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ORIGINAL ARTICLE

EVALUATION OF GESTATIONAL WEIGHT GAIN IN WOMEN WITH TWIN PREGNANCIES AND ITS RELATIONSHIP TO NEONATAL BIRTH WEIGHT. A PILOT STUDY

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ABSTRACT

Background. To date, there have been no studies in Poland on weight gain in women with twin pregnancies in relation to recommendations.

Objectives. The aim of this study was to analyze the gestational weight gain of women with twin pregnancies depending on their body weight before pregnancy, and to assess the relationship between the observed weight gain and the neonatal birth weight.

Material and Methods. The study was conducted among 50 women in twin pregnancies and their 100 newborns delivered after 36 weeks of gestation. Gestational weight gain was assessed based on the American Institute of Medicine guidelines for women in twin pregnancies. Data on the pre-pregnancy body weight and gestational weight gain were collected by interviewing the patients. Neonatal data were obtained from the hospital medical records.

Results. Normal gestational weight gain was observed only in 38% of the women. In women with monochorionic pregnancy, too low body weight gain occurred almost 3 times more often than in women with dichorionic pregnancy (74% vs. 26%), ($p<0.001$). Women with monochorionic pregnancies also gave birth to statistically significantly more newborns with low birth weight (<2500 g), compared to women with dichorionic pregnancies (62.5% vs. 37.5%) ($p=0.007$). The mean birth weight of newborns born to mothers with excessive weight gain was 151 g higher than children born to mothers with normal weight gain (2727 g vs. 2576 g) ($p=0.035$).

Conclusions. In the majority of studied women in twin pregnancies, gestational weight gain was not compliant with the current recommendations. The risk of insufficient weight gain is higher in women with monochorionic pregnancies compared to women with dichorionic pregnancies.

Key words: *twin pregnancy; gestational weight gain; neonatal birth weight*

INTRODUCTION

Over the past 30 years, there has been a considerable increase in the number of multiple pregnancies worldwide. In the US, France, and Australia twin births now account for 3.0–3.5% of all births (one birth in about 30 births) [1, 2], and in Poland in 2022 they accounted for 1.3%, giving a number of 3787 births [3]. The main factor contributing to multiple pregnancies is the use of assisted reproductive technology, followed by older age of women giving birth and possibly maternal obesity prior to pregnancy [2, 4].

In both singleton and twin pregnancies, the gestational weight gain (GWG) is an important factor affecting the course of pregnancy. Too low maternal weight gain increases, among others, the risk of preterm birth, while an excessive weight gain – the risk of gestational diabetes and hypertension [5, 6]. The weight gain of pregnant women also correlates with neonatal birth weight. Mothers with insufficient weight gain more frequently give birth to small-for-gestational-age children, while among the newborns of mothers who gained too much, macrosomia is more common [7, 8].

According to some data, the body weight gain of mothers with a twin pregnancy starts sooner than those with a singleton pregnancy [9], while according to others, weight gain is the same until the 18th week of pregnancy and only after that time does it increase significantly in the case of twin pregnancies [10]. The literature also suggests that in women with twin pregnancies, weight gain in individual trimesters of gestation is more important than the total gain. It is believed that adequate weight gain at the beginning

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of pregnancy has a significant impact on the development and functioning of the placenta, and in multiple pregnancies the placenta probably matures and ages more rapidly, which shortens the time of optimal nutrient supply to the fetus [9, 11, 12]. Some experts claim that, the weight gain of women in twin pregnancies in the first half of gestation also affects the weight of both newborns to the greatest extent [13]. The results of other studies indicate that only in the second trimester weight gain has a statistically significant relationship with neonatal birth weight [12].

When it comes to the total maternal body weight gain, many countries, including Poland, adopted the guidelines of the American Institute of Medicine of 2009 [14, 15]. As in the case of a singleton pregnancy, the weight gain of women in twin pregnancies depends on the Body Mass Index (BMI) before pregnancy. In contrast to the guidelines for women with singleton pregnancies, no weight gain values have yet been developed for obese women depending on the degree of obesity [14, 16]. It is worth noting that a body weight gain in women pregnant with twins who had a normal pre-pregnancy body weight is 47–56% higher compared to women expecting one child, while in obese women – even 111–120% higher.

