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ORIGINAL RESEARCH

Dietary Intakes of Women with Gestational Diabetes Mellitus and Pregnancy Outcomes: A Prospective Observational Study

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Purpose: Nutrient intake for pregnant women with gestational diabetes mellitus (GDM) is important to ensure satisfactory birth outcomes. This study aims to explore the dietary profiles of patients with GDM, compare the results with the Chinese dietary guidelines or Dietary Reference Intakes (DRIs) from China and investigate the relationship between maternal dietary intake and pregnancy outcomes.

Patients and Methods: A total of 221 patients with GDM in the second trimester were included in the cohort. Dietary intake data were collected using a 24-hour recall method for three consecutive days. The pregnancy outcomes of these participants were subsequently monitored. Both univariate logistic regression and multivariate logistic regression analyses were conducted to explore the associations between dietary intake variables or general characteristics variables and adverse pregnancy outcomes.

Results: Participants with adverse pregnancy outcomes showed a lower intake of iodine and vitamin D, a lower percentage of dietary energy intake from carbohydrates and a higher percentage of dietary energy intake from fats, compared to participants without adverse pregnancy outcomes. The gestational weight gain and family history of diabetes were associated with an increased risk of adverse pregnancy outcomes. Conversely, regular exercise, the intake of iodine and Vitamin D, and the percentage of dietary energy intake from carbohydrates were associated with a decreased risk.

Conclusion: The daily diet of pregnant women with GDM in China did not meet the dietary guidelines or DRIs. The low intake of Vitamin D and iodine, the low dietary carbohydrate ratio, family history of diabetes, lack of exercise, and high gestational weight gain were associated with increased risk of adverse pregnancy outcomes in pregnant women with GDM.

Keywords: gestational diabetes, nutrient intake, dietary reference intakes, pregnancy outcomes, adverse pregnancy outcome

Introduction

Gestational diabetes mellitus (GDM) is one of the most common metabolic complications during pregnancy. With the relaxation of China's fertility policy, the incidence of hyperglycemia during pregnancy is increasing, affecting between 9.3 and 19.7% of all pregnancies in China.[1–3] First-line treatment for GDM is medical nutrition therapy, together with weight management and physical activity,[4,5] where medical nutrition therapy could decrease the incidence of complications and improve the outcomes of GDM. However, suboptimal dietary intake is a common issue among pregnant women in China. Women are traditionally encouraged to increase their consumption of meat or meat soup during pregnancy, which may have contributed to excessive fat intake.[6] Such dietary habits can lead to higher rates of overweight and obesity among Chinese pregnant women, subsequently increasing the risks of hyperglycemia and related adverse pregnancy outcomes. Thus, the nutritional intake of pregnant women with GDM is important to ensure satisfactory birth outcomes. Insufficient dietary intake or lack of essential micronutrients and macronutrients may yield substantial negative impacts on pregnancy outcomes and neonatal health, increasing the likelihood of complications such as abortion, pre-eclampsia, preterm birth, cesarean delivery, congenital malformations, low birth weight and

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macrosomia.[7–10] Although better food quality has been linked to decreased risks of several pregnancy complications, incorporating dietary assessment as part of antenatal care for pregnant women in China remains a challenge due to the large population and limited access to dietitians.[11] In addition, maternal dietary intake has been shown to affect the development of GDM, but the findings are inconsistent. Moreover, there has been no study particularly focusing on the daily dietary intake of Chinese women with GDM and its impact on pregnancy outcomes. Available data are limited regarding the optimal diet for achieving maternal euglycemia and improved pregnancy outcomes.[12–14] Therefore, in this prospective cohort study, we aimed to identify maternal dietary profiles of pregnant women with GDM and compare their dietary intakes with Chinese dietary guidelines[15] or Dietary Reference Intakes (DRIs) from China[16] and analyze the associations between the risk of adverse pregnancy outcomes and maternal dietary intake, demographic, lifestyle and clinical characteristics.

