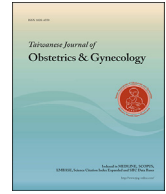




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Original Article

Medical nutrition therapy for pregnant women with gestational diabetes mellitus—A retrospective cohort study

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ABSTRACT

Objective: Women diagnosed with gestational diabetes mellitus (GDM) remain at high risk of developing type 2 diabetes mellitus in the future. The effectiveness of medical nutrition therapy (MNT) acting on GDM is increasingly becoming noteworthy.**Materials and Methods:** A retrospective cohort study involving 488 GDM cases was conducted. The prepregnancy weight, weight changes during pregnancy, glucose levels, GDM management, follow-up, and birth outcomes were recorded from 2008 to 2012.**Results:** Overall, 62.91% of the women received MNT, with an increasing trend from 2008 to 2012 ($p < 0.01$). The fasting plasma glucose, 2-hour blood glucose, and weight gain at 28 weeks, 32 weeks, and 36 weeks as well as intrapartum were lower in the MNT group than in the non-MNT group. Total weight gain during pregnancy and the rates of adverse events during pregnancy were lower in the MNT group compared to the non-MNT group (all $p < 0.05$). Moreover, 92.2% of the participants in the MNT group had a normal oral glucose tolerance test result, and the rate of exclusive breastfeeding within 4 months after delivery was 54.4% in the MNT group; both were higher than those of the non-MNT group (66.3%, $p < 0.001$; 29.3%, $p < 0.05$).**Conclusion:** MNT can reduce the incidence of pregnancy complications, increase the exclusive breastfeeding rate, and improve pregnancy outcomes.Copyright © 2016, Taiwan Association of Obstetrics & Gynecology. Published by Elsevier Taiwan LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Gestational diabetes mellitus (GDM) is defined as glucose intolerance that is first detected during pregnancy. Shortly after delivery, glucose homeostasis is restored to nonpregnancy levels, but women diagnosed with GDM remain at high risk of developing type 2 diabetes mellitus (T2DM) in the future [1]. The association between GDM and T2DM is important for the elucidation of the causes of these disorders, and for the prediction

and possible prevention or delay of T2DM in women. GDM has a negative impact on pregnant women as well as fetal and neonatal development. GDM causes maternal polyhydramnios, pregnancy-induced hypertension syndrome, fetal macrosomia, deformities, and stillbirths. GDM is also linked to apnea syndrome, hypoglycemia, hypocalcemia, and polycythemia in newborns. Long-term exposure to intrauterine hyperglycemia increases the risks of obesity, diabetes, and other metabolic syndromes in children [2]. Studies show that by managing blood sugar during pregnancy, short- and long-term outcomes for the mother and children can be significantly improved [3]. A number of known risk factors for GDM have become increasingly prevalent among pregnant Chinese women: the average age of pregnant women is increasing,

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and according to the Nutrition and Health Status Survey of Residents in China, carried out in 2002, the prevalence of overweight and obesity rose 39% and 97%, respectively, compared to the results of the previous survey conducted in 1992 [2]. Excessive body weight gain during pregnancy is an independent risk factor for GDM.

Medical nutrition therapy (MNT) is a key tool to manage GDM and can positively influence pregnancy outcomes of mother and child health [4,5]. The clinical manifestations of GDM are most apparent during the mid and third trimesters of pregnancy and include abnormally high blood glucose, and even diabetic ketoacidosis [6,7]. In this stage, maternal nutritional needs reach their peak, and the contradiction between glucose control and nutritional needs is most pronounced [8]. MNT to manage GDM is designed to guarantee nutritional needs during pregnancy while achieving acceptable glucose control [9,10].

The *China Medical Nutrition Therapy Guidelines for Diabetes (2010)* [11], edited by the Chinese Diabetes Society and the China Medicine Doctor Association Nutrition Doctor Specialized Committee, is the first diabetes MNT guideline published in China. It focuses on evidence-based MNT, dietary recommendations, MNT of diabetic complications, MNT workflow, and personalized MNT programs for special situations, such as GDM, children with diabetes, and diabetes among the elderly.

A few studies about the status and effectiveness of MNT to manage GDM in China had been published. We reviewed the experience with regard to diagnosis of GDM and its management through MNT among high-risk pregnant women in a hospital in Beijing, China, in the period 2008–2012. We focused on pregnant women's weight changes, blood glucose monitoring results, adverse events during pregnancy, pregnancy outcomes, infant feeding, and postpartum prognosis. The findings were then discussed with a view to establish a more rational and effective prenatal care model.