To the best of authors' knowledge, there have been no studies in Poland on the weight gain of women with twin pregnancies and its relationship with the birth weight of newborns. Therefore, the aim of this study was to analyze the gestational weight gain of women with twin pregnancies in relation to BMI before pregnancy, and to assess the relationship between the observed weight gain and the neonatal birth weight.

MATERIAL AND METHODS

Study design

This retrospective study was conducted among 50 women with twin pregnancies and their 100 newborns delivered after 36 weeks of pregnancy at the 1st Department of Obstetrics and Gynecology, Medical University of Warsaw (years 2021–2022) or at the Department of Obstetrics, Perinatology and Neonatology, Centre of Postgraduate Medical Education in Warsaw (year 2023). Although delivery before 37 completed weeks of gestation is considered preterm birth, in case of uncomplicated monochorionic twin pregnancies it is recommended to terminate the pregnancy between 36 and 37 weeks due to the lowest rate of neonatal complications [17]. The exclusion criteria for patients were age below 18 years, non-Polish nationality, and pregnancies complicated by twin-to-twin transfusion syndrome or with congenital anomalies of either of the twins. The patients gave their written consent to participate in the study. The study was approved by the Bioethics Committee of the National Institute of Public Health NIH – National Research Institute in Warsaw under No. 6/2021.

Gestational weight gain was assessed based on the American Institute of Medicine guidelines for women in twin pregnancies [14] (Table 1).

As stated in the Table 1, the weight gain for women who were underweight before pregnancy is not established, therefore, as other authors [18], for such women (10% of the group) we assumed the gain as for women with normal body weight. Some studies also show that the weight gain in underweight women equal to that in women with normal body weight is optimal to reduce the risk of adverse perinatal outcomes [19, 20].

Given that our study included pregnant women whose gestation exceeded 36 weeks, it is worth emphasizing that the assessment of gestational weight gain is in line with the above-mentioned guidelines, which were developed on the basis of the weight gain of women who gave birth to twins weighing no less than 2500 g after the end of the 36th week of pregnancy. The minimum gestational length of 36 weeks for assessing the weight gain in women with twin pregnancies in the context of the guidelines is also used by other authors [5].

Data collection

Data on the body weight of women before pregnancy, their height, gestational weight gain, diet, taking vitamin and mineral preparations, course of pregnancy, lifestyle during pregnancy and sociodemographic data were collected by the method of an interview conducted by a dietician during the perinatal period. Maternal weight gain was calculated as the difference between mothers' self-reported prenatal weight or weight measured at the last obstetric visit and the pre-pregnancy weight. As this part of the study was based on a survey, pre-pregnancy weight

Table 1. Weight gain recommendations for women with twin pregnancies [14]

Pre-pregnancy BMI (kg/m^2)	Nutritional status	Recommended weight gain for women with twin pregnancies (kg)
<18.5	Underweight	Not established
18.5–24.9	Normal body weight	17–25
25.0–29.9	Overweight	14–23
≥30.0	Obesity	11–19

and gestational weight gain were expressed rounded to 1 kg. The latter was categorized into three groups: below, in line with or above the recommendations.

Neonatal data (sex and birth weight) were obtained from the hospital medical records. Birth weight of the newborns was measured using a physician beam scale. The characteristics of women and newborns are presented in Table 2.

Statistical analysis

The following descriptive statistics were determined for the analyzed variables: percentage

