



## Nutritional status and dietary characteristics of pregnant women with gestational diabetes mellitus at National hospital of Endocrinology in 2023

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### ABSTRACT

**Objective:** To describe the nutritional status and dietary characteristics of pregnant women with gestational diabetes mellitus at the National Hospital of Endocrinology in 2023. **Method:** A cross-sectional descriptive study combined with a retrospective review of 185 pregnant women was conducted from March to August 2023. **Results:** Women aged 30-34 years accounted for the highest proportion at 38.4%. Before pregnancy, the rates of overweight, obesity, and normal weight were 21.1%, 13%, and 61.6%, respectively. During pregnancy, the average weight gain was  $0.55 \pm 0.3$  kg/week, with 53% of women gaining excess weight. The average total energy intake was  $1427.2 \pm 319$  kcal/day, with an average Protein : Lipid : Glucid ratio of 21.2 : 27.5 : 51.2%. The average values for some nutrients were as follow: fiber  $10.9 \pm 5.3$  g, calcium  $722.2 \pm 307.7$  mg, iron  $13.2 \pm 7.8$  mg, vitamin D  $1.58 \pm 2.05$   $\mu$ g, folate  $296.71 \pm 136.91$   $\mu$ g, vitamin C  $149.64 \pm 78.27$  mg, vitamin B1  $1.39 \pm 0.45$  mg. **Conclusion:** The prevalence of overweight and obesity before pregnancy among women with gestational diabetes mellitus was relatively high, and the rate of weight gain during pregnancy was not reasonable. In addition, the dietary intake was unbalanced and failed to meet recommended requirements.

**Keywords:** Nutritional status, gestational diabetes, weight gain, diet, micronutrients.

### INTRODUCTION

Gestational diabetes mellitus (GDM) is a current concern in the field of maternal health due to its implications for both mothers and fetuses, coupled with the rising incidence of GDM in recent years. According to a report by The Centers for Disease Control and Prevention for the period 2016-2022, the rate of gestational diabetes mellitus in the US was at 7.8%, equivalent to 281 thousand cases of GDM annually <sup>1</sup>. In Vietnam, research conducted by Le Thi Thanh Tam

in 2017 on 1511 pregnant women revealed a GDM prevalence of 20.5% <sup>2</sup>. Gestational diabetes mellitus, if not controlled, may cause many consequences for both mothers and infants. Newborns of mothers with GDM have a high risk of hypoglycemia, jaundice and risk of obesity and type 2 diabetes. Additionally, about 20 - 50% of mothers with GDM will develop type 2 diabetes in 5-10 years after giving birth, with a 7.4-fold increase in the risk of type 2 diabetes <sup>3</sup>. One contributing factor that causes to increase

the incidence of GDM is overweight and obesity among women of reproductive age<sup>4</sup>. Overweight and obesity before pregnancy, if combined with excessive weight gain during pregnancy, also increases the risk of postpartum type 2 diabetes in pregnant women with GDM<sup>5, 6</sup>. Assessing the nutritional status and dietary characteristics of patients helps healthcare providers with essential data to offer recommendations and provide early, effective intervention therapy for patients with GDM. Therefore, this study aims to describe the nutritional status and some dietary characteristics of pregnant women with gestational diabetes mellitus at the National Hospital of Endocrinology in 2023.

## PARTICIPANTS AND METHODS

**Participants:** Pregnant women diagnosed with gestational diabetes mellitus who were treated at the Department of Reproductive Endocrinology, National Hospital of Endocrinology.

*Inclusion criteria:* Pregnant women from 14 weeks to 40 weeks gestation, aged 20 years and older.

*Exclusion criteria:* Patients were diagnosed with diabetes before pregnancy, and the patient had diseases that affected metabolism such as: Basedow, Hypothyroidism, Cushing's, Pheochromocytoma.

### Location and duration of the study:

The study was conducted at the Department of Reproductive Endocrinology, Central Endocrine Hospital from April 2023 to August 2023.

**Research design:** Cross-sectional descriptive research combined with retrospective information on the patient's pre-pregnancy weight were employed.

**Sample size and sample selection:** The following formula was used to calculate sample size.

$$n = Z_{1-\alpha/2}^2 \frac{p(1-p)}{d^2}$$

Where:

n: Total number of participants.

$Z_{(1-\alpha/2)}$ : limited reliability with probability threshold 5%, ( $Z_{1-\alpha/2} = 1.96$ ).  $d = 0.05$  was the deviation margin between the sample and the research population.  $p = 0.14$  was the obesity percentage of patients with GDM before pregnancy according to research by Nguyen Thi Trang in 2022<sup>7</sup>.

Substituting the value into the formula, the sample size was 185 patients.

**Sampling method:** Convenient sampling was employed until the desired sample size was achieved.

### Research variables and assessment standards:

\* Research variables:

+ *Characteristics of the participants:* Age, education level, occupation, living area.

