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A comparative study of pregnant women's health behaviours and pregnancy weight gain during and before the COVID-19 pandemic – preliminary report

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ABSTRACT

Introduction: The nutrition of pregnant women has a decisive influence on organogenesis, pregnancy, delivery, puerperium, and the clinical condition of the newborn. The COVID-19 pandemic and its relation to the mental burden of pregnant women, along with other diseases, make the assessment of factors determining their size an important element.

The aim of the study was a comparison of the weight gain of pregnant women before and during the COVID-19 pandemic, taking into account selected sociodemographic, medical and health-related factors.

Materials and methods: In total, 403 women were included in the study. In 2014, before the pandemic, the study concerned 237 women. In 2020, during the COVID-19 pandemic, an additional 166 women were included in the study. Both groups were hospitalised at the Provincial Integrated Hospital in Kielce Obstetrics and Gynaecology Clinic in Kielce. Necessary information was collected based on medical records and through the use of a questionnaire.

Results and conclusions: In the 1st group, the weight classified as appropriate in relation to pre-pregnancy body mass index (BMI) was observed in 36.12% of respondents, and in 34.36% of women, high weight gains were observed. In the 2nd group, it was 35.37% and 37.20%, respectively. The percentage of overweight and obese women in the 1st group was 23.56% and 27.71% in the 2nd group. In both groups, pregnant womens alcohol-consumption was lower during the pandemic. Studies indicate the need to educate women of childbearing age to reduce excess weight and pathological obesity before pregnancy.

Keywords: pregnant women's health behaviours; pregnancy weight gain; clinical condition of the newborn.

INTRODUCTION

The COVID-19 pandemic caused by the SARS-CoV-2 is a serious challenge for the entire world due to its widespread presence. As a result of infection, it carries a high risk of health complications and mortality. The risk of COVID-19 effects the entire population including pregnant women and their children. Data on this group indicate that up to 1 in 8 pregnant women may be tested positive for SARS-CoV-2. It carries serious consequences for the newborn due to the immaturity of the immune and respiratory systems. Both the virus and the socioeconomic situation it causes are a source of serious stressors for pregnant women. On the one hand, the awareness that COVID-19 infection can be fatal for both the mother and the fetus, and on the other hand, problems of an economic and social nature, previously unknown on such a scale, cause anxiety, insecurity, and stress among pregnant women. Maternal stress during pregnancy creates unfavorable environmental patterns that may have long-term consequences for the child's development later in life [1]. The COVID-19 pandemic and the associated additional psychological burdens that may be experienced by pregnant women make it legitimate to investigate whether it is also a factor that changes health behavior, including the dietary habits of expectant mothers. COVID-19 could have a negative impact on the course of pregnancy and childbirth and may interfere with the clinical condition of the mother and newborns in the following years, shaping the image of future generations. The comparative analysis was based on studies of women and their children giving birth at the Provincial Complex Hospital in Kielce. The 1st group consisted of women tested in 2014, and the 2nd group were women giving birth in September 2020.

The nutrition of pregnant women has a decisive influence on organogenesis, pregnancy, delivery, puerperium, and the clinical condition of the newborn. The COVID-19 pandemic and its relation to the mental burden of pregnant women, along with other diseases, make the assessment of factors determining their size an important element. The pandemic may have a negative effect on the pregnant woman and the newborn in the years following the birth. Therefore, it seems important to conduct research on abnormal weight gain in pregnant women and study the factors determining their size. In both analysed groups, the

disturbing phenomenon of the commonality of excessive weight gain during pregnancy was revealed [2, 3]. This can incur the risk of giving birth to hypertrophic newborns, shoulder dystocia, arterial hypertension and gestational diabetes caused by complicated pregnancy, increased likelihood of cesarean section, prolonged hospitalization and maintenance of increased postpartum body weight, which can lead to obesity [4, 5, 6, 7]. Therefore, this research, which studies weight gain among future mothers and factors that cause it allowing to determine the extent of pathology, was conducted.

The aim of the study was to compare weight gain of pregnant women before and during the COVID-19 pandemic, taking into account selected sociodemographic, medical and health-related factors.

