INTRODUCTION

Maternal diet, and the type and content of carbohydrate in particular, influence maternal blood glucose concentrations (1). Nutritional management plays an important role in glycemic control in diabetic pregnant women in addition to physical activity and insulin therapy. It helps to have a good glycemic control. It should be based on the particular needs of pregnancy and manage the needs of the mother and fetus (2).

Dietary mistakes may be an excessive intake of carbohydrates, a poor distribution of inputs during the day or the week, a completely unstructured diet or an intake miss.

There is strong evidence that hyperglycemia is harmful to the women’s fetus of with diabetes, increasing the risk of pregnancy-related complications (3). Also, excessive energy intake may lead to excessive weight gain that is associated with an increased prevalence of large for gestational age infants and neonatal morbidity (4,5).

The aim of this study was to evaluate dietary behavior in diabetic pregnant women and to determine the main errors especially regarding carbohydrate intake.

Patients and methods

We conducted a retrospective study, including 60 patients, with diabetic pregnancy, hospitalized in the Endocrinology Diabetology department, over a period from January to December 2016.

The data collection was done using a questionnaire to fill out from dietary surveys carried out by dieticians in the service. The questionnaire included items relating to:

- Clinical characteristics: Age, school and economic level, body mass index (BMI), degree of motivation for pregnancy and gestational age.
- Medical characteristics: Diabetes type, its duration and therapeutic scheme.
- Glycemic balance: HbA1c before conception and glycemic control during pregnancy.

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**ABSTRACT**

Introduction: Diabetes in pregnancy is common and need to be treated by a good diet and medication if necessary. Maternal diet, the type and content of carbohydrate in particular, influence maternal blood glucose concentrations. Our study aims to evaluate food consumption behavior in these patients and to determine the main errors.

Methods: We conducted a retrospective study, including 60 patients, with diabetic pregnancy, hospitalized in the EndocrinologyDiabetology department, over a period from January to December 2016.

Results: The study included patients with an average age of 30.4 years. Mean gestational age was 22 weeks of gestation, 26.7% had gestational diabetes and 73.3% pre-gestational diabetes. Correct BMI was found in 21.7% patients, overweight at 33.3% and obesity at 45%. 13.3% of patients were on diet and lifestyle rules and 87.7% were on insulin. Total carbohydrate intake was excessive (>220 g/day) in 41.7%, while it was insufficient (<180 g/day) in 16.7%. For meal distribution, 53.4% had an excessive intake at breakfast, 56.7% had an inadequate intake of dinner and 51.7% took bedtime snack. In qualitative terms, major source of carbohydrates came from starchy foods. Glycemic control was significantly related to the overall carbohydrate intake (p<0.05).

Conclusion: Our study highlights the various dietary errors in terms of the quantity of carbohydrate intake, or their distribution during the day, hence the interest of a targeted dietary education.

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• Dietary survey: Total level of carbohydrates, distribution according to meals, consumption of starchy foods, simple sugars, vegetables, fruits, meat, fish or egg and dairy products per day.

The glycemic control was said to be perfect if more than 70% of the blood glucose levels are in the objective (according to American Diabetes Association guidelines 2017, Fasting blood glucose (FBG) : < or = 0.95 g / l and Post prandial blood glucose (PPG) < or = 1.20 g / l) (6).

All statistical analyzes were performed with SPSS®. For the descriptive part, the means, standard deviations and percentages were calculated to summarize the qualitative variables distributions. Analytical study was done by the Pearson Chi 2 test with a significant p if it was <0.05.

RESULTS

The study included 60 patients with an average age of 30.4 years (18-49). Mean gestational age at the dietary assessment was 22 weeks of gestation (WG) (5-36), 26.7% had gestational diabetes and 73.3% pre-gestational diabetes. A correct BMI was found in 21.7% of patients, an overweight in 33.3% and obesity in 45% which 22.2% was morbid. Among our patients, 13.3% were on diet and lifestyle rules and 87.7% were on insulin, 40% had regular physical activity. The following table represents the main characteristics of the population studied.

<table>
<thead>
<tr>
<th>Clinical characteristic</th>
<th>Average</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle age (years )</td>
<td>30.4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gestational age (WG)</td>
<td>22</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Diabetes type:</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Gestational Diabetes</td>
<td>-</td>
<td>16</td>
<td>26.7%</td>
</tr>
<tr>
<td>Pre-gestational diabetes</td>
<td>-</td>
<td>44</td>
<td>73.3%</td>
</tr>
<tr>
<td>BMI:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct</td>
<td>-</td>
<td>13</td>
<td>21.7%</td>
</tr>
<tr>
<td>overweight</td>
<td>-</td>
<td>20</td>
<td>33.3%</td>
</tr>
<tr>
<td>Morbid obesity</td>
<td>-</td>
<td>27</td>
<td>45%</td>
</tr>
<tr>
<td>Treatment :</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lifestyle and diet</td>
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<td>7</td>
<td>12.3%</td>
</tr>
<tr>
<td>Insulin therapy</td>
<td>-</td>
<td>53</td>
<td>87.7%</td>
</tr>
<tr>
<td>Regular physical activity</td>
<td>-</td>
<td>24</td>
<td>40%</td>
</tr>
</tbody>
</table>

| Table 1 Characteristics of the studied population. 