+ *Nutritional status of the participants:* Pre-pregnancy BMI, weekly weight gain according to pre-pregnancy BMI, weight gain during pregnancy within recommendations, above recommendations, or below recommendations.

+ *Dietary characteristics:* Dietary nutritional value and composition of energy-producing substances in a day.

\* Assessment standards:

- Pre-pregnancy overweight and obesity assessed when pre-pregnancy BMI is  $\geq 23$ , following the WHO 2000 standards for Asians<sup>8</sup>.

Nutritional status	Asia-Pacific (BMI)
Underweight	< 18.5
Normal range	18.5 - 22.9
Overweight	23.0 - 24.9
Obese I	25.0 - 34.9
Obese II	35 - 39.9
Obese III	>= 40

- Standards for assessing weight gain during pregnancy was based on the Ministry of Health’s 2018 National Guidelines for the Prevention and Control of GDM <sup>9</sup>.

Pre-pregnancy BMI	Total weight increase	Weight gain last 6 months period
< 18.5	12.5 - 18 kg	0.51 kg/week (0.44 - 0.58)
18.5 - 24.9	11.5 - 16 kg	0.42 kg/week (0.35 - 0.50)
25 - 29.9	7 - 11.5 kg	0.28 kg/week (0.23 - 0.33)
≥ 30	5 - 9 kg	0.22 kg/week (0.17 - 0.27)

**Data collection method:** 24-hour rations were collected by direct interviews at the time after the patient was admitted to the hospital, the “ask and record 24-hour rations” combined with the “Ration survey photo book” provided by the National Institute of Nutrition was employed. This included documenting all food, beverages, quantities, and cooking methods consumed by the patient in the past 24 hours. Data entry was performed using Epidata 3.1 and Excel 2016 software.

**Data collection and analysis:** Data was coded and analyzed using SPSS 22.0 software.

**Handling Deviations:**

- Investigator-Related Deviations: Interviewing investigators underwent thorough training encompassing presentations, group discussions, and role-playing exercises.

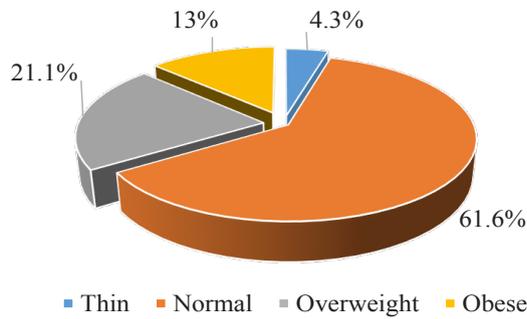
- Interview Deviations: Investigators received meticulous training on interview methodologies.

- Recall-Related Deviations: Patients were encouraged to recall information, with gentle suggestions provided if necessary.

**Research ethics:** The study received the participants consent and was approved by the Ethics Committee of Viet Nam University of Traditional Medicine under decision No. 1035/QD-HVYDCT dated April 27, 2023. The participants had the right to refuse to participate, and their personal information was guaranteed to be kept confidential for research purposes only.

**RESULTS**

The study included 185 pregnant women diagnosed with gestational diabetes mellitus. Among them, the group of pregnant women aged 30-34 accounted for the highest proportion with 38.4%, followed by those aged 35 or older at 33.5%. The number of pregnant women with an education level of intermediate level or higher accounted for 75.7%, with a university-level education or above accounted for 45.4%. The majority of participants had administrative and office jobs (53.5%), lived in Hanoi (68.6%), and had given birth twice or more (66%).



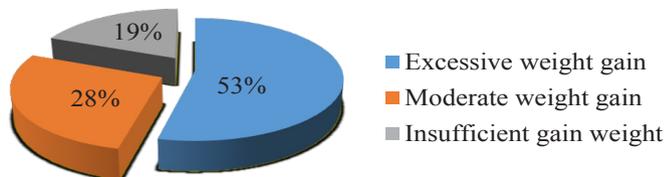
**Figure 1. Pre-pregnancy BMI classification of the participants (n = 185)**

The results in figure 1 illustrated that 61.6% of pregnant women had a normal pre-pregnancy BMI, while 21.1% were overweight and 13% were classified as obese. The average BMI in the study was  $22.31 \pm 2.7$  kg/m<sup>2</sup>

**Table 1. Participants' average weight gain per week**

Pre-pregnancy BMI (kg/m <sup>2</sup> )	n	$\bar{X} \pm SD$ weight gain (kg/week)	Excessive weight gain compared to the recommended limitation
Shared	185	$0.55 \pm 0.3$	
<18.5	8	$0.57 \pm 0.4$	-0.01 kg/week
18.5 - 24.9	153	$0.57 \pm 0.3$	0.07 kg/week
25 – 29.9	21	$0.48 \pm 0.3$	0.15 kg/week
$\geq 30$	3	$0.41 \pm 0.3$	0.14 kg/week

The results in table 1 reported that the participants' average weight gain was  $0.55 \pm 0.3$  kg/week. Those with a BMI  $\geq 25$  had a higher proportion of excessive weight gain compared to those with a BMI < 25. Specifically, the overweight BMI group (25-29.9) exceeded recommended weight gain by 0.15kg/week, while the obese BMI group ( $\geq 30$ ) surpassed recommendations by 0.14kg/week.