MATERIALS AND METHODS

The study included 422 women patients and their children from the Provincial Integrated Hospital, Obstetrics and Gynaecology Clinic in Kielce. In 2014, before the pandemic, the study concerned 247 women. In 2020, during the COVID-19 pandemic, an additional 175 women were included in the study. The analyses included women who gave birth between 38–42 weeks of gestation to healthy newborns without malformations. Therefore, in the 1st group, 2 patients with twin pregnancies and 8 patients who experienced preterm labour were excluded, and similarly, in the 2nd group, 3 patients with multiple pregnancies and 6 who experienced premature birth were excluded. Ultimately, the analysis was carried out on the data of 403 women and their children.

The study used a proprietary questionnaire, which collected information on the place of residence, age, height and weight, smoking, and diet during pregnancy. Information on the number of pregnancies and deliveries, and the course and duration of pregnancy were collected through the analysis of medical records after obtaining the informed consent of the patients.

In both cohorts of women, anthropometric measurements of women were performed in the 1st trimester of pregnancy between 7–9 weeks, and between 24–26 weeks and the last week before delivery. The tables show maternal weight gain, taking into account the number of deliveries, newborn body weight, smoking, pre-pregnancy body mass index (BMI), diet, and stimulants during pregnancy.

Statistical analysis

Statistical analysis was performed with the Statistica 13.3 software (StatSoft). The χ^2 test was used to assess differences between health behaviors, pre-pregnancy nutritional status, and sociodemographic factors and their amount for the highest reliability.

The study was approved by the Bioethics Committee of Collegium Medicum Jan Kochanowski University of Kielce.

RESULTS

In the studied cohort, the average age of all women in both groups was 29.79 years. In the 1st group, the average age was 29.00 years, and in the 2nd group, it was 30.91 years. The youngest mother was 16-years-old and the oldest was 43. In the study from 2014, pregnant women below 29 years of age prevailed, while in the 2020 cohort over 57% of women were over 30 years of age (Tab. 1). The group of women surveyed before the pandemic consisted of 39.24% rural residents and 60.76% urban residents. The 2nd group, from the time during the COVID-19 period, consisted of 55% pregnant women from rural environments and 45% from cities (Tab. 1). The questions in the survey concerning the groups of consumed food products and the size of consumed portions per person were determined in accordance with the current standards. The portion size of the food was determined in accordance with the current standards [8]. The nutritional status of women was assessed based on height and weight data used to calculate the BMI (kg/m^2). In accordance with the accepted range of variability (WHO 2005), women were assembled into 4 groups: underweight (BMI <18.5), normal body weight (BMI 18.5–24.99), overweight (BMI 25–29.9) and with obesity (BMI ≥30.0) – Table 2. Total weight gain was calculated as the difference between perinatal weight and pre-pregnancy weight. According to the guidelines of the National Academy of Sciences in the USA and the Institute of Medicine, weight gain in pregnancy was defined as: low, recommended or high [2, 9, 10, 11]. In women who were underweight before pregnancy, weight gain should be 12.5–18 kg, with a recommended body weight it should be in the range of 11.5–16.0 kg, while for obese and overweight women the recommendations are in the range of 5–9 kg.

Table 1 presents 2 groups of respondents. In about 20% of cases, overweight and obesity were observed in both groups. Weight gain of pregnant women, classified according to the recommendations with the BMI value before pregnancy, was reported in less than 37% of respondents, while large increases of about 40% were observed. Among the respondents from both groups, 1.69% from the 1st group and 1.81% from the 2nd group indicated drinking alcohol. As many as 15.19% of patients before the pandemic admitted drinking beer, compared to 13.86% in the pandemic period. These results indicate an existing alcohol problem among pregnant women. In about 30% of patients, large weight gains were noted in pregnant women who were overweight before pregnancy and among patients who were having their 1st child. It was less frequently observed in patients who gave birth to the 2nd or 3rd child. Low weight gains were observed in the pre-pandemic group in 59.09% of the respondents, whereas in the pandemic period it was only 33.3%. Large weight gains compared to normal in the 1st group occurred in 70.51% of women and 28.34% in the 2nd group. During the COVID-19 pandemic, fewer macrosomic fetuses were born with a birth weight above 4000 g.