Table 2. Maternal and neonatal characteristics

Maternal characteristics	
Number of women, n	50
including:	
monochorionic pregnancies, n (%)	23 (46)
dichorionic pregnancies, n (%)	27 (54)
Age (in years), mean ± SD	31.7±4.6
Education, n (%)	
higher	36 (72)
other	14 (28)
Place of residence, n (%)	
city/town	46 (92)
rural/village	4 (8)
Number of pregnancies, n (%)	
first	26 (52)
subsequent	24 (48)
Gestational age (in weeks), median (min-max)	36 (36–38)
Gestational age of monochorionic pregnancy (in weeks), median (min-max)	36 (36–37)
Gestational age of dichorionic pregnancy (in weeks), median (min-max)	37 (36–38)
Maternal Body Mass Index (BMI) prior to conception, median (min-max)	22.5 (16.6–38.9)
Gestational diabetes, n (%)	10 (20)
Hypertension, n (%)	3 (6)
Anaemia, n (%)	17 (34)
Smoking during pregnancy, n (%)	0 (0)
Supplementation with vitamin-mineral preparations (multicomponent), n (%)	49 (98)
Calcium intake from milk and dairy products (mg), median (min-max)	641.1 (0.0–2900.4)
Daily vitamin D intake	
with food (µg), median (min-max)	2.4 (0.4–9.1)
with food and dietary supplements (µg), median (min-max)	52.1 (1.2–154.6)
Caffeine intake from coffee and tea (mg), mean ± SD (mg)	91.7±73.2
Fish consumption (at least once a week), n (%)	20 (40)
Food consumption during pregnancy compared to before pregnancy, n (%):	
no change (same amount of food consumed)	23 (46)
10–20% more food consumed	12 (24)
approximately 30% more food consumed	10 (20)
approximately 50% more food consumed	3 (6)
more than 50% more food consumed	1 (2)
less food consumed	1 (2)
Neonatal characteristics	
Number of newborns, n	100
Sex of the newborn, n (%)	
male	45 (45)
female	55 (55)
Neonatal weight (g), mean ± SD	2557.8±295.6
Number of newborns with low birth weight (<2500 g), n (%)	40 (40)
Number of twin pairs with low birth weight (<2500 g), n (%)	12 (24)
Birth weight discordance, n (%)	6 (12)
Neonatal length (cm), median (min-max)	51 (46–56)
Neonatal head circumference (cm), median (min-max)	33 (30–35)
Neonatal chest circumference (cm), median (min-max)	31 (27–35)
Apgar score at 5 minutes (points), median (min-max)	10 (8–10)

frequencies for qualitative variables, arithmetic mean with standard deviation for quantitative variables with a normal distribution and median and range of variability for other quantitative variables. The normality of distribution was tested using the Kolmogorov-Smirnov test.

Values of quantitative variables were compared between distinguished study subgroups using the Student's t-test or non-parametric Mann-Whitney test according to their distribution normality. The significance of differences in frequencies of qualitative characteristics were tested by the chi-square test or the exact Fisher's test depending on subgroup size. The comparison of statistical significance of differences in GWG expressed in kg, according to the nutritional status of women was performed using the Kruskal-Wallis test. To identify different pairs the Mann-Whitney test with Bonferroni correction for multiple comparisons was applied.

The significance level of 0.05 was adopted for all statistical analyses. They were carried out using SPSS software version 12.0 PL.

RESULTS

The gestational weight gain in 62% of women in twin pregnancies was not compliant with the current American Institute of Medicine recommendations, with most of them gaining too little weight (Figure 1).

The prevalence of too low and normal weight gain in women was not statistically significantly related to women's pre-pregnancy BMI. In contrast, excessive weight gain occurred almost exclusively in women with normal BMI before pregnancy (difference on the border of statistical significance; p=0.071 – exact Fisher's test) (Table 3). The median weight gain for all women was 16 kg (min 4 kg – max 41 kg). The difference in GWG expressed in kg between 3 groups of women is statistically significant (p=0.015) (Table 3). This effect results from the difference between the weight gain of women with normal body weight in comparison to women with excessive weight (p=0.004).

Of the factors analyzed in the study that could be related to the gestational weight gain (maternal age, education, place of residence, number of pregnancies, pre-pregnancy BMI, use of multivitamin preparations, type of pregnancy, gestational diabetes, anemia, hypertension during pregnancy), only the type of pregnancy proved statistically significant. Women with monochorionic pregnancy were more likely to have too low body weight gain, compared to women with dichorionic pregnancy (74% vs. 26%), (p<0.001).

Maternal weight gain was statistically significantly associated with neonatal weight (p=0.035) and risk of low birth weight (<2500 g) (p=0.014). The mean birth weight of children born to mothers with excessive weight gain was 151 g higher compared to children born to mothers with normal weight gain (2727 g vs. 2576 g) (Table 4).

