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Adherence to the DASH and Mediterranean diets is associated with decreased risk for gestational diabetes mellitus

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ABSTRACT

Objectives: Few studies have examined the association between adherence to the Dietary Approaches to Stop Hypertension (DASH) or Mediterranean (MED) diets and prevalence of gestational diabetes mellitus (GDM). The aim of the present study was to evaluate the association between the two diets and GDM.

Methods: In a case–control hospital-based study, pregnant women with (n = 200) and without (n = 260) GMD were recruited. An average of three 24-h dietary records were used to assess participants' dietary intakes. DASH scores were calculated based on the Fung method and MED scores were calculated using the Trichopoulou method. GDM was defined as fasting glucose >95 mg/dL or 1-h postprandial glucose >140 mg/dL for the first time in the pregnancy. The risk for GDM was assessed across tertiles of DASH and MED scores.

Results: DASH and MED diets were negatively related to fasting blood glucose, hemoglobin A_{1c}, and serum triacylglycerol concentrations. High-density lipoprotein cholesterol was significantly higher for those in the top tertile of the DASH diet but not the MED diet in comparison with the lowest tertile. Total serum cholesterol level was lower in the third tertile of the MED diet but not in the DASH diet. Participants in the highest tertile of the MED diet had 80% lower risk for GDM compared with those in the lowest tertile (P_{trend} = 0.006). Greater adherence to the DASH eating plan was associated with 71% reduced risk for GDM (P_{trend} = 0.006) after adjustment for potential confounders.

Conclusion: Adherence to either the DASH or Mediterranean diet is associated with decreased risk for GDM.

Introduction

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance first recognized during pregnancy [1]. It affects 1–14% of all pregnancies worldwide [2]. The prevalence of GDM is 4.7% in Iran [3]. It is positively related to short- and long-term complications for both mothers and their newborns [4], including increased risk for diabetes, hypertension, and cardiovascular diseases in later life [5]. Several strategies including dietary counseling, lifestyle modification, moderate hypocaloric diet, dietary intervention, and glucose-lowering agents have been used to manage GDM and to improve pregnancy outcomes [6–11]. Although diet therapy focusing on fatty acids, micronutrient supplementation, and low-glycemic load diets are considered cornerstone approaches to manage GDM [6,7,11–13], according to a recent meta-analysis no strong conclusions can be drawn as to the best intervention for managing GDM [11]. Because of the interactions between foods and nutrients, it is

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optimal to study dietary patterns together than to study them separately [4]. Also, due to differences in dietary patterns between Western and Eastern societies, epidemiologic studies in both contexts should be conducted.

The Dietary Approaches to Stop Hypertension (DASH) diet is a low-glycemic index and low-energy dense dietary pattern, which contains high quantities of phytoestrogens, magnesium, potassium, and dietary fiber [2]. The DASH diet was initially suggested for hypertensive patients [5], but it is an effective approach for improving cardiovascular risks, diabetes, and metabolic syndrome [2,5]. The Mediterranean (MED) diet, emphasizes consumption of fruits, vegetables, legumes, whole grains, and foods rich in monounsaturated fatty acids (MUFAs), and is associated with lower risk for many chronic diseases [14,15].

Most available research on this topic has been focused on Western populations. However, due to substantial differences in dietary patterns between Middle-Eastern and Western populations, it is useful to examine the overall effects of these dietary patterns in epidemiologic studies conducted in diverse settings [2,4,16,17]. This is of particular importance given that the consumption patterns of different components of the DASH and MED diets in Iranian populations differ from those in other countries. Also, most research has examined this association in women with a prior history of GDM [16,18]. Therefore, evaluating the association between adherence to healthy dietary patterns, such as the DASH or MED diets, and incidence of GDM in Iranians might add to current knowledge. The aim of the present study was to evaluate the association between the two dietary patterns and the prevalence of GDM.