Patients and Methods

Participants

A total of 266 female patients with GDM from the Department of Endocrinology and Diabetes, the First Affiliated Hospital of Xiamen University (Xiamen, China) were screened. Participants in the second trimester who have been screened for hyperglycemia between 24–28 weeks of gestational age and diagnosed with hyperglycemia for the first time during the current pregnancy were included. Many international organizations have adopted the International Association of Diabetes and Pregnancy Study Group (IADPSG) guidelines as described by the World Health Organization (WHO) for the diagnosis of hyperglycemia first detected in pregnancy as GDM,[17] when fasting glucose is ≥ 5.1–6.9 mmol/L, 1h ≥ 10.0 mmol/L or 2h ≥ 8.5–11.0 mmol/L. The exclusion criteria were as follows: (1) age < 18 years (2) multiple pregnancy (3) diagnosed with T1DM or T2DM before the onset of this pregnancy (4) complete daily dietary intake data were not available (5) lost to follow-up, and (6) diagnosed with other concomitant disease such as chronic hypertension, thyroid disease, etc. After the exclusion of non-singleton pregnancies (n=5), participants with incomplete dietary survey (n=26), or lost to follow-up (n=14), a total of 221 pregnant women with GDM were included in the final analysis. This study was approved by the ethics committee of the First Affiliated Hospital of Xiamen University and conducted in accordance with the Declaration of Helsinki of 1975, revised in 2013. Informed consent was obtained from all participants and participants' anonymity was preserved. Face-to-face interviews were conducted to collect participants' information and daily dietary intake assessments through questionnaires when they were enrolled in the study. The collected information included age, education, physical activity, alcohol consumption, smoking status, and treatment, family history of diabetes, height, pre-pregnancy weight, gestational weight gain and so on. The participants' BMI was calculated based on height and weight as kg/m^2. According to the BMI classification for Chinese, BMI<18.5 kg/m^2 was classified as underweight, 18.5–23.9 kg/m^2 as normal, and ≥24 kg/m^2 as overweight or obese.[18] Pregnancy outcomes of these participants were followed up using medical records, with adverse outcomes examined including preterm birth, abortion, cesarean delivery, pre eclampsia, low birth weight, macrosomia, and shoulder dystocia.

Dietary Intake Assessment

Dietary intake data were collected by trained dietitians using a 24-hour recall method for three consecutive days, including weekdays and weekends. To enhance the accuracy of reported dietary intakes, nutritionists provided participants with guidance on employing the 24-hour dietary recall method, supported by visual aids such as food models and photographs. The nutritionist did face-to-face interviews with the participants to collect all food consumption information including amounts, types of meals, frequencies of meals and places of consumption, the intakes of energy, macronutrients, and micronutrients, which were calculated according to the Chinese Food Composition Table.[19] The participants' diet during the second trimester was compared with the corresponding DRIs from China to assess their compliance with these dietary guidelines.

Statistical Analyses

The data set underwent normality testing through the Shapiro-Wilks tests ($p > 0.05$=normal). Data with a normal distribution were described as Mean ± SD (standard deviations). Medians and interquartile ranges (IQR) were used for data with a non-normal distribution. Categorical data were described using frequencies and percentages. To discern differences between two groups regarding continuous variables, the Student's t test was utilized for data with normal distribution, whereas the Kruskal-Wallis test was applied to those with skewed distributions. Univariate logistic regression analyses were used to evaluate the associations between adverse pregnancy outcomes and dietary intake or general characteristics variables. Variables with $p < 0.05$ in univariate analysis were included in a multivariate logistic regression. All statistical analyses were performed using SPSS version 21.0 software (IBM Corporation, Armonk, NY). All p-values were two-sided and a $p < 0.05$ was considered statistical significant.