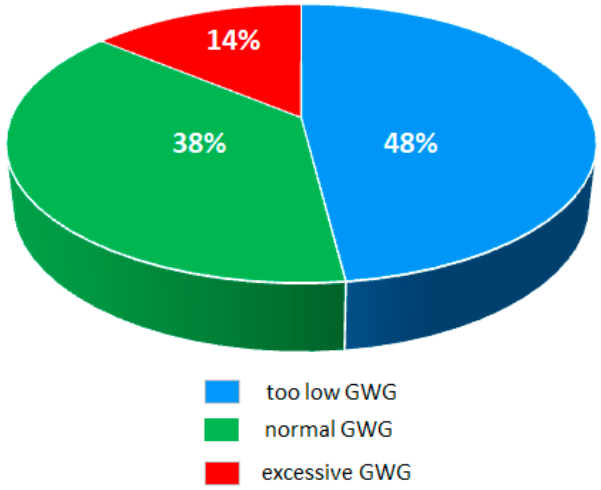

Figure 1. Gestational weight gain in women in relation to the recommendations

Table 3. Gestational weight gain in women depending on pre-pregnancy BMI

GWG ranges	Nutritional status			Significance (p-value)
	Underweight (BMI <18.5) Number of women, n=5 (100%)	Normal weight (BMI 18.5–24.9) Number of women, n=31 (100%)	Overweight/obesity (BMI ≥25.0) Number of women, n=14 (100%)	
GWG lower than recommended	3 (60%)	13 (42%)	8 (57%)	NS*
GWG within recommendations	2 (40%)	12 (39%)	5 (36%)	NS*
GWG higher than recommended	0 (0%)	6 (19%)	1 (7%)	p=0.071
GWG (kg) median (min-max)	14 (9–25)	20 (10–41)	12 (4–36)	p=0.015

* statistically insignificant

Table 4. Gestational weight gain vs. birth weight of neonates

Neonatal birth weight (g)	Gestational weight gain ranges		
	too low GWG	normal GWG	excessive GWG
mean ± SD	2500±328.9	2576±261.1	2727±159.3
min-max	1640–3445	1935–3270	2350–3030
Significance vs. normal GWG (p-value; Student's t-test)	NS*	–	p=0.035

* statistically insignificant

Regarding the risk of low birth weight, out of 40 such newborns (40% of the group), 25 of them (62.5%) were born to mothers with GWG below the recommendations, 14 (35.0%) were born to mothers with a normal GWG and only 1 newborn (2.5%) was born to mother with excessive GWG. Among the 60 children with normal birth weight, their distribution by maternal weight gain groups was as follows; 23 newborns (38.3%), 26 newborns (43.3%) and 11 newborns (18.3%), respectively. Statistically significant differences were also found in the total maternal weight gain of women giving birth to one or two babies weighing <2500 g vs. ≥2500 g (p=0.026). Newborns weighing less than 2500 g were born to mothers with lower weight gain (median 14 kg; min 4 kg – max 26 kg), whereas children weighing ≥2500 g were born to mothers with higher weight gain (median 18 kg; min 8 kg – max 41 kg).

As for the risk of having a low birth weight baby, the type of pregnancy and the woman's height were also statistically significant factors. Significantly more newborns with low birth weight were born to women with monochorionic pregnancies than to women with dichorionic pregnancies (62.5% vs. 37.5%) (p=0.007). In terms of women's height, all women <160 cm gave birth to both babies with low birth weight, while among taller mothers this was the case for only 19% (exact Fisher test =0.022).

DISCUSSION

Nearly half of the women in twin pregnancies in our study did not meet the minimum weight gain according to the US guidelines. This is highly consistent with the results obtained by Amyx et al. in their study conducted in France [7]. Forty seven percent of women with twin pregnancies studied there had insufficient GWG, and the proportion of women with excessive GWG was also very similar in both studies (14% vs. 10%). In a study in Australia, 29% of women had too little weight gain and 24% had too much weight gain [21]. Similar result was found in Canada, with 27% and 30%, respectively [22]. In light of the recent meta-analysis of studies (2022), more than 35% of women in twin pregnancies gained weight below US recommendations, more than 21% gained above, and less than 44% gained weight correctly [23].

