

Case Report



In-depth Medical Nutrition Therapy for a Woman with Diabetes: From Pregnancy to Delivery

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Conflict of Interest

The authors declare that they have no competing interests.

ABSTRACT

Diabetes in pregnancy is associated with higher rates of miscarriage, pre-eclampsia, preterm labor, and fetal malformation. To prevent these obstetric and perinatal complications, women with diabetes have to control levels of blood sugar, both prior to and during pregnancy. Thus, individualized medical nutrition therapy for each stage of pregnancy is essential. We provided in-depth medical nutrition therapy to a 38-year-old pregnant woman with diabetes at all stages of pregnancy up to delivery. She underwent radiation therapy after surgery for breast cancer and was diagnosed with diabetes. At the time of diagnosis, her glycated hemoglobin level was 8.3% and she was planning her pregnancy. She started taking an oral hypoglycemic agent and received education regarding the management of diabetes and preconception care. She became pregnant while maintaining a glycated hemoglobin level of less than 6%. We provided education program for diabetes management during the pregnancy, together with insulin therapy. She experienced weight loss and ketones were detected; furthermore, she was taking in less than the recommended amount of foods for the regulation of blood sugar levels. By giving emotional support, we continued the counseling and achieved not only glycemic control but also instilled an appreciation of the importance of appropriate weight gain and coping with difficulties. Through careful diabetes management, the woman had a successful outcome for her pregnancy, other than entering preterm labor at 34 weeks. This study implicated that the important things in medical nutrition therapy for pregnant women with diabetes are frequent follow-up care and emotional approach through the pregnancy process.

Keywords: Diabetes in pregnancy; Individualized medical nutrition therapy; Ketones; Glucose control

INTRODUCTION

Pregnancy is associated with changes in insulin sensitivity, which may in turn lead to changes in plasma glucose levels. For women with diabetes, or those who are developing diabetes during their pregnancy, these changes can contribute to outcomes with risk [1]. Diabetes in pregnancy is associated with higher rates of miscarriage, pre-eclampsia, preterm labor, and fetal malformation [2].

Author Contributions

All the authors read, commented on, and contributed to the submitted manuscript. The research proposal was registered by Dal Lae Ju and nutrition counseling was performed by Miyoung Jang and MeeRa Kweon. The manuscript was written by Miyoung Jang and finalized by Dal Lae Ju and Misun Park.

The risks can be minimized by optimal glycemic control, both prior to and throughout the pregnancy [3,4]. It is achieved throughout comprehensive preconception care including other factors such as genetic risks, health status, reproductive history, exposure to environmental toxins, and immunization, in addition to lifestyle risk factors [5]. It can also be addressed through a multidisciplinary approach to community-based management of diabetes before and during pregnancy [6].

Women with pre-existing diabetes who are planning pregnancy or who have become pregnant should receive counseling on preconception care that highlights the importance of glycemic control targeting a level as close to normal as is safely possible (ideally A1c < 6.5%) to reduce the risk of congenital anomalies [7,8]. Fasting, pre-prandial and postprandial self-monitoring of blood glucose (SMBG), are recommended in both of gestational diabetes mellitus and pregestational diabetes in pregnancy to achieve glycemic control [7].

The purpose of this case report is to share our experience of delivering medical nutrition therapy to pregnant woman with diabetes. This case report was approved, and the requirement for informed consent waived, by the Institutional Review Board of the Seoul National University College of Medicine (H-1609-009-789).

CASE

First visit

In August 2014, a 38-year-old woman visited our nutrition care center. She had undergone radiation therapy after surgery for breast cancer and was diagnosed with diabetes. She wanted to become pregnant and decided to receive hormone therapy later. Her A1c value was 8.3% and the fasting glucose sugar level was 175 mg/dL. She started taking an oral hypoglycemic agent, metformin (500 mg per day), and was referred for diabetes education.