The sample size required for our study was determined using power analysis as follows: In a preliminary survey, the incidence rate of adverse pregnancy outcomes among patients whose diets adhered to dietary guidelines was 45%, whereas it was 65% for those whose diets did not meet dietary guidelines. For this study, we set α at 0.05 and a power at 90%, with the size of the two groups being 1:1 for a two-sided test. Each group, both exposed and non-exposed, required 96 participants. Accounting for a 10% loss to follow-up, each group would ultimately need at least 106 participants, bringing the total minimum number of participants needed for the study to 212. Additionally, we took into account the effect size observed in similar studies. We enrolled a total of 235 participants.

Results

Characteristics of Participants at Baseline

Table 1 shows the general characteristics of participants, including demographic, health-related, and lifestyle variables. As can be observed, the average age of these 221 GDM patients was 32.5 ±4.51 years. The average gestational age was 25.7 ± 1.07 weeks since it was in the second trimester of pregnancy. The average pre-pregnancy BMI was 23.3 ± 3.59 kg/m^2. Regarding educational background, 48.9% of the participants had attained a level of higher education. In terms of pregnancy history, 46.2% were experiencing their first pregnancy, 45.8% had been pregnant once before, and 8% had been pregnant twice before. Concerning GDM history, 20% of the participants had a history of GDM in a previous pregnancy. Moreover, as for the family history of diabetes, 33.9% indicated its presence within their family. For the dietary

Table 1 Characteristics of Participants at Baseline

Characteristics	Value
Age (years)	32.5±4.51
Gestational age (weeks)	25.7±1.07
Pre-pregnancy Weight (kg)	58.5±9.67
Pre-pregnancy BMI (kg/m2)	23.3±3.59
Gestational Weight Gain (kg)	13.8±3.42
Family history of DM, n (%)	75 (33.9)
History of GDM	44 (20.0)
Education level	
Middle school or below, n (%)	55 (24.9)
High school	58 (26.2)
College or above	108 (48.9)
Gravidity	
1	102 (46.2)
2	101 (45.8)
3	18 (8.0)

(*Continued*)

Table 1 (Continued).

Characteristics	Value
Therapy using Insulin, n (%)	20 (9.0)
Exercised regularly, n (%)	98 (44.3)
Sedentary time (h)	10 (9,11)
Accepted education	
Ever	48 (21.8)
Never	173 (78.2)
Alcohol consumption	
Ever	6 (2.7)
Never	215 (97.3)
Smoking	
Ever	4 (1.8)
Never	217 (98.2)
Frequency of snack consumption	
0	21 (9.5)
1	36 (16.2)
2	76 (34.2)
3	88 (39.6)
Hobby of eating sugary foods	93 (42.1)
Adverse pregnancy outcomes	123 (55.7)
Preterm birth	16 (7.2)
Caesarean delivery	66 (30.0)
Abortion	2 (1.0)
Shoulder dystocia	5 (2.2)
Pre-eclampsia	10 (4.5)
Low birth weight	25 (11.3)
Macrosomia	26 (11.8)

habits, less than 10% of the participants stuck to three meals a day, while a notable 39.6% engaged in snacking throughout the day—one each in the morning, afternoon, and evening. Meanwhile, up to 80% of participants had not received dietary education during pregnancy, with a small percentage reported smoking (1.8%) and alcohol consumption (2.7%) during this period. Additionally, a significant 42.1% showed a preference for sugary foods, such as cakes, candies, and soft drinks. Turning to physical activity, fewer than half the participants exercised regularly. Moreover, sedentary behavior was common, with the average sedentary time reaching 10 hours per day.

