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Gestational Diabetes Diet: Alternative Approaches

Yılmaz E and Öztürk Altuncevahir I*

Nutrition and Dietetics, Bahcesehir University, Turkey

***Correspondence:** İlayda Öztürk Altuncevahir, Nutrition and Dietetics, Bahcesehir University, Turkey

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Abstract

Obesity and type 2 diabetes, which is rapidly increasing prevalence worldwide, are the most common subunits and potential risk factors for gestational diabetes mellitus (GDM). The diet plan is very important in the treatment of diabetes, but it has more importance during pregnancy due to fetal and maternal outcomes. Those patients who suffer from GDM need to have a well-planned diet plan and consultations with a dietitian to learn how to feed themselves during this period. This review emphasizes the effects of diet types on GDM. Most suggested diet types are low glycemic index (GI), low carbohydrate intake, calorie-restricted diet, and Mediterranean diet (MD). They all have specific, individualized points to apply and are effective in GDM treatment. Lastly, when a healthy diet plan and well-done consultation are mixed, the patient will start a new life with a healthy body and baby. The most important macronutrient in diabetes, carbohydrates, was clearly described in the study. The study aimed to investigate the beneficial diet types for GDM.

Keywords: gestational diabetes, pregnancy, diet, carbohydrate, insulin resistance

Abbreviations: GDM: gestational diabetes mellitus; GI: glycemic index; BMI: body mass index; HF: high fiber; LGA: large for gestational age; LCD: low carbohydrate diet; SAM: S-adenosyl methionine; MD: Mediterranean diet

Introduction

Pregnancy is a unique duration for both women and offspring, and requirements must be re-arranged through new conditions. Gestational diabetes mellitus (GDM) is a common disease in pregnant women. According to a study, 18% of pregnant women suffer from GDM. Rising numbers of obesity and type 2 diabetes mellitus directly affect GDM and the potential risks of GDM. GDM may also turn into overweight or obesity for offspring in the future. GDM can be prevented within pre-pregnancy, solution criteria such as < 25 kg/m^2 body mass index (BMI). According to the same study, 46.4% of GDM patients were obese or overweight before pregnancy. Higher childbearing age is another important co-factor to trigger GDM. GDM may result in large for gestational age (LGA), neonatal hypoglycemia,

neonatal adiposity, jaundice, and birth trauma [1]. Some authorities, the American Diabetes Association (ADA), the Academy of Nutrition and Dietetics, and the Canadian Diabetes Association (CDA), stated that weight gain should not be avoided during pregnancy. Overweight and obese women may slow down the weight gain process, but losing weight during pregnancy has no suggestion because of the health conditions of the maternal and fetus and to prevent ketosis. Diet plans should be arranged by experts, and changed requirements through pregnancy should be analyzed. Consultation should include nutrition education to express the importance of therapy and increase awareness. Medical nutritional therapy is also beneficial for the fetus and provides adequate growth [2, 3]. Different diet types may have different results for GDM. Thus, every GDM patient needs individualized medical nutritional therapy. This study aimed to investigate the optimal dietary approaches to prevent GDM consequences.

Different Dietary Approaches for Gestational Diabetes Mellitus

Low-glycemic index diet

Arranging maternal blood glucose levels is the first step in the treatment of GDM. Determining the carbohydrate groups to consume for GDM is more important than carbohydrate restriction [4, 5] because the lower absorption and digestion rate of carbohydrates have beneficial effects on blood glucose levels. A study made the comparison between high/normal *vs.* low glycemic index (GI) level foods, and results showed that the consumption of the same amount of carbohydrates with low GI level has different effects and low GI level may lead to a reduction in the postprandial glucose level in healthy individuals [4]. This difference between low GI and high GI is the same for no pregnancies [6]. Therefore, low GI may present a different way of treatment without restricting carbohydrates. Also, the Canadian Diabetes Association states that a low GI diet can be a good option in diabetes treatment and has other beneficial effects such as improved weight management, better heart health conditions, and developed satiety [7]. Moses et al. [8] claimed that a high GI diet is inclined to commence insulin when compared to a low GI diet (high GI 59% *vs.* low GI 29%). In the same study, 47% of the high GI group, who had insulin usage commence, changed the diet type to low GI, but there were no reported differences in fetal and obstetric outcomes [8]. In a study held in China, investigators aimed to analyze GDM patients who have 20–21 kg/m^2 BMI values. One of the groups has a low GI diet, while the other has a routine, daily diet plan. A critically important amount of difference has been reported in postprandial plasma glucose levels through passed time. The low GI group decreased by 19–22%, while the high GI group decreased by 7–12%. The total energy and carbohydrate amount of groups were constant. Also, the authors suggest that a low GI diet improves postprandial glucose levels and reduces infant birthweight [9].