Height, place of residence, and age had no effect on weight gain. Table 3 shows the frequency of consumed products. Women who consumed more sweets, milk, and dairy products tended to experience high weight gain more frequently. Products providing proteins of animal origin gave the lowest weight gain (Tab. 3). Higher body weight gains in relation to BMI were noted among patients who declared drinking beer and alcohol during pregnancy. There was a tendency for large weight gain in both groups of women who consumed sweetened soda (Tab. 4).

TABLE 1. Characteristics of the studied populations

	2014 study		2020 study		All
	n	%	n	%	n
	237	58.81	166	41.19	403
Place of residence % (n)					
village	93	39.24	91	54.82	184
city	144	60.76	75	45.18	218
Age					
≥29.99	144	60.76	71	42.77	215
≤30.00	93	39.24	95	57.23	188
Number of deliveries					
1	128	54.01	75	45.18	203
2	90	37.97	76	45.78	166
3 and more	19	8.02	15	9.04	34
Way of pregnancy termination					
natural	121	61.06	82	49.39	203
cesarean section	116	48.94	84	50.61	200
Pre-pregnancy BMI					
<18.5	12	5.33	10	6.02	22
18.5–24.9	160	71.11	110	66.27	270
≥25.0–30.0	40	17.78	29	17.47	69
>30.0	13	5.78	17	10.24	30
Getational weight gain					
low	67	29.52	45	27.19	112
recommended	82	36.12	58	34.95	140
high	78	34.36	61	42.36	139

BMI – body mass index

TABLE 2. Percentage of women with low, recommended, and high pregnancy weight gain, number of deliveries, and way of pregnancy termination

Factors		Gestational weight gain							
		2014				2020			
		p (χ^2 statistic)	low (%)	recommended (%)	high (%)	p (χ^2 statistic)	low (%)	recommended (%)	high (%)
Pre-pregnancy BMI	<18.5	0.0004	11.80	6.30	2.30	0.00305	11.76	5.56	1.61
	18.5–24.9		80.40	81.30	64.40		79.41	79.63	61.29
	≥25.0		7.80	12.50	33.30		8.82	14.81	37.10
Birth	1st	0.0055	31.90	44.40	64.10	0.07189	44.12	38.10	53.20
	2nd		55.30	44.40	32.10		47.10	48.40	35.50
	3rd or subsequent		12.80	11.10	3.90		8.78	13.50	11.30
Age	<30 years	0.2430	51.00	65.00	63.20	0.12434	47.10	66.70	66.10
	>30 years		49.00	35.00	36.80		52.90	33.30	33.90
Place of residence	city	0.1300	54.90	55.00	44.80	0.42704	52.90	27.00	34.00
	village		45.10	45.00	55.20		47.10	73.00	66.00
Cigarette smoking during pregnancy	non-smokers	0.4131	72.00	76.00	64.00	0.19580	66.70	79.20	59.00
	passive		16.00	17.70	23.30		18.20	15.10	26.20
	smokers		12.00	6.30	12.80		15.10	5.70	14.80

BMI – body mass index

TABLE 3. Percentage of women with low, recommended and high weight gain in pregnancy depending on the frequency of consumption of selected products during pregnancy in studies from 2014 and 2020