Table 2 details a comparison of the nutritional intakes of the participants with the DRIs from China. The recommended dietary energy intake is given according to pre-pregnancy BMI. For participants who were underweight (pre-pregnancy BMI < 18.5), the average energy intake during pregnancy was 2276.7 kcal, which did not differ from the

Table 2 Dietary Intake Comparison with Chinese DRIs

Variable		DRIs	*P*
Energy (kcal)			
Pre-pregnancy BMI< 18.5	2276.7±654.9	2300	0.69
18.5≤Pre-pregnancy BMI<24.0	2272.2±553.6	2100	0.002
Pre-pregnancy BMI≥24.0	2266.0±586.8	1800	<0.001
Protein (%kcal)	19.2±4.2	15~20	0.008
Total fat (%kcal)	37.9±8.0	25~30	<0.001
Protein (g)	107.7±33.7	70	<0.001
Carbohydrate (%kcal)	43.8±9.2	50~60	<0.001
Carbohydrate (g)	77.1±5.2	175	<0.001
Dietary fiber (g)	15.1±6.4	25~30	<0.001
Iron (mg)	22.4±6.4	24	<0.001
Sodium (mg)	1751.7±826.1	1500	<0.001
Calcium (mg)	750.0±291.3	1000	<0.001
Potassium (mg)	2736.2±743.9	2000	<0.001
Zinc (mg)	14.6±5.0	9.5	<0.001
Selenium (mg)	74.3 (54.5,108.5)	65	<0.001
Iodine (μg)	199.1 (184.6,231.1)	230	0.009
Vitamin A (μgRE)	945.6 (717.7,1263.3)	770	<0.001
Vitamin B1 (mg)	1.2±0.5	1.4	<0.001
Vitamin B2 (mg)	1.3±0.4	1.4	0.01
Vitamin B6 (mg)	1.4±0.5	2.2	<0.001
Folate (μgDFE)	279.4 (169.3,399.9)	600	<0.001
Vitamin C (mg)	122.6 (73.9,182.6)	105	<0.001
Vitamin E (mgα-TE)	23.0±8.2	14	<0.001
Vitamin D (μg)	6.6±2.5	10	<0.001

DRIs. Participants with normal pre-pregnancy weight (18.5 ≤ pre-pregnancy BMI<24.0) and with overweight/obese (pre-pregnancy BMI ≥ 24.0) had higher intakes of energy compared to the respective DRIs. For all participants, the percentage of total dietary energy intake from fat, and the average intake of sodium was higher than the respective DRIs, while the percentage of energy intake from carbohydrates, the average intake of dietary fiber, iron, iodine, Vitamin B1, Vitamin B2, Vitamin B6, folate and Vitamin D was lower compared to DRIs. The average intake of potassium, zinc, selenium, Vitamin A, Vitamin C and Vitamin E met the recommendations of DRIs.

In Table 3, participants were divided into two groups according to the presence or absence of adverse pregnancy outcomes, and their nutritional intake was compared. Participants with adverse pregnancy outcomes had a lower percentage of dietary energy intake from carbohydrates, iodine and Vitamin D and had a higher percentage of intake from fat compared to the other group. There were no significant differences in the intakes of other nutrients between the two groups.