Methods

Study site, participants, and definitions

The retrospective cohort study focused on the register of high-risk pregnancies, which was managed by the associated Department of Clinical Nutrition and Obstetrics of the China–Japan Friendship Hospital (Beijing, China) during 2008–2012. The study participants were high-risk pregnant women with GDM (a singleton fetus), who had undergone regular pregnancy examination and have delivered a live-born baby. Women who had a history of adverse pregnancy outcomes or multiple pregnancies were excluded. The diagnostic criteria for GDM in the hospital were as follows: positive 75-g oral glucose tolerance test (OGTT) result in gestational Weeks 24–28 as described by the American Diabetes Association 2004 [12] and the Guidelines for Clinical Diagnosis and Treatment Recommendations for GDM (2007, Draft) promulgated in China during 2008–2011 [13–16]. The following cutoffs were observed: fasting plasma glucose (FPG), 5.3 mmol/L; 1-hour blood glucose (1hBG), 10 mmol/L; and 2-hour blood glucose (2hBG), 8.6 mmol/L. Patients with one item reaching or exceeding the above threshold values were diagnosed to have GDM. In 2012, the International Association of Diabetic Pregnancy Study Group 2010 and the professional standards for diagnosis of GDM issued by the Ministry of Health based on the American Diabetes Association 2011 were introduced in the hospital, and the following cutoffs were observed: FPG, 5.1 mmol/L; 1hBG, 10 mmol/L; and 2hBG, 8.5 mmol/L. Patients with at least one of these diagnostic factors reaching or exceeding the above threshold values were diagnosed with GDM.

Aside from the maternal monitoring records archived in the Medical Records room and the high-risk pregnancy documentation archived at the Department of Prevention and Healthcare, nutritional treatment records archived at the Department of Clinical Nutrition were also reviewed. Written informed consent for the use of health data for research purposes was obtained from all participants when they accepted the pregnancy monitoring. The study protocol has been revised by the Ethical Committee of China–Japan Friendship Hospital, and verbal consent was obtained from the patients (IRB 2015-110).

Management of high-risk pregnant women

The Department of Prevention and Healthcare keeps the files detailing the status and management of pregnant women with GDM and their fetuses. The documentation also tracks the incidence of common complications during pregnancy and their management (gestational hypertension, pregnancy vulvovaginal candidiasis, etc.), use of insulin during pregnancy, adverse pregnancy outcomes (preterm birth, premature rupture of membranes and amniotic fluid abnormalities, neonatal hypoglycemia, etc.), mode of delivery (cesarean section or vaginal delivery), birth weight, neonatal blood glucose levels, postpartum infant feeding, and OGTT reexamination results. A complete set of data was acquired, with missing data completed by consulting complementary medical records. Home visits or telephone follow-up interviews were conducted to identify data not available in the hospital.

Medical nutrition therapy

Pregnant women with GDM were routinely advised to receive MNT counseling in the associated Department of Clinical Nutrition and Obstetrics, where trained nutritionists provide individualized MNT programs for pregnant women with confirmed GDM. Nutritionists filled in the general prepregnancy record form upon the initial diagnosis of GDM and referral to them; these data included height, prepregnancy body weight, medical history and family history, and the prepregnancy body type {calculated as the prepregnancy body mass index (BMI) based on the 2002 standards issued by the Working Group on Obesity in China, International Life Science Institute [17]}. They also established daily energy requirements and calorie supply proportions of the three major nutrients in accordance with the *China Medical Nutrition Therapy Guideline for Diabetes (2010)* based on the prepregnancy body type, gestational age at the time of GDM diagnosis, increase in body weight during pregnancy, blood pressure, and lipid outcomes [11]. They then provided suggestions with regard to the type of food, specifically quantifying the recommended intake for each type of food. They also assisted in the selection of foods among similar food types via the “method of food exchange serving” to diversify the patients' diets while ensuring a balanced intake of all necessary nutrients. Finally, they suggested reasonably arranged meal times and foods in each meal based on blood glucose monitoring data, recommended staple foods with low glycemic index values, and emphasized eating many small meals to reduce each meal's glycemic load. Regular postprandial exercise was also recommended. Pregnant women were encouraged to obtain private fast blood glucose meters, kitchen scales, and body weight scales for self-monitoring of finger-prick blood glucose, food intake, and body weight at home. The monitoring forms (3 d/wk) focused on food contents in each meal, intake, fasting glucose, 2-hour postprandial blood glucose, and fasting body weight measured in the morning for timely adjustment of the therapy on follow-up appointments.

The first follow-up visit was scheduled within 2 weeks since the initial diagnosis of GDM and the start of MNT. Compliance was

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