In twin pregnancies, as in singleton pregnancies gestational weight gain is associated with birth weight of the newborns [5, 8, 24, 25], which was also proven in our study. Children born to mothers with excessive weight gain were heavier than infants born to mothers with normal weight gain. The study by Lal and Kominiarek [18] showed that women with underweight or normal body weight before pregnancy, who did not achieve the minimum weight gain, more often gave birth to children weighing less than 2500 g or even less than 1500 g (57.2% and 10.6% of newborns), compared to women whose weight gain was higher than the recommendations (36.2% and 4.3% of newborns). A significantly higher percentage of children with low birth weight, born to mothers with a weight gain lower than in the recommendations, compared to the percentage of such children born to other mothers, was also shown in our study.

In our study, the risk of low birth weight was associated with the type of pregnancy, which is not surprising, since previous studies indicates that women with monochorionic pregnancies give birth to smaller babies than women with dichorionic pregnancies [26–29]. Moreover, the risk of low birth weight was related to the height of women. It is quite well known that maternal and paternal height reflects the genetic growth potential of the fetus, with taller mothers generally giving birth to larger children [30–32]. In the light of a meta-analysis of studies conducted in singleton pregnancies, short-statured women have a greater risk of giving birth to newborns with low birth weight [33].

The median GWG of studied women was 16 kg (min 4 kg – max 41 kg) and was exactly the same as in another study in Poland conducted among women with twin pregnancies (median 16.0 kg) [34]. Moreover, the same result was also found in a French study, although in this case the authors report a mean value – 16.1 kg [7]. The weight gain of women with normal BMI before pregnancy is also very similar in the literature. In our study, the median was 20 kg, in the American study 20.4 kg [35], and in the Australian study 19 kg [21]. As for the GWG of overweight or obese women, it was 21.3 kg and 13.6 kg in the American study

[35] and 17.5 kg and 15 kg in the Australian study [21], respectively. The smallest weight gain in obese women is a positive result, regardless, it is important to bear in mind that the recommended weight gain decreases with increasing BMI of the mothers-to-be, which is due to accumulated energy stores in the form of adipose tissue [14].

However, in the scientific publications there is a debate as to whether the US weight gain guidelines for twin pregnancies are optimal. Some experts argue that these recommendations should be used in everyday obstetric practice, as weight gain in accordance with guidelines reduces the risk of low birth weight, pregnancy-induced hypertension, and preterm birth [6]. Others believe that it is currently impossible to determine whether the American recommendations are adequate [21]. In particular, the guidelines do not seem optimal for women from Asian countries, due to the lower height of women. Among Japanese women with twin pregnancies, normal birth weight for both babies was found in more than 70% of women, whose weight gain in all BMI categories was significantly lower than American guidelines (by 36%–80%). It was 11.5–16.5 kg in underweight women, 10.3–16.0 kg in normal-weight women, 6.9–14.7 kg in overweight women and 2.2–11.7 kg in obese women in the preconception period [5].

There are several limitations to this study that should be considered when interpreting the results. The most important is the relatively small sample size, mostly due to the small overall population of women pregnant with twins. Another limitation is retrospective nature of the study, including self-reported pre-pregnancy weight. This might have affected the credibility of the BMI calculations and the later interpretation. However, as the study shows utilization of self-reported or measured pre-pregnancy weight for pre-pregnancy BMI classification results in identical categorization for the majority of women [36]. Still another limitation is that the study did not analyze the energy value of the women's diet, the level of their physical activity and socioeconomic status. Therefore, it is not known to what extent these factors were related to gestational weight gain, but in the case of diet, as many as 46% of women reported that they ate the same amount of food as before pregnancy, which could have influenced the results obtained. It is also worth noting that the study was conducted at tertiary care centers in Warsaw, which also run separate outpatient clinics for multiple pregnancies. For this reason the study group may not reflect the situation in patients from smaller centers.

CONCLUSIONS

Almost half of the studied women with twin pregnancies had insufficient weight gain. This occurred significantly more often in women with monochorionic pregnancies than in women with dichorionic pregnancies. Women with monochorionic pregnancies also gave birth to statistically significantly more newborns with low birth weight.

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Conflicts of Interest

Author declares no conflict of interest.

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