Table 3 Dietary Intake According to the Statue of Pregnancy Outcome

Variable	Adverse Pregnancy Outcomes		t/z	P
	not	yes		
Energy, (kcal)	2241.5±559.2	2265.5±580.0	−0.311	0.756
Protein, g	104.1±33.1	110.7±34.0	−1.442	0.151
Protein (%kcal)	18.7±4.3	19.7±4.0	−1.675	0.095
Fat (g)	91.7±31.8	98.5±36.0	−1.469	0.143
Total fat (%kcal)	36.6±7.1	38.8±8.5	−2.076	0.039
Carbohydrates (g)	256.3±75.7	238.5±77.6	1.714	0.088
Carbohydrate (%kcal)	45.9±8.6	42.3±9.4	2.924	0.004
Dietary fiber (g)	15.1±6.1	15.2±6.6	−0.145	0.885
Iron (mg)	22.1±6.3	22.6±6.4	−0.644	0.520
Sodium (mg)	1779.0±745.4	1695.5±795.2	0.797	0.427
Calcium (mg)	722.5±292.3	755.7±290.8	−0.842	0.804
Potassium (mg)	2664.7±697.8	2793.1±776.8	−1.277	0.203
Zinc (mg)	14.3±4.8	14.9±5.1	−0.857	0.393
Selenium (mg)	70.1 (53.9,101.3)	77.0 (53.6,113.6)	−0.874	0.382
Iodine (μg)	208.4 (188.6,249.2)	196.9 (182.4,220.7)	−2.736	0.006
Vitamin A (μgRE)	953.6 (732.9,1149.4)	950.4 (739.2,1400.3)	−0.696	0.487
Vitamin B1 (mg)	1.2±0.5	1.2±0.5	−0.598	0.550
Vitamin B2 (mg)	1.3±0.4	1.3±0.5	−0.276	0.783
Vitamin B6 (mg)	1.4±0.5	1.4±0.5	−0.074	0.941
Folate (μgDFE)	206.1 (158.7,379.8)	300.1 (169.6,425.2)	−1.520	0.129
Vitamin C (mg)	133.3±80.4	135.5±79.1	−0.197	0.844
Vitamin E (mgα-TE)	22.0±7.8	23.8±8.5	−1.602	0.110
Vitamin D (μg)	7.0±2.1	6.2±2.7	2.503	0.006

Table 4 shows the results of univariate and multivariate logistic regression analysis for associations between adverse pregnancy outcomes and dietary intake or general characteristics variables. A total of 40 variables were included in the univariate analysis. There were 8 factors associated with adverse pregnancy outcomes, including the percentage of dietary energy intake from carbohydrates and fats, the intake amounts of iodine and vitamin D, gestational weight gain, exercise, education level, and family history of diabetes. These factors were included in the multivariate logistic regression analysis. The gestational weight gain (OR = 1.12, 95% CI:1.02–1.24) and family history of diabetes (OR = 2.73, 95% CI:1.36–5.48) were associated with increased risk of adverse pregnancy outcomes. Exercise (OR = 0.46, 95% CI:0.23–0.89), the percentage of dietary energy intake from carbohydrates (OR = 0.89, 95% CI:0.83–0.96), the intake of iodine (OR=0.99, 95% CI:0.98–0.99) and Vitamin D (OR = 0.82, 95% CI:0.72–0.94) were associated with a lower risk of adverse pregnancy outcomes, while no significant associations in the multivariate analysis were observed for the percentage of dietary energy intake from fat or education level.

Table 4 Univariate and Multivariate Logistic Regression Analysis of Adverse Pregnancy Outcomes

Variable	Univariate Logistic Regression		Multivariate Logistic Regression	
	OR (95%CI)	*p*	OR (95%CI)	*p*
Carbohydrate (%kcal)	0.96 (0.93,0.99)	0.005	0.89 (0.83,0.96)	0.004
Fat (%kcal)	1.04 (1.00,1.07)	0.040	0.92 (0.85,1.01)	0.083
Iodine	1.0 (0.99.1.00)	0.030	0.99 (0.98,0.99)	0.027
Vitamin D	0.87 (0.81,1.0)	0.050	0.82 (0.72,0.94)	0.005
Weight gain	1.12 (1.03,1.22)	0.008	1.12 (1.02,1.24)	0.015
Exercise	0.57 (0.33,0.98)	0.040	0.46 (0.23,0.89)	0.023
Education level				
Middle school or below	1		1	
High school	2.154 (1.086,4.274)	0.028	1.96 (0.86,4.46)	0.105
College or above	1.032 (0.545,1.955)	0.922	1.00 (0.47,2.15)	0.98
Family history of DM	2.46 (1.36,4.47)	0.003	2.73 (1.36,5.48)	0.005

Discussion

The present study explored the dietary profiles of patients with GDM, compared the results with the Chinese dietary guidelines or DRIs from China and investigated the relationship between maternal dietary intake and pregnancy outcomes, as well as investigated the general and clinical characteristics of the patients. This study found that the dietary intake of participants was not optimal and did not comply with Chinese dietary guidelines or DRIs during pregnancy. The gestational weight gain and family history of diabetes were associated with an increased risk of adverse pregnancy outcomes. Exercise, the percentage of total dietary energy from carbohydrates, and the intake of iodine and Vitamin D were associated with a decreased risk of adverse pregnancy outcomes.

