

Research Article

Effect of Pathological Gestational Weight Gain on Subsequent Lactation

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Abstract

The onset, duration of lactation and exclusive breastfeeding (BF) depend on maternal factors. **Objective:** The aim of our study was to investigate the effect of pathological gestational weight gain (GWG) on subsequent lactation.

Design: This was a prospective cohort study of 219 women, aged 18 to 43 years, who were enrolled at 9-11 weeks and were followed-up at 22-24, 37-39 weeks of pregnancy, and 1 year postpartum. Anthropometry, body mass index, GWG were calculated. The percentage of body fat mass (% FM) was calculated on the basis of bioelectrical impedance analysis (BIA) using the "Diamant-aist" analyzer (St. Petersburg). The delayed onset of lactation (more than 72 hours), the duration of lactation, exclusive BF were interviewed. The results were statistically analyzed using statistical analysis package based on Microsoft Excel and Statistica 6.0 program pack (StatSoft Inc., USA).

Results: The total BF and exclusive BF median durations were 29.7 ± 10.1 (95% CI 25.7-33.7) weeks and 22.2 ± 6.2 (95% CI 18.2-26.2) weeks, respectively. A negative association between the elevation of the %FM during pregnancy and the duration of BF ($r = -0.21$, $p = 0.001$; $r = -0.32$, $p < 0.0001$; $r = -0.47$, $p < 0.0001$, respectively in the first, second and third trimesters) was diagnosed. It has been proved that excessive GWG was significantly associated with shorter duration of lactation ($p < 0.05$), with shorter duration of exclusive BF (OR 0.5; 95% CI 0.2-0.9, $p = 0.03$), with increased chances of discontinuing BF before 6 month postpartum (OR 2.2; 95% CI 1.0-4.5, $p = 0.04$), and delayed onset of lactation (OR 2.1; 95% CI 1.1-4.1, $p = 0.04$) compared with the recommended GWG women.

Conclusion: Informing the pregnant women about the negative effect of pathological GWG on subsequent lactation, regular assessing the dynamics of weight gain during pregnancy, and taking measures to prevent overweight and obesity in the postpartum period should be an important focus of antenatal care.

Keywords

pregnancy; gestational weight gain; lactation.

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Problem statement and analysis of the latest research

Pregnancy is a period of rapid weight gain and change in body composition during a short period of time. Gestational weight gain (GWG) occurs mainly due to the accumulation of fat depots necessary to support maternal metabolic adaptation, optimal fetal development and the energy cost of lac-

tation [11]. The ranges of GWG based on prepregnancy body mass index (BMI) are recommended by international and national guidelines [1, 2].

Excessive GWG is associated with a high risk of macrosomia, gestational hypertension, the frequency of operative delivery, weight retention and the development of obesity after childbirth [3]. Studies consider the excessive weight gain as a negative

factor influence the onset and duration of breastfeeding (BF) that cases a risk to the health and development of children [5]. The positive association between short-term lactation and postpartum reduced weight retention is proved [6, 10, 13].

According to the WHO recommendations (2011), BF is recommended for 12 months and exclusively for HS within 6 months after delivery [15]. Onset of lactation has been defined as the "initiation of copious milk production in the mammary gland" and measured as the time at which women report a perception that their breast milk has "come in," based on cues such as breast hardness, fullness/heaviness, or swelling and leakage of colostrums or breast milk [16]. Normally, during the first two days after delivery, a minimum amount of milk is produced, which increases significantly from the second to the third day due to the second stage of lactogenesis, which is dependent on the drop in progesterone level [12]. Several studies indicate that delayed onset of lactation (more than 72 hours) has a direct impact on the subsequent duration of BF [8, 9]. The timing of onset of lactation has been shown to be related to

BF outcomes, such as perceived insufficient milk, the preonset introduction of breast milk supplements, and the timing of supplementation several months after delivery [4]. Due to the result of meta-analysis (2016), obese women are at increased risk of delayed onset of lactation and of discontinuing BF earlier compared with normal-weight women [7].

Objective: The aim of our study was to investigate the effect of pathological GWG on subsequent lactation.

