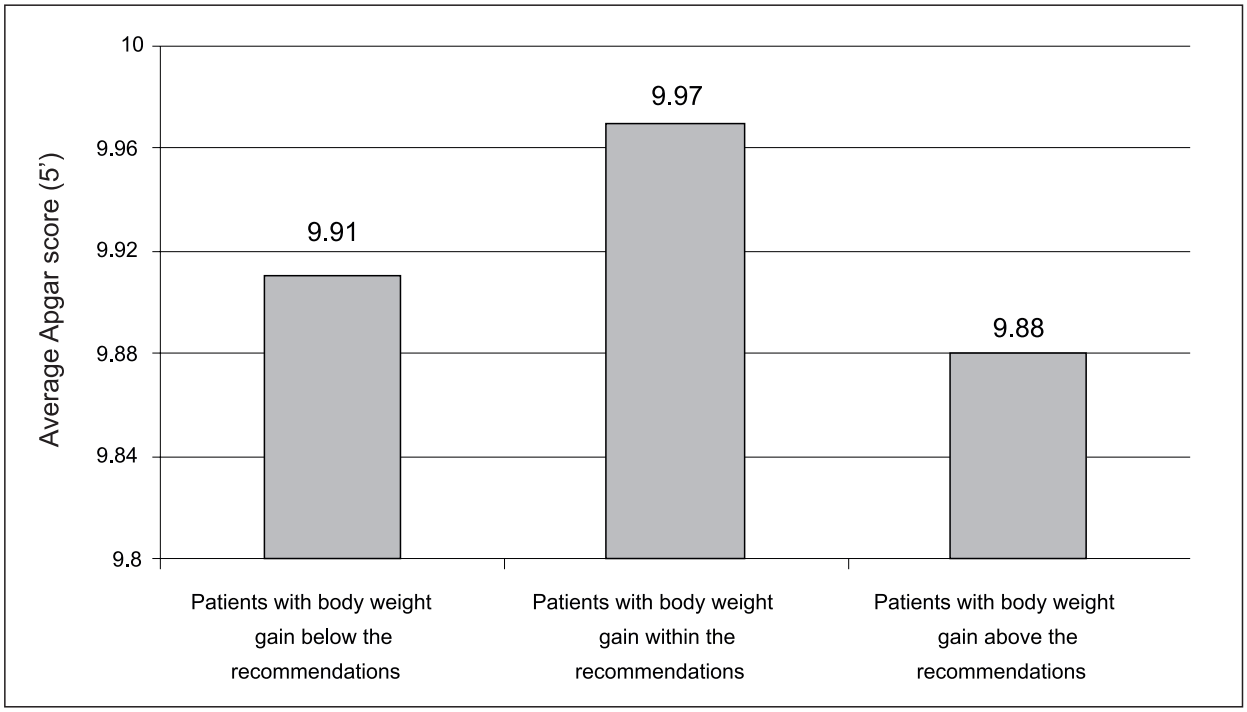

Fig. 2. Comparison of average Apgar score of newborns depending on gestational weight gain.

weight than among women with correct pre-pregnancy body weight. The frequency of gestational diabetes was comparable with the results obtained in other studies conducted among the Polish population (30, 31).

The presented study confirmed also the tendency for greater probability of newborn macrosomy in case of excessive gestational body weight gain (7, 16, 24, 27, 32, 33). The average body weight of the newborns was found to increase with the increasing gestational body weight gain, but the established differences were not statistically significant. The influence of the gestational body weight gain on the body weight of the newborn was shown in the research conducted by Szostak-Węgierek et al., Wiczyńska et al., and Kaim et al. (6, 28, 34). No differences in the general health status of the newborns, expressed by the Apgar score, depending on the gestational body weight gain were found. The studies conducted up to now in Poland concerned in general comparing the newborns' condition at birth depending on the pre-pregnancy BMI of the women. Most of those studies confirmed lack of differences in Apgar scores of newborns from women with excessive and correct pre-pregnancy body weights (2, 3, 5).

CONCLUSIONS

1. A statistical dependency was found between the pre-pregnancy BMI of women and the gestational body weight gain. The study showed that, together with increasing pre-pregnancy BMI, the percentage of women with body weight gain during pregnancy above the recommended value rises, and the percentage of women with weight gain not meeting the recommendations diminishes.
2. Macrosomy of the newborns occurred more often among patients with excessive body weight gain during pregnancy.
3. No statistical dependency was shown between the body weight gain during pregnancy and type of birth, average birth weight and average Apgar score of the newborns.

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