Participants and methods

Participants

This hospital-based case–control study was conducted in the Azzahra Hospital, Nutrition Clinic of Isfahan and Shahid Beheshti Hospital with 463 pregnant women carrying singleton fetuses. The women were ages 22 to 44 y and between 5 and 28 wk pregnant. Of the women, 263 healthy and 200 had GDM. For every pregnant woman with GDM selected in a specific week of the pregnancy, another woman in the same week of pregnancy was chosen for the control group. Pregnant women having abnormal fasting glucose (FG; >95 mg/dL or 1-h postprandial glucose >140 mg/dL for the first time in pregnancy) were selected. We did not include women who were carrying multiple fetuses, had abnormal energy intake (<800 or >4200 kcal/d), type 1 or 2 diabetes, cancer, and cardiovascular diseases. Participants with incomplete daily food records and health information were also excluded. Written informed consent was obtained from all participants. The present study was approved by the Isfahan University of Medical Sciences, Isfahan, Iran.

Assessment of dietary intake

Participant dietary intake was estimated from the average of three 24-h dietary records. A trained dietitian counseled the women regarding how to complete the dietary food record forms and they checked the forms to ensure accuracy. Incomplete forms were followed up with phone calls to complete them. Household measures were used to convert all portion sizes to grams. Food records were analyzed using Nutritionist IV software modified for Iranian foods (First Databank Division, The Hearst Corporation, San Bruno, CA, USA).

Creation of dietary scores

We followed the methodology of Trichopoulou et al. to calculate MED dietary scores [19]. Accordingly, there were a maximum of 9 points, counting 1 point if the daily serving of fruits, fish, vegetables, whole grains, legumes, nuts, and ratio of grams of MUFA to saturated fatty acids (SFAs) were equivalent to or greater than the median intake of study population and the daily serving of meats (red meat, poultry, and processed meats) and dairy products were less than the median intake of the study population. Energy adjustment, using the residual method, was done for all food groups before the score ranking. Finally, we categorized participants according to tertiles based on their scores.

Calculating the DASH dietary score according to a previously described method [20], 1 point was received if participant intake of fruits, vegetables, nuts and legumes, low-fat dairy products, or whole grains consumed were within the highest quintile of the study population. One point also was given if daily intake of sodium, red and processed meats, or sweetened beverages were in the lowest quintile of intake of the study population.

Assessment of anthropometric variables and blood pressure

Participant weight was recorded to the nearest 100 g using SECA scales, while wearing light clothing and no shoes. Height was measured using tape, when not wearing shoes. Body mass index (BMI) was calculated by weight (kg)/height $(m)^2$. Systolic and diastolic blood pressures (SBP and DBP) were measured in duplicate after ≥5 min of rest in sitting position and being calm. Appropriate cuff sizes according to arm size and SBP were defined as a clearing of the first sound of pulsation (first Korotkoff phase) and DBP was defined as disappearance of the sound (fifth Korotkoff phase). The average of two BP measurements was recorded as the final value.

Assessment of other variables

Trained health care providers asked women about sociodemographic information. The three sociodemographic categories based on the distribution of responses were high (scores >66%), middle (scores 33%–66%), and low (scores <33%).

Blood samples were centrifuged within 30 to 45 min of collection for 10 min at 500g and at 4°C. Samples were analyzed using an auto-analyzer (Selectra 2; Vital Scientific, Spankeren, Netherlands). Alanine aminotransferease (ALT), aspartate aminotransferase (AST), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), FG, and serum level of total cholesterol (TC) were measured using commercially availableenzymatic kits (Pars Azmmoun, Tehran, Iran). Triacylglycerols (TGs) were measured with glutathione oxidase.

Statistical analysis

We categorized participants based on tertiles of DASH and MED dietary patterns scores collected during their pregnancies. Higher scores indicated higher compliance and lower scores corresponded to lower compliance. We used one-way analysis of variance (ANOVA) for continuous variables (e.g., BMI, age, BP, and biochemical markers). For the categorical variables, we used χ^2 tests to assess the distribution of categorical variables across the tertiles of DASH and MED