**Figure 2. Classification of weight gain during pregnancy of the participants (n = 185)**

The results presented that the group of pregnant women with weight gain over the recommendation accounted for the highest proportion at 53% and the group of pregnant women gaining weight under the recommendation accounted for the lowest proportion at 19%.

**Table 2. Composition of substances according to 24-hour rations**

		<b>n</b>	<b>%</b>	$\bar{X} \pm SD$
Energy generating substances (%)	Protein			21.2 ± 3.4
	Lipids			27.5 ± 7.3
	Glucid			51.2 ± 8.7
Protein percentage (%) (n = 185)	< 13	1	0.5	
	13 – 20	71	38.4	
	> 20	113	61.1	
Glucid percentage (%) (n = 185)	< 55	121	65.4	
	55 – 60	37	20	
	> 60	27	14.6	
Lipid percentage (%) (n = 185)	< 20	25	13.5	
	20 – 30	97	52.4	
	> 30	63	34.1	

The results in table 2 indicated that the average percentage of energy-generating substances in the diet was Protein : Lipid : Glucid in the ratio of 21.2 ± 3.4% : 27.5 ± 7.3% : 51.2 ± 8,7%, respectively. The majority of participants had a dietary protein intake exceeding 20% (61.6%), a glucid intake below 55% (65.4%), and a lipid intake between 20% - 30% (52.4%).

**Table 3. Nutritional value according to 24-hour rations of participants**

	$\bar{X} \pm SD$	<b>National recommendations for pregnant women<sup>10</sup></b>
<b>Total energy (kcal)</b>		
General (n = 185)	1427.2 ± 319	
The second quarter (n = 133)	1425.6 ± 326	
The third quarter (n = 52)	1431.2 ± 306	
Protein (g)	75.3 ± 19.6	
Lipids (g)	44.6 ± 18.6	
Glucid (g)	176.4 ± 43.6	
Fiber (g)	10.9 ± 5.3	28
Calcium (mg)	722.2 ± 307.7	1200
Iron (mg)	13.2 ± 7.8	41.1

	$\bar{X} \pm SD$	National recommendations for pregnant women <sup>10</sup>
Cholesterol (mg)	174.9 ± 242.3	200
Zinc (mg)	9.79 ± 3.14	10
Folate (µg)	296.71 ± 136.91	600
Vitamin A(µg)	261.43 ± 286.25	650
Vitamin D (µg)	1.58 ± 2.05	15
Vitamin C (mg)	149.64 ± 78.27	110
Vitamin B1 (mg)	1.39 ± 0.45	1,2

The results reported the average total energy intake was  $1427.2 \pm 319$  kcal, with energy provided by dietary Protein at  $753 \pm 19.6$ g, Lipid at  $44.6 \pm 18.6$ g, and Glucid at  $176.4 \pm 43.6$ g. Some non-energy-producing substances were lower than recommended levels, including fiber, Calcium, Iron, Vitamin D, and Folate, at  $10.9 \pm 5.3$ g,  $722.2 \pm 307.7$ mg,  $13.2 \pm 7.8$ mg,  $1.58 \pm 2.05$ µg,  $296.71 \pm 136.91$ µg, respectively. Some substances had an average value higher than recommended, such as Vitamin C at  $149.64 \pm 78.27$  mg, and Vitamin B1 at  $1.39 \pm 0.45$  mg.

## DISCUSSION

Overweight and obesity are established risk factors for many diseases related to metabolic disorders in the body that have been proven through epidemiological studies such as diabetes, cardiovascular disease, and gestational diabetes mellitus (GDM). In this study, one-third of pregnant women were overweight or obese in the pre-pregnancy period, with 34.1% having a BMI  $\geq 23$ . Specifically, 21.1% were classified as overweight, while 13% were considered obese. The findings were similar to the results of some studies in Hanoi such as research by Nguyen Manh Thang in 2022 with a high proportion of overweight at 19.4% and obese at 14.1%<sup>10</sup> and research by Nguyen Thi Trang in 2019-2020 with the overweight and obesity percentage of 34%<sup>7</sup>, but higher than research in other provinces such as a study by Nguyen Thi Mai Phuong in Hai Phong in 2015 with an overweight and obesity rate of 18.1%<sup>11</sup>,

and research by Le Thi Thanh Tam in Vinh city in Nghe An in 2017 with the overweight and obesity proportion of 22.6%<sup>2</sup>. These differences may be because this research was conducted in Hanoi city, which is the second most densely populated city in Vietnam with increasing urbanization. In addition, more than half of the participants had administrative - office jobs and had the habit of using processed foods every day and a sedentary lifestyle.