Firstly, total dietary energy intake during the second trimester did not meet the recommendations of DRIs. Dietary energy intake is a major determinant of pregnancy weight gain and achievements of appropriate weight gain can improve pregnancy outcomes. Thus, obese patients with GDM should restrict their caloric intake appropriately. In our study, participants with low pre-pregnancy weight met the requirements of energy intake, while participants with pre-pregnancy normal weight and overweight/obese pregnant women consumed excessive energy compared to the recommendations of DRIs. These findings were consistent with the study of Chang et al (2001)[20] in GDM patients. Nevertheless, we noted that the mean daily energy intake levels of GDM subjects reported by Aleksandra Kozlowska[21] were lower compared to our study. However, it may be difficult to directly compare these results, considering the differences in data collection procedures.

Secondly, the macronutrient distribution also did not meet the recommendations, with a lower percentage of energy from carbohydrates and a higher percentage of energy from fat. The restriction of the carbohydrates intake may lead to the tendency of pregnant women to consume a higher quantity of fat.[22] Several observational studies of patients with GDM reported that the percentage of total calorie intake from carbohydrates was 30% to 60%.[23] Similar to our study, several studies showed that a higher carbohydrate energy ratio was negatively correlated with poor glycemic control and higher carbohydrate intake was associated with decreased incidence of macrosomia. Romon et al[24] used a high-carbohydrate diet to reduce macrosomia and argued that high-fat diets will increase glucose concentrations. Hernandez TL et al[25,26] found that higher-carbohydrate/lower-fat diet would decrease fasting and postprandial glucose, improve maternal insulin resistance and infant adiposity. However, there are studies whose findings contradict ours, such as the research by Huang L,[27] which indicates that high starchy food intake may increase the risk of adverse pregnancy outcomes in non-diabetic pregnant women. It is worth noting that this discrepancy could likely stem from the higher glycemic index (GI) of the staple foods consumed by participants in that region.

These findings underscore the importance of both the quantity and type of carbohydrate intake. It is crucial to guide pregnant women with GDM to maintain an adequate carbohydrate intake, ensuring a minimum of 175 grams of carbohydrates daily.[28] This requirement suggests the need for a low-fat diet to control total energy intake and the selection of staple foods with a low GI. The distribution of carbohydrate intake throughout the day can also be instrumental in preventing postprandial hyperglycemia. Therefore, it is recommended to distribute carbohydrates throughout the day into three main meals and 2–3 snacks.[29] However, in our study, only about 35% of participants consumed 2–3 snacks per day.

Thirdly, the actual intake of micronutrients of the participants in the present study failed to meet the recommendations, which is similar to several previous studies in GDM women or normal glucose tolerance pregnant women,[30–32] even though their total dietary energy intake was adequate. This indicates that the dietary quality of the study participants was not optimal. Some micronutrients are particularly important for GDM women. For example: Vitamin D inadequacy is very common among pregnant women in China.[33] Accumulating evidence has demonstrated that Vitamin D is important not only for bone health, but also for glucose regulation, immune function, and good uterine contractility in labor. Several studies have associated low maternal Vitamin D status with adverse outcomes in pregnancy, including pre-eclampsia, gestational diabetes, preterm births, low birth weight, primary cesarean birth and others.[34,35] Vitamin D supplementation in GDM patients showed a low risk of caesarean section and newborn hospitalization.[35] Hence, efforts to supplement or improve dietary sources of Vitamin D are required to help reduce pregnancy complications. So far, maternal iodine deficiency disorder has affected 20–50% of pregnancies worldwide, including both developing and high-income countries, and many pregnant women still do not intake enough iodine.[36,37] Consistent with this, insufficient intake of iodine for pregnant women was also observed in our study. Iodine deficiency is associated with adverse maternal and fetal outcomes, including preterm birth, low birth weight infants, fetal neuropsychological and cognitive impairments, and increased perinatal morbidity and mortality.[38] Although Xiamen is located in the coastal area, it is speculated that early pregnancy reaction leads to poor appetite and, pregnancy oedema and pregnancy hypertension may limit the intake of iodized salt and result in insufficient dietary iodine intake.