1. Materials and Methods

This was a prospective cohort study of 219 women, aged 18 to 43 years, who were observed in antenatal clinics and in the city maternal hospital in Ivano-Frankivsk, Ukraine. Patients under 18 years old, diagnosed with multiple pregnancy, preterm labor, severe chronic diseases were excluded from the study. All women have signed "Informed consent to participate in the study". The research design was

approved by the Ethics Committee of the Ivano-Frankivsk National Medical University (# 93/16 from 01.12.2016).

133 (60.7±3.3 %) of the examined patients were nulliparous and 86 (39.3±3.3 %) were multiparous women. The average age of patients on the onset of examination was 28.6±4.6 years (95%CI 28.0-29.2) and did not differ significantly in the groups of women with different prepregnancy BMI ($p>0.05$). The average height of the patients was 164.2±2.3 cm (95%CI 159.7-168.7), prepregnancy weight was 60.6±14.3 kg (95%CI 58.7-62.5) and also did not differ between women with different BMI ($p>0.05$).

Patients were enrolled at 9-11 weeks and were followed-up at 22-24, 37-39 weeks of pregnancy, and 1 year postpartum. Information on the body weight of women before pregnancy was obtained by interviewing patients and medical records. Patients were weighted on the electronic scale to the nearest 0.1 kg. Height was measured using a digital stadiometer with an accuracy of 1.0 cm. GWG was evaluated by the difference between the weight before delivery and prepregnancy. The results were compared with the recommendations of the Institute of medicine in the USA (2009) and the Order of the ministry of health of Ukraine # 417 (2011). The recommended GWG was diagnosed in 100 (45.7±3.4 %), inadequate in 45 (20.5±2.7 %), and excessive in 74 (33.8±3.2 %) patients. Antenatal care with nutrition and physical activity recommendations was carried out in accordance with existing Ukrainian guidelines (2011).

The percentage of body fat mass (% FM) was calculated on the basis of bioelectrical impedance analysis (BIA) using the "Diamant-aist" analyzer (St. Petersburg). The delayed onset of lactation (more than 72 hours), the duration of lactation, exclusive BF were interviewed.

The received results were statistically analyzed using statistical analysis package based on Microsoft Excel and Statistica 6.0 program pack (StatSoft Inc., USA). The mean ± m was obtained for each parameter. Odds ratio (OR), 95% confidence interval (CI), chi-square (χ^2) and P-value were obtained. The differences between the selections were considered

Table 1. The average breastfeeding duration, depending on maternal prepregnancy BMI and GWG, weeks, (n=219).

	M±m	95% CI
Prepregnancy BMI		
- normal weight	36.9±5.8	34.6-39.2
- insufficient weight	41.0±3.5	38.9-43.1
- excessive weight	23.9±3.0 *	21.9-25.9
- obesity	23.1±3.4 *	21.3-24.9
GWG		
- recommended	36.5±8.0	34.3-38.7
- inadequate	40.0±8.6	36.9-43.1
- excessive	14.3±7.3 #	12.2-16.4

Notes: * - compared with a group of women with normal weight ($p<0.05$), # - compared with a group of women with recommended GWG ($p<0.05$).

statistically reliable at $p<0.05$ (Tukey's test).

2. Results and Discussion

The total lactation median duration in our cohort of women was 29.7 ± 10.1 (95% CI 25.7-33.7) weeks, exclusive BF median duration 22.2 ± 6.2 (95% CI 18.2-26.2) weeks. 36 (16.4±2.5 %) women from 219 maintained lactation for up to 1 year or more, 145 (66.2±3.2 %) for up to 6 months, 34 (15.5±2.4 %) from 6 to 11 months, and 4 (1.8±0.9 %) patients were not fed.

We have studied the association of BF duration with prepregnancy weight (Table 2). No significant difference was found between lactation duration in women with normal and insufficient BMI ($p>0.05$). However, in overweight and obese patients, lactation was significantly shorter 1.5 and 1.6 times, respectively (in both cases, $p<0.05$) compared with normal weight subjects. But it has been proved that excessive GWG was significantly associated with 2.5-fold shorter duration of BF ($p<0.05$) compared with the recommended weight gain patients.