A very low carbohydrate diet (LCD) (< 20 g carbohydrates/day) is rigidly restricted. That amount of restriction affects insulin metabolism. Insulin metabolism is altered when rigid carbohydrate restriction and high-fat consumption are combined. Thus, insulin levels cannot demand the preventing lipolysis levels and free fatty acid (FFA) levels have been increased in plasma [10]. Additionally, another study says that a low carbohydrate, high animal fat, and protein-sourced diet leads to turning GDM into type 2 diabetes mellitus after pregnancy [11]. Viana et al. [12] analyzed 9 randomized trials, and the review says that there has been no difference in insulin use, number of cesareans, or risk for macrosomia between the energy restriction diet, LCD, and low GI diet. Also, another study reviewed 19 trials and found no neonatal outcomes due to the dietary pattern of the mother [13].

Kizirian et al. [14] conducted a study that included 139 women at high risk for GDM (14–20 weeks of pregnancy). 72 women are in the first group with a low GI diet (50 GI target), and 67 women in the second group with a moderate GI (60 GI target) and high dietary fiber diet. At the 36th week, there were no differences in glycosylated hemoglobin (HbA1C), lipids, birth weight, or fat ratio in infants between groups. In the subsequent prospective study, the low GI group had lower length and lower birth weight when compared to the high fiber (HF) group. However, both group's babies had no big differences when they reached 1 year of age.

The Australian Longitudinal Study on Women's Health has made a study which aimed to discuss carbohydrate quality and carbohydrate amount importance in the diet. 3607 women aged 25–30 years participated, and their diet routines were followed for 10 years. Results show that low carbohydrate amount in diet mostly refers to high fat and protein

intake, and low carbohydrate intake was associated with GDM. The same authority stated that a HF diet reduces the risk of GDM by 33%. Lastly, it has been suggested that fruits, as carbohydrate sources, negatively correlated with GDM, and high amounts of cereals intake as a risk factor for GDM. Thus, the suggestion is glycemic load, GI, carbohydrate type, and carbohydrate amounts are all bounded to GDM [15].

In a different study, subjects aged between 18 and 45 were diagnosed with GDM after a 75 g oral glucose tolerance test (OGTT) at 20–32 weeks of gestation. GDM diagnosis criteria was based on the Australasian Diabetes in Pregnancy Society (ADIPS). Subjects were divided into two groups and were classified by their healthy diet type. At the end of the study, the low GI diet group had a lower GI and glycemic load when compared to the HF group. Fat, fiber, calcium, iron, zinc, and folate intake significantly increased in the low GI group. Only the low GI group has reduced the GI rates. The HF group has no changes. Weight gain comparison between groups was evaluated, and HF is inclined to weight gain more than the low GI group [16]. Results showed that there is no big fetal outcome difference between groups. Also, both groups have lower GI levels than the population's general diet. In another Australian study, low GI and HF are associated with lower LGA prevalence (9% *vs.* 22%), macrosomia (4% *vs.* 21%), and emergency cesarean section (16% *vs.* 20%) [17]. The authority suggests that both types of diet (HF or low GI) have beneficial effects on GDM. Women within normal weight range (< 25 kg/m^2) can have more benefits through diet when compared to overweight or obese [18].

Low carbohydrate diet

A low carbohydrate diet (LCD) means total diet's 35–45% of energy comes from carbohydrates [19]. A LCD may help to reduce hyperglycemia, support fetal health, and prevent overgrowth and fetal glucose exposure [19, 20]. The control of the consumption amounts of carbohydrates does not mean that it turns into a healthier response. Carbohydrate types should be arranged. Healthy food choices, portion control, and different cooking techniques are other beneficial criteria [1]. Carbohydrate distribution has no clear information about how it affects glucose levels. Breakfast's carbohydrate levels should not be under 15 g because of peaked cortisol levels in the morning [21].