She was 153 cm in height and 60 kg in weight (body mass index [BMI] = 25.6 kg/m²). She had an irregular diet pattern including having all meals at once. She preferred noodles and rice and drank beer frequently. She had tried several regimens for weight-loss, but any weight loss did not sustained for a long time. Her usual energy intake was approximately 1,774 kcal/day. Her carbohydrate intake was irregular due to a lack of knowledge about diet therapy for diabetes, as evidenced by an A1c value of 8.3%, and the patient's report of irregular diet pattern and preference for noodles. We provided a nutrition intervention by formulating a meal plan with the recommended number of calories, and providing information on cooking methods and appropriate snacks. We also recommended to limit alcohol intake with regular exercise and educated the patient regarding pre-conception care of diabetes.

Second visit

In August 2015, the patient attended the clinic center for the second time. She had maintained an A1c value with less than 6%. She tried to become pregnant and was successful. She requested diabetes education at a gestational age of 6 weeks and her medication was discontinued. She was 59 kg in weight, giving a BMI of 25.2 kg/m². The patient's A1c value was 5.4%. She has reduced not only the intake of energy and carbohydrate but also the consumption frequency of noodles and alcohol after receiving nutrition counseling a year ago. Through these efforts and drug therapy, her blood glucose level has been kept near normal. But, she had reduced her carbohydrate intake excessively; she often did not have

breakfast and sometimes ate only meat and vegetables without carbohydrate containing foods. Her usual energy intake was 1,474 kcal/day; carbohydrates accounted for less than 45% of her total energy intake. We determined that her carbohydrate intake was inadequate. We provided a daily menu comprising three meals and three snacks to control blood sugar without producing ketones. We explained that morning urine ketone testing would be helpful to determine whether she was consuming adequate calories and carbohydrate to ensure optimal growth and development of her baby. Also, we explained the need for frequent SMBG and the impact of the relationship between food intake and physical activity on blood glucose level.

Third visit

After 2 weeks (i.e., at 8 weeks of gestation), she visited the clinic center again. Her 1-hour postprandial glucose level was elevated to 140–200 mg/dL. Urine ketone test results were 1 positive on three mornings over a 2-week period. She had reduced her carbohydrate intake to regulate her blood sugar and performed 1 hour of exercise after every meal. She consumed snacks at night irregularly. She started insulin therapy; i.e., 4 units of Humalog (insulin lispro) before each meal. We educated her on the importance of appropriate carbohydrate intake and regular night snacks for prevention of ketones on insulin therapy during pregnancy. We recommended reducing exercise to 30 minutes after every meal.

Fourth visit

After 2 weeks, the patient visited us again (i.e., at 10 weeks of gestation). She had bad morning sickness that reduced her appetite markedly. In addition, she was attempting to reduce her carbohydrate intake so as not to increase her insulin dose. Her body weight had decreased by 1.5 kg during the past 2 weeks and by more than 2.5 kg compared to the pre-pregnancy value. Ketonuria was still evident, and her urine was darker. Her energy intake was approximately 930 kcal per day, 70% of the required level. After being noticed that ketones were still detected, she expressed worries regarding their impact on the fetus. We counseled the patient on appropriate energy intake and provided the recipe with cooking direction to increase caloric density. We educated food exchange models, especially carbohydrate containing foods. Also, we provided emotional support to alleviate her sense of uneasiness.

Fifth visit

After a further 2 weeks, the patient revisited the clinic center (i.e., at 12 weeks of gestation). Her carbohydrate intake had increased as she was now consuming bread, pasta, rice cakes, and cereal instead of rice. The frequency of ketone detection had also decreased.

Her body weight was 58.4 kg. When her morning fasting blood glucose level was high, the insulin lispro dose was increased by 2 units. After 12 weeks of gestation, her nutrition requirements had increased. We repeated the education component of the therapy, adjusted her meal plan and encouraged to increase her energy intake.

Sixth visit

The patient visited the clinic center at 32 weeks of gestation. Her morning fasting blood glucose level was maintained at 95–105 mg/dL. Therefore, 4 units of humulin N were added to her medication, to be taken at night. The patient's body weight was 66.9 kg, which represented a 7.9 kg increase over the course of her pregnancy. Based on Institute of Medicine (IOM) guidelines, her weight gain during pregnancy was appropriate [9]. Her energy intake was adequate, and urine ketone tests were negative. We consulted the diet tips that meet the demand for the third trimester of pregnancy and night snacks to prevent hypoglycemia or urine ketone.