The fat component, as the most labile component of the body, plays a significant role in the dynamics of body weight during pregnancy. A negative association between the elevation of the % FM during pregnancy and the duration of BF

($r = -0.21$, $p=0.001$; $r = -0.32$, $p<0.0001$; $r = -0.47$, $p<0.0001$, respectively in the first, second and third trimesters) was diagnosed. As the more amount of fat accumulates during pregnancy, the shorter lactation period is expected.

In the group of patients with BF duration for up to 6 months, since the second trimester of pregnancy, the % FM was significantly higher 1.3 times, in the third trimester 1.4 times, and after birth 1.4 times (in all cases, $p<0.05$) compared with the group of women with 1 year or more lactation (Fig. 1). Therefore, the intensity of body fat accumulation during pregnancy may be a predictor of lactation.

Exclusive BF has a significant positive impact on the mother's body and the development of the baby [5, 8]. Our results have shown that the chances of exclusive BF during 3 months are 2 times (OR 1.8; 95% CI 1.1-2.8, $p=0.01$) significantly higher in women with normal prepregnancy weight (Table ??). In this group of patients there was a significantly lower incidence of partial BF ($p<0.05$) and, very importantly, discontinuation of lactation for up to 3 months ($p<0.05$). No significant differences were found between BF duration in women of other BMI groups ($p>0.05$). However, it was noted that in insufficient prepregnancy body weight patients had 3.3 times less probability of wean before completing 3 months ($p<0.05$).

It has been studied that the recommended GWG significantly increases the chances of exclusive BF in 2.0 times (OR 2.0; 95% CI 1.1-3.6, $p=0.01$) and significantly reduced the introduction of breast milk supplements ($\chi^2=23.8$, $p<0.0001$) and wean of lactation ($\chi^2=35.6$, $p<0.0001$) (Table 2). Insufficient GWG similarly increases the chances of exclusive BF at the age of 3 months in 4.0 times (OR 4.0; 95% CI 1.6-9.6, $p=0.003$) and significantly reduces partial BF ($\chi^2=22.2$, $p=0.02$) and discontinuation BF earlier ($\chi^2=20.1$, $p=0.02$). Excessive weight gain was significantly associated with shorter duration of exclusive BF (OR 0.5; 95% CI 0.2-0.9, $p=0.03$), with increased probability of being weaned before 6 months postpartum (OR 2.2; 95% CI 1.0-4.5, $p=0.04$) compared with the recommended GWG women.

According to the fact that delayed onset of lac-

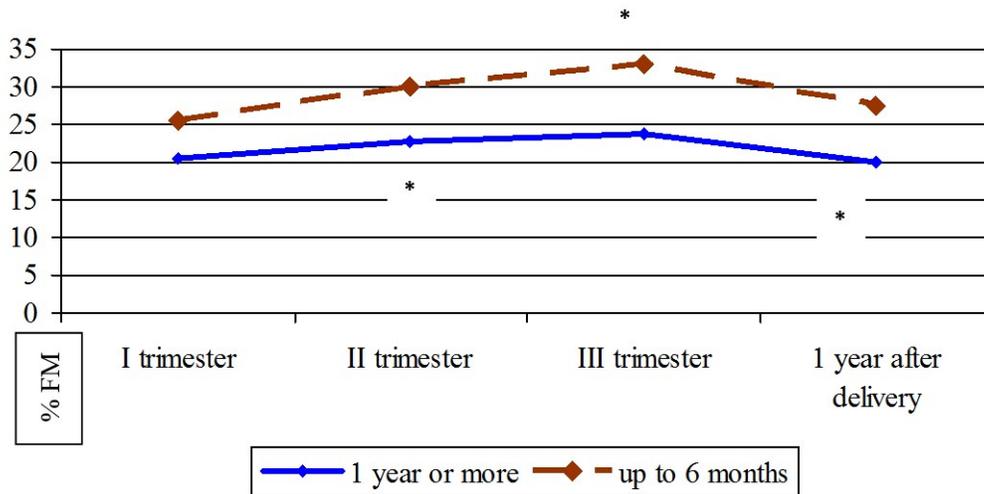


Figure 1. Dynamics of the percentage of FM in women with BF duration of up to 6 months and 1 year or more; * - $p < 0.05$.