According to a study that aimed to try foods and mixed foods, which especially includes carbohydrates, investigators measured participants' 1 h postprandial glucose levels and aimed to achieve < 7.8 mmol/L. Mixed meals have an effect on blood glucose levels *via* their carbohydrate amount [22]. Also, other investigators claimed that postprandial hyperglycemia was associated with infant size [23]. These investigators also suggest that less than 42% of carbohydrate/total energy consumption may lead to a decrease or avoid insulin medication requirements for patients. The results say 42% of carbohydrates may cause lower postprandial glucose and reduce the risk of LGA, macrosomia, and cesarean section [23].

In a study, 18–45-year-old women diagnosed with GDM participated. National Diabetes and Pregnancy Clinical Guidelines were followed in the diagnosis procedure. All women have a glucose meter, so self-monitoring for glucose levels was available. The patient's energy requirements were calculated through pre-gestation weight (min 1800 kcal/day). The study included two groups, and both groups had the same amount of protein (20%). Carbohydrate amounts are 40% in LCD and 55% in the control group, and fat amounts are 40% in LCD and 25% in the control group, mainly olive oil intake has increased. Carbohydrate distribution is planned, and contravening is strictly forbidden. Carbohydrate distribution is re-planned if the patient needs insulin usage [24, 25]. The results show that there are no big differences between the normal diet *vs.* LCD for insulin treatment and the starting time of insulin usage treatment. According to Louie et al. [26], a low GI diet is more beneficial than a LCD, especially for obese and overweight women. A LCD may lead to a lower intake of energy than the optimal range and cause gestational weight loss or a low amount of weight gain during pregnancy. Thus, it may cause malnutrition in fetal and maternal. A LCD may cause lower gestational weight gain but also provides healing for the GDM consequences that occur due to obese or overweight conditions. Authority says that 40% carbohydrate consumption has no big difference in insulin requirement when compared to 55% carbohydrate consumption in the same population [27].

Caloric restriction diet

The caloric restriction diet is a well-known type in the treatment of diabetes. The caloric restriction diet should be followed by expert and monitoring the blood values and analysis should be checked [2]. The wrong way of caloric restriction and high-fat consumption leads to maternal ketosis [28]. Also, the restriction has to be calculated through gestational weight gain and new requirements of the mother to sustain better health for the mother and prevent fetal development alterations [1, 29].

Two randomized trial says that a moderate level of calorie restriction improves glycemic control, and the calorie restriction should be planned properly to prevent maternal ketosis and make fetal growth conditions better in obese and overweight diabetic/GDM mothers [2]. Additionally, severe caloric restriction provides better glycemic control but, at the same time, provides ketonuria [1, 30]. According to a study held by Viana et al. [12], results show that there is no difference in macrosomia, cesarean, and neonatal hypoglycemia. Han et al. [13] found that calorie restriction has no beneficial effects on perinatal outcomes. According to an experimental study, results show that 20% caloric restriction does not cause lower offspring size, lower birth weight, and delayed development. The expert should have to take action for malnutrition through caloric restriction *via* supplements if required [31]. An animal study showed that plasma choline, betaine, and S-adenosyl methionine (SAM) levels were reduced with a 50% calorie-restricted diet. The reduction amounts were 40%, 45%, and 20% respectively. Choline is one of the most important parts of the regulation of cell division and fetal development [32]. SAM is a donor to methyltransferase metabolism to obtain S-adenosyl-homocysteine, which converts to homocysteine and helps methylation metabolism reactions [33]. These results show that the redundant calorie restriction leads to reduced birth weight, increased risk for cognitive dysfunction, and may result in malnutrition [34].