If pre-pregnant high BMI and excess weight gain during pregnancy combine, the risk of postpartum type 2 diabetes also increases. A study confirmed the association between pre-pregnant BMI and the risk of diabetes and postpartum prediabetes at all levels of weight gain. Pre-pregnancy obesity combined with weight gain  $\geq 3$ kg (from pre-pregnancy to postpartum) increased the risk of diabetes by 17.3 times and the risk of pre-diabetes by 3.32 times compared to people with BMI  $< 23$

kg/m<sup>2</sup> and increased risk of diabetes with weight gain < 3kg<sup>6</sup>. In this study, more than half of participants gained excess weight compared to recommendations, accounting for 53%. These results were higher than the study by Do Hai Anh in 2019 on the rate of excess weight gain in pregnant women in general, whose rate of excess weight gain was only 19%<sup>12</sup>. Meanwhile, the number of overweight and obese pregnant women was the group with the highest number of weight gained per week compared to recommendations (table 1 results). These results have important implications for nutritional counseling for pregnant women with gestational diabetes mellitus. Controlling weight gain during pregnancy and controlling weight in the postpartum period is very necessary for pregnant women with GDM.

Regarding the characteristics of the 24-hour rations, the average total energy in the study was  $1427.2 \pm 319$  kcal/day. The findings were similar to the results of a study by Nguyen Thi Thu Lieu's in 2022 with the average total energy of  $1518.6 \pm 256.4$  kcal/day<sup>13</sup> but lower than the results of a study by Nguyen Trong Hung in 2021 with the average total energy of  $1841.7 \pm 92.2$  kcal/day<sup>14</sup> and a study by Nurul-Alia Samiun in 2019 with an average total energy of  $2163 \pm 820$  kcal/day<sup>15</sup>. The difference in energy was because this study was conducted several years later when the issue of gestational diabetes mellitus received more attention, and nutritional communication activities for pregnant women with gestational diabetes was implemented more strongly, so pregnant women tended to reduce their food intake during sick, leading to a reduction in the total energy intake per day. However, the average total energy intake was lower than the recommended needs based on

national guidelines on nutrition for pregnant women<sup>16</sup>. Specifically, pregnant women in the second trimester had the average total energy intake at  $1425.6 \pm 326$  kcal/day (the recommended needs was ~2000 kcal/day), in the third trimester it was  $1431.2 \pm 306$  kcal/day (the recommended needs was ~2200 kcal/day). Therefore, it is necessary to focus on reducing carbohydrate intake but still need to ensure enough energy according to recommended needs to ensure adequate nutrition for the fetus.

The ratio of energy-generating substances P : L : G was at 21.2 : 27.5 : 51.2. The average amount of glucid provided by a ration was 176.4g. The search results were similar to the study by Nguyen Thi Thu Lieu's in 2022, with an average glucid of 177.3g, equivalent to 47.9%<sup>13</sup>. By contrasts, the findings was lower than the research by Nguyen Trong Hung in 2021<sup>14</sup> with the average glucid of 243.4g, equivalent to 52%. Thus, compared to 2021, pregnant women with GDM were now having a lower glucose intake, which indicated that, after receiving nutritional advice, pregnant women had the right awareness about reducing the amount of carbohydrates in their rations to better control blood sugar. However, up to 65.4% of the participants had a glucose intake < 55%, while the recommended glucose intake is 55-60%<sup>9</sup>, 34.1% of the participants had a dietary lipid proportion >30%, higher than the recommended need of 20-30%<sup>9</sup>. Thus, the structure of rations of pregnant women was not balanced.

The research results demonstrated that dietary intakes of some non-energy-producing substances such as fiber, calcium, folate, and vitamin D were lower than recommended needs. In particular, fiber plays a crucial role in limiting excessive postprandial hyperglycemia in pregnant

women with gestational diabetes mellitus<sup>9</sup>. However, the findings reported that the average fiber only reached 10.9 g/day while the recommended need was 28 g/day. Therefore, in nutritional intervention counseling, attention should be paid to the practice of eating 400g of vegetables per day to provide enough fiber as recommendation for pregnant women with gestational diabetes mellitus to control blood sugar well and prevent complications of diabetes.

### CONCLUSION

The study revealed that the prevalence of pre-pregnancy overweight and obesity among women with GDM was relatively high. In addition, weight gain during pregnancy was not reasonable. Besides, the structure of rations was not balanced and did not meet recommended needs.

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