Table 2. Frequency of breastfeeding pattern at 3 months, depending on maternal prepregnancy BMI and GWG, $M \pm m$, ($n=219$).

Indications	n	Breastfeeding up to 3 months		
		Exclusive, n (%)	Partial, n (%)	Weaned, n (%)
Total	219	120 (54.8 \pm 3.4)	51 (23.3 \pm 2.9)	48 (21.9 \pm 2.8)
Prepregnancy BMI				
- normal weight	153	88 (57.5 \pm 4.0)	30 (19.6 \pm 3.2) *	35 (22.9 \pm 3.4) *
- insufficient weight	18	10 (55.6 \pm 11.7)	5 (27.8 \pm 10.6)	3 (16.7 \pm 8.8) *
- excessive weight	23	10 (43.5 \pm 10.3)	8 (34.8 \pm 9.9)	5 (21.7 \pm 8.6)
- obesity	25	12 (48.0 \pm 10.0)	8 (32.0 \pm 9.3)	5 (20.0 \pm 8.0)
GWG				
- recommended	100	59 (59.0 \pm 4.9)	24 (24.0 \pm 4.3) *	17 (17.0 \pm 3.8) *
- inadequate	45	30 (66.7 \pm 7.0)	7 (15.6 \pm 5.4) *	8 (17.8 \pm 5.7) *
- excessive	74	31 (41.9 \pm 5.7) #	20 (27.0 \pm 5.2)	23 (31.1 \pm 5.4) #

Notes: * - compared with a group of women with exclusive breastfeeding ($p < 0.05$), # - compared with a group of women with recommended GWG ($p < 0.05$).

tation has a direct effect on the subsequent duration of BF [8, 9], we have showed a positive association between the onset of lactation and GWG ($r=0.22$, $p=0.03$), and the absence of statistically association prepregnancy BMI ($p > 0.05$). Delayed onset of lactation was noted in 45 of 219 women (20.5 \pm 2.7%). It was proved that the excessive weight gain significantly increases the chances of delayed onset of lactation 2.1 times (OR 2.1; 95% CI 1.1-4.1,

$p=0.04$) compared with the recommended, while an insufficient level of GWG does not statistically significantly affect this indicator (OR 0.9; 95% CI 0.2-3.4, $p=0.84$). Therefore, the negative effects of GWG beyond the recommended limits on the onset of adequate lactation may be one of the factors that explain the decrease in the duration of BF and exclusive BF duration in the group of women with excessive GWG.

Excessive GWG is characterized by a slow weight reduction after delivery and increases the percentage of overweight and obese women after childbirth [10]. The series of hypotheses trying to explain possible reasons why overweight and obese women are less likely to breastfeed have been proposed in the literature: delayed lactogenesis and lower prolactin response to suckling of the child, adipose tissue would act as a depot for steroid hormones then leading to higher progesterone levels, large breast size in obese women have been associated with BF practical/mechanical difficulties, higher mother medical conditions (obstetric complications, cesarean section, metabolic diseases, diabetes) in overweight and obese women may lead to delayed lactogenesis, psychological factors in obese women (body image dissatisfaction, post-partum depression can turn them less likely to continue BF than normal-weight or non-depressed women, smoking mothers have lower intention to breastfeed [4, 5, 9, 11, 14].

3. Conclusions

It has been proved that excessive GWG was significantly associated with shorter duration of lactation ($p < 0.05$), with shorter duration of exclusive BF (OR 0.5; 95% CI 0.2-0.9, $p = 0.03$), with increased chances of discontinuing BF before 6 month postpartum (OR 2.2; 95% CI 1.0-4.5, $p = 0.04$), and delayed onset of lactation (OR 2.1; 95% CI 1.1-4.1, $p = 0.04$) compared with the recommended GWG women. Informing the pregnant women about the negative effect of pathological GWG on subsequent lactation, regular assessing the dynamics of weight gain during pregnancy, and taking measures to prevent overweight and obesity in the postpartum period should be an important focus of antenatal care.

4. Prospects of Further Researches

Additional research of association of pathological GWG and the condition of the newborn is needed.

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