Products and meals	Number of servings	Gestational weight gain							
		2014				2020			
		p (χ^2 statistic)	low (%)	recommended (%)	high (%)	p (χ^2 statistic)	low (%)	recommended (%)	high (%)
Fruit	<1 serving daily	0.1889	9.8	8.8	9.2	0.46337	8.8	5.6	9.7
	1–2 servings daily		52.9	67.5	50.6		52.9	64.8	46.8
	≥3 servings daily		37.3	23.8	40.2		38.3	29.6	43.5
Vegetables	<1 serving daily	0.5303	23.5	18.7	17.3	0.5561	32.4	18.5	46.8
	1–2 servings daily		43.2	57.5	51.7		55.9	57.4	40.3
	>3 servings daily		33.3	23.8	31.0		11.7	24.1	12.9
Milk and dairy products in total	<1 serving daily	0.1889	21.6	25.0	21.8	0.79598	5.9	1.9	3.2
	1–2 servings daily		56.9	62.5	50.6		17.6	22.2	19.4
	≥3 servings daily		21.6	12.5	27.6		76.5	75.9	77.4
Animal protein (meat, fish, eggs)	<1 servings daily or never	0.0260	25.5	16.3	25.3	0.03217	32.4	9.3	30.6
	1–2 servings daily		60.8	68.7	46.0		52.9	70.4	45.2
	≥3 servings daily		13.7	15.0	28.7		14.7	20.3	24.2
Sea fish	never	0.3452	15.7	11.2	17.3	0.41747	23.5	9.3	17.7
	<1 serving weekly		35.3	51.3	47.1		35.3	50.0	43.5
	≥1 serving weekly		49.0	37.5	35.6		41.2	40.7	38.8
Sweets, cakes	≤3 servings weekly	0.3692	51.0	53.7	39.1	0.34285	30.3	46.3	32.3
	4–7 servings weekly		29.4	27.5	33.3		36.4	27.8	27.4
	>7 servings daily		19.6	18.8	27.6		33.3	25.9	40.3
Number of meals daily	≤3	0.0521	21.6	5.0	14.9	0.03249	32.4	3.7	19.4
	4		29.4	40.0	37.9		26.5	44.4	37.1
	≥5		49.0	55.0	47.2		41.1	51.9	43.5
Snacking between meals	<1 daily	0.0699	26.0	46.2	32.2	0.28547	52.9	55.6	40.3
	1 daily		48.0	30.0	33.3		35.3	25.9	32.3
	>1 daily		26.0	23.8	34.5		11.8	18.5	27.4

Table 2 shows that in about 30% of patients, large weight gains were noted in pregnant women who were overweight before pregnancy and among patients who were having their 1st child. It was less frequently observed in patients who gave birth to their 2nd or 3rd child. Low weight gains were observed in the pre-pandemic group in 59.09% of the respondents, whereas in the pandemic period it was only 33.3%. Large weight gains in the 1st group occurred in 70.51% of women and 28.34% in the 2nd group. During the COVID-19 pandemic, fewer macrosomic fetuses were born with a birth weight above 4000 g.

During the pandemic, a slight upward trend was observed in the increased consumption of fruit, milk and dairy drinks, and less frequent snacking between meals by mothers of low weight children compared to those who gave birth to children of adequate and high weight. No relationship has been found between the consumption of folic acid and other vitamins and/or mineral supplements in pregnancy and the birth weight of newborns.

DISCUSSION

In the study, the diets of pregnant women were assessed by analysing the nutrients provided in daily food intake. The above data were compared with the recommendations for pregnant women according to the Institute of Food and Nutrition and their influence on the clinical condition of the pregnant woman, weight gain, biochemical parameters, and clinical condition of the newborn after delivery in the analysed periods.

A comparative analysis of both groups before the pandemic and during the COVID-19 pandemic showed that women who were underweight before pregnancy were more likely to have small for gestational age (SGA) babies, while women who were obese or overweight before pregnancy were more likely to have large for gestational age (LGA) babies. Comparable data were obtained by other researchers [7, 8, 12, 13, 14, 15]. In both groups, there were no statistically significant differences between the