Concomitantly, dietary and adverse pregnancy outcomes are also associated with clinical and lifestyle characteristics, such as family history of diabetes, exercise, and gestational weight gain. In our study, 33.9% of participants had a family history of diabetes, which was associated with a higher incidence of adverse pregnancy outcomes. Similarly, several other studies have also reported that pregnant women with a family history of diabetes are at increased risk of macrosomia, cesarean section, and pre-eclampsia compared with women without a family history of diabetes,[39–41] possibly because the expression of diabetes-related susceptibility genes in pregnant women with a family history of diabetes causes reduced insulin secretion, resulting in elevated glycosylated hemoglobin and induced abnormalities in glucolipid metabolism, which contribute to a variety of pregnancy complications.[42,43]

Physical activity level, like diet, has received much attention as a modifiable risk factor. Regular exercise in this study is defined as exercise at a moderate intensity for 30 minutes per day for at least 5 days per week. Physical activity has beneficial effects on glucose metabolism and insulin sensitivity leading to better glycemic control. Our finding is consistent with several studies showing that regular exercise is associated with reduced adverse pregnancy outcomes (macrosomia, premature birth, cesarean) in GDM pregnant women.[44]

In GDM women, excessive gestational weight gain may further increase the risk of adverse maternal and perinatal outcomes, which was consistent with the present study.[45–47] Excessive gestational weight gain could lead to increased insulin resistance and abnormal distribution of adipose tissue, which further contribute to impaired maternal metabolism and an unhealthy intrauterine environment.[48] However, it is a big challenge for pregnant women to maintain weight gain within the suggested limits.[49] In the present study, 37.9% of the participants were overweight or obese before pregnancy, and 63.6% of them had gained excessive weight gain. This situation might be due to the absence of a specific nutritional education. Up to 78% of participants in our study have never received any nutrition education, which may contribute to the low adherence to dietary guidelines by GDM women and unhealthy lifestyles during pregnancy. Therefore, clinicians and dietitians should improve their strategies to help GDM women reach the most appropriate GWG for them.

Our study had several evident strengths. Firstly, to our knowledge, there has been no study focusing on the dietary intake of Chinese GDM women. The present study is the first study to evaluate the dietary intake of Chinese women with GDM for compliance with dietary guidelines and DRIs. Furthermore, we assessed intake using 24-hour dietary recall on 3 consecutive days, which is considered as the gold standard for determining usual intake.[50] Finally, this study prospectively evaluated the relationship between adverse pregnancy outcomes and dietary intake or other related factors to help identify factors that increase the risk of adverse pregnancy outcomes in GDM women. Therefore, the study is original and clinically and epidemiologically significant. On the other hand, there are limitations to this study that merit consideration. The sample size in this study is relatively small based on pregnant women from a public general hospital, which is a lack of data from the primary hospital. In addition, this study represents observational data which cannot support the establishment of causality.

Conclusion

This study showed that the daily diet of pregnant women with GDM in China did not meet the dietary guidelines or DRIs. These findings demonstrated that low dietary carbohydrate ratio, low intake of Vitamin D and iodine, family history of diabetes, lack of exercise, and high gestational weight gain were associated with increased risk of adverse pregnancy outcomes in pregnant women with GDM. Consequently, there is a strong recommendation for the provision of tailored nutritional education and specific interventions for this population to improve pregnancy outcomes.

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Disclosure

The authors report no conflicts of interest in this work.

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