Glycemic balance recommended in diabetic pregnancy was reached in 42.6% of patients and was significantly related to overall carbohydrate intake (p <0.05).

Food behavior

The total carbohydrate intake was excessive (> 220g / d) in 41.7% of our patients, whereas it was insufficient (<180g / d) in 16.7%, and adequate (180-220) in 41.6%. Figure 1 illustrates the variability of total carbohydrate intake.

Distribution of carbohydrate intake by meal was as follows: 53.4% had an excessive intake of breakfast, while 56.7% had insufficient intake for dinner and 51.7% had adequate intake at lunch. Figure 2 illustrates the distribution of carbohydrate intake by meal.

Regarding snacks, only 6.7% of patients observed 3 snacks daily, 18.3% observed snacks at bedtime, 38.3% had a snack at 10 am and 60% took that of 04 pm. In qualitative perspective, the snack taken at 10am was rich in carbohydrates (> 20g) in 47.8% of cases, for that of 04 pm in 61.1% of cases, and for that of 12 am in 18.18%.

In terms of carbohydrate distribution, the major source of carbohydrates came from starchy foods. In addition, 28.3% of patients continued to consume fast sugars. Only half of the patients consumed vegetables and fruit more than 5 times per day and 46.7% consumed less than two dairy products per day.

DISCUSSION

Dietary advices during pregnancy for a diabetic woman have been significantly modified to be closer to the recommendations of the non-diabetic pregnant woman (7). For healthy pregnant women the acceptable macronutrient distribution ranges for consumption of carbohydrates, protein and fat as a percentage of total energy intakes are estimated to be 45–65% for carbohydrate, 10–35% for protein and 20–35% for fat (3).

It is recommended for diabetic pregnant women to have an intake between 180-220g/d divided into 3 meals and 3 snacks to minimize all metabolic fluctuations including hyperglycemic postprandial peaks, hypoglycemia at a distance from meals (especially late morning, afternoon or night), lipolysis and accelerated ketone production during nights (8,9). Moreover, the interest of food fractionation remains debated (2,10).

In our study the main dietary anomaly found is excessive carbohydrate intake.

In addition, the optimal carbohydrate distribution is 10–15% at breakfast, 30% at lunch and at dinner, and the remaining...
divided into 2–4 snacks (2, 8). Also, some studies showed that the highest plasma glucose during the day for pregnant women with diabetes is seen after breakfast. This relative intolerance is explained by increased levels of hormone of human placental lactogens, progesterone, prolactin and cortisol, and the net-result is an increased insulin resistance in the morning (11). With this background, a limitation in the amount of carbohydrate taken at breakfast is recommended to prevent postprandial hyperglycemia.

In our patients, excessive carbohydrate intake is mainly at the breakfast meal and the snack of 04 pm. It is insufficient at the meal of the dinner. Low calorie diets are not recommended because they lead to weight loss and significant ketosis (12, 13). However, some studies showed that a carbohydrate intake reduced to 40% or 35% of calories (moderate to low carbohydrate diet) met the needs of pregnancy with fewer cases of postprandial hyperglycemia in women with gestational diabetes and type 2 during pregnancy (14,15). A caloric restriction of 1600 kcal/d is indicated in case of obesity and in the absence of acetonuria, and given these risks, must be taken into consideration (9). In our patients, insufficient carbohydrate intake was found in 16.7% of patients.

Quantifying carbohydrate intake helps control postprandial glucose levels (12, 13). However, studies showing the influence of the proportion of carbohydrate in meals on postprandial glucose are few and small (16). In our study, the glycemic objectives recommended during a diabetic pregnancy was reached in 42.6% of the patients, and was significantly related to the overall carbohydrate intake (p <0.05).

Besides the amount of carbohydrate ingested, also the type and amount of dietary fibers affects the postprandial blood glucose level and the glycemic control (17, 18). In our study, fiber source consumption was inadequate. The practice of a regular physical activity improves insulin sensitivity and postprandial blood glucose. It is recommended during pregnancy, apart from contraindications (2). In our study, regular physical activity was performed in 40% of patients, and was not significantly related to glycemic control.

The consumption of saccharose during a diabetic diet remains controversial, traditionally it is excluded from the diet. It may however be consumed occasionally in small amounts during a meal preferably high in fiber (12, 13). For our patients, 28.3% of them continued to consume fast sugars, especially those rich in sucrose.

**CONCLUSION**

The recommended carbohydrate intake for diabetic pregnant women is between 180–220g/d divided into 3 meals and 3 snacks to minimize any metabolic fluctuation. Our study highlights the various dietary errors in terms of the quantity of carbohydrate intake, or their distribution during the day, hence the interest of a targeted dietary education in order to obtain an optimal glycemic control.

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**References**