TABLE 4. Comparison of consumed drinks and stimulants

Beverages	Number of servings	Gestational weight gain							
		2014				2020			
		p (χ^2 statistic)	low (%)	recommended (%)	high (%)	p (χ^2 statistic)	low (%)	recommended (%)	high (%)
Sweetened carbonated beverages	never	0.6856	41.2	37.5	36.8	0.55867	44.1	35.2	38.7
	≤3 glasses weekly		41.2	43.7	36.8		38.2	46.3	33.9
	≥4 glasses weekly		17.7	18.8	26.4		17.7	18.5	27.4
Fruit juice	<1 glass weekly or never	0.4509	23.5	21.5	15.0	0.39068	29.4	18.9	12.9
	1–6 glasses weekly		41.2	36.7	49.4		38.2	41.5	48.4
	≥7 glasses daily		35.3	41.8	35.6		32.4	39.6	38.7
Milk	<1 glass weekly or never	0.7250	32.0	33.7	33.3	0.90316	32.4	31.5	38.7
	1–6 glasses weekly		32.0	38.8	41.4		38.2	40.7	38.7
	≥7 glasses daily		36.0	27.5	25.3		29.4	27.7	22.6
Consumption of alcohol	no	0.0286	82.4	87.5	71.3	0.11389	100.0	100.0	95.0
	yes		17.7	12.5	28.7		0.0	0.0	5.0
Consumption of beer	no	0.0451	90.2	91.3	79.3	0.30166	91.2	92.6	80.6
	yes		9.8	8.8	20.7		8.8	7.4	19.4

birth weight of newborns and the frequency of consumption by pregnant women of individual groups of products during pregnancy. Suliga and Adamczyk-Gruszka and Poon et al. obtained comparable data [16, 17]. There was a slight upward trend in the increased consumption of fruit, milk and dairy drinks in the 2nd group, and less frequent snacking between meals by mothers of SGA children compared to those who gave birth to appropriate for gestational age and LGA children. No relationships have been found between the consumption of folic acid and other vitamin and/or mineral supplements during pregnancy and the birth weight of newborns [2, 4, 5, 6, 15, 18, 19, 20]. Drug due to its commonness, is an important health problem for both pregnant women and their children, is smoking by the mother. Maternal fetuses exposed to nicotine as passive or active smoker show a higher risk of respiratory disorders and low birth weight [21]. A greater list of complications that will be revealed later in the child's life has been proven. These include somatic and mental problems [22]. Moreover, Lee et al. concluded that in utero exposure to cigarette smoke is associated with thinner retinal nerve fiber layer in young adulthood, regardless of other environmental factors in early life [23]. About 30% of the cases smoked or were exposed to tobacco smoke and depended on pregnancy weight gain in both studies. In the pre-pandemic group, 20.51% of women were exposed to tobacco smoke and 9.4% of women smoked cigarettes, in the 2nd group during the pandemic, the figures were 20.51% exposed to tobacco smoke, and 9.4% of women smoked cigarettes, respectively.

Cigarette smoking and exposure to tobacco smoke affected weight gain in women in both groups. A trend toward a higher incidence of low birth weight in children of mothers who smoke and are exposed to tobacco smoke, compared to non-smokers has been noted, which is also consistent with the results of other researchers [24]. Wojtyła et al., in a study from 2021, concluded that smoking causes a decrease in the birth weight of a child. A positive correlation was found between the number of cigarettes smoked by the mother and a decrease in the birth weight of the offspring [25]. Alcoholic beverages and alcohol were consumed by pregnant women in both groups [26]. A 2011 meta-analysis showed that low or moderate alcohol consumption (up to 10 g/day) does not increase the risk of SGA. It occurs only in the case of heavy alcohol consumption. In the conducted study, no relationship has been found between alcohol consumption by pregnant women and the birth weight of newborns [27, 28]. The presented report is an introduction to further research and confirms the impact of unfavourable health behaviour in pregnant women on weight gain in pregnancy. The obtained data may be useful in developing an effective prophylaxis of nutritional disorders in pregnant women.

The increased risk of greater weight gain in pregnancy than recommended was significantly related to health behaviours, i.e., alcohol consumption during pregnancy, increased consumption of supplied animal protein products, and being overweight before pregnancy. Yan et al. also noted that the diet of women of reproductive age may be closely related to the birth weight of their offspring [29]. This study showed that there is a need for health education of women of reproductive age in order to reduce excess weight earlier and promote appropriate health behaviours during pregnancy to maintain normal weight gain during this period.

CONCLUSIONS

1. The COVID-19 pandemic has caused a change in the lifestyle of pregnant women, as evidenced by the increase in the number of women with excessive weight gain observed in 2020 compared to the study among women surveyed in the pre-pandemic range.

2. Studies indicate the need to educate women of childbearing age in order to reduce excess weight and pathological obesity before pregnancy.

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