Table 1. Summary of visits

| Visit | #1 | #2 | #3 | #4 | #5 | #6 | #7 |
|------------------------------------|---|-------------------------------------|-------------------------------------|---|--|---|--|
| Period, wk | Preconception | GA 6 | GA 8 | GA 10 | GA 12 | GA 32 | After delivery |
| Energy intake, kcal | 1,774 | 1,474 | 1,430 | 930 | 1,702 | 2,020 | 1,500 |
| Weight, kg | 60.0 | 59.0 | 58.0 | 56.5 | 58.4 | 66.9 | 67.3 |
| Weight change during pregnancy, kg | - | - | -1 | -2.5 | -0.7 | 7.9 | 8.3 |
| Urine ketones | - | - | Negative-1+ | 1+-2+ | Negative-trace | Negative | - |
| A1c, % | 8.3 | 5.4 | 5.5 | - | - | 5.2 | - |
| SMBG | - | - | FBS < 95 mg/dL PP1 140-200 mg/dL | FBS < 95 mg/dL PP1 < 140 mg/dL | FBS < 95 mg/dL PP1 < 140 mg/dL | FBS 95-105 mg/dL PP1 < 140 mg/dL | Normal range |
| Nutrition interventionw | Education for diabetes and preconception care | Education for diabetes in pregnancy | Diet plan on insulin therapy | Education for weight gain without producing ketones | Increased energy requirement of +340 kcal/day (second trimester) | Increased energy requirement of +450 kcal/day (third trimester) | Rearrangement energy requirement +320 kcal/day (breast feeding), education for postpartum care |

GA, gestational age; SMBG, self-monitoring of blood glucose; FBS, fasting blood sugar; PP1, postprandial 1 hour.

Seventh visit

The patient gave birth to a male infant weighing 2.5 kg, after entering preterm labor at 34 weeks. Glycemic control was good at the time of birth (glycated hemoglobin = 5.2%), and overall weight gain during pregnancy was in the normal range, at 8.3%. Furthermore, no ketones were detected in her urine. After the birth, the patient's medication was changed into oral hypoglycemic agents and her blood sugar level was maintained within the normal range. She planned to breastfeed her baby and requested information on dietary management strategies to achieve a healthy weight and control her diabetes. We educated the patient on the energy and protein intake requirements for breastfeeding and encouraged SMBG.

A summary of the parameters recorded during the seven visits is provided in **Table 1**.

DISCUSSION

This case study focuses on medical nutrition therapy provided to a woman with diabetes from pregnancy to delivery. The patient achieved close to normal glucose levels through effective preconception counseling and had a successful pregnancy. Furthermore, glycemic control during pregnancy was good, with daily insulin therapy and glucose monitoring.

In addition to monitoring blood sugar, pregnant women with diabetes also have to monitor for ketones in the urine [10]. Our patient had difficulty in reducing the production of ketones during her pregnancy. Ketones are produced when the body catabolizes stored or ingested fat for energy, which occurs when an insufficient quantity of carbohydrate is consumed. The patient decreased her carbohydrate intake to reduce the frequency of insulin injections and the insulin dose. Moreover, her carbohydrate intake was insufficient due to morning sickness. The patient became cognizant of the importance of adequate carbohydrate after receiving counseling from a dietitian, and so the problem was overcome.

A meal plan based on each individual's needs is one of the most important elements of treatment for patients with diabetes. The meal plan should ensure that the adequate proportions of carbohydrates, protein, fat, vitamins, and minerals, which are needed for diabetes care and healthy pregnancy, are delivered. Dietitians with knowledge of the effects

of various foods on diabetes patients should assist with developing meal plans based on the individual needs of the patient [10]. We formed an intimate relationship with our patient during seven nutrition consultations and thus were able to provide an appropriate meal plan and level of emotional support.

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