The Mediterranean diet

The Mediterranean diet (MD) is mainly known for higher consumption of vegetables, fruits, nuts, seeds, and legumes. The animal-based protein source consumption is rarer than in previously mentioned groups. Consumption amounts are classified as a moderate number of fish and poultry and limited amounts of dairy products, red meat, processed meat, and refined sugars. This diet has beneficial effects, improves GI quality, and has high amounts of antioxidants due to vegetable/fruit content [35, 36]. The MD has other beneficial effects, such as satiety, decreased insulin sensitivity, and increased insulin secretion [37]. Also, plant-based diets serve you much of antioxidants due to their content. That much antioxidant intake is beneficial for increasing inflammatory markers with GDM [38].

The MD should not be judged as only beneficial for pregnancy. It improves cardiovascular health, reduces the risk of diabetes, increases the GI quality, and prevents obesity. The MD benefits for GDM but still need more studies [39]. The St. Carlos GDM Prevention Study has been planned with 874 pregnant women and aimed to clarify the efficacy of the early phase (8–12 weeks gestation) of the MD in GDM. Experts found that the MD reduces the GDM numbers and decreases perinatal outcomes such as insulin-treatment GDM, cesarean, perineal trauma, small for gestational age, and LGA [40]. Another study compared GDM and normal glucose tolerance levels in women, and the results show that there is no big difference, especially in excessive weight gain, pregnancy-based hypertension, perineal trauma, and LGA [40].

There is a study made in Virgen de las Nieves University Hospital of Granada, in Spain. The participants were evaluated as older than 18 years, had a lower risk of being pregnant, and had type 1 or 2 diabetes or insulin resistance in the pre-pregnancy era. Smokers were determined who smoked at least 1 cigarette/day for the last 6 months, and education levels of women were collected and classified into groups ranging from lower to higher education levels. BMI values were calculated individually and grouped according to the World Health Organization (WHO) suggestions; + 30 kg/m^2 is classified as obese, and 25–30 kg/m^2 is classified as overweight. Blood glucose level tests were applied as emphasized in previous information and as found in the guidelines [41]. 291 participants had GDM and 1175 participants who did not have GDM completed the whole process of the study. The average age was higher in cases compared to the control group, and the average BMI score was higher in cases compared to the control group.

Legume consumption was somewhat similar for both groups. Each dietary component value was collected to analyze the adherence to the MD diet, and only a big difference was found in the meat and derivatives consumption scale [42]. The results showed that the amount of adherence to the MD is strongly associated with preventing GDM. Also, the prevention amount is increasing directly within increasing adherence to the diet. Also, researchers claimed that the lower consumption of meat and derivatives is related to delaying or preventing GDM development. This study includes different parts of Spain, thus there are different lifestyles included in the results. The study also includes differences between cases and control groups, and global health guideline procedures and Spain's health procedures were applied to them to obtain clear results. This study ranges from the dietary routines of mothers to physiological changes during the pre-pregnancy and pregnancy era and how they affect diet. The health effects of the MD on GDM were not designated to one specific dietary pattern. Mediterranean dietary patterns were analyzed in each, but the big differenced result was not collected by themselves, but, when you combine them as a total diet, the results are clarifying in last. Also, the meat group effect is clearly seen in the results by itself. According to Schoenaker et al. [43], the consumption of meat, sandwiches, and sweets is associated with a greater risk for GDM. Other studies support the emphasized suggestion that meat consumption increases GDM and diabetes mellitus development. The last suggestion was that the MD should be provided during pre-pregnancy, and a professional dietary plan should be planned by experts [42].

Conclusion

Obesity and overweight are two major potential risk factors for getting diagnosed with GDM. Different dietary approaches have been published to prevent the increasing GDM rates. Pre-pregnancy BMI is a critical parameter to analyze the pregnancy weight and GDM condition for each individual. Different techniques have been used to diagnose patients with GDM. Also, well-known authorities have published suggestions for women who might have a risk of getting diagnosed with GDM to prevent it in the early phase. Optimum blood glucose levels were served to examine the situation and diagnosis criteria for everyone. Different diet types have been suggested to prevent GDM and the consequences of disease and sustain better health conditions for both mother and offspring. Different diet types were compared to reach the best diet plan for GDM treatment, but more information is required to claim that. Even though it is very important to consider the potential risks of each of them, this review results show that specific diet types, especially the MD, low GI, and LCD, may be beneficial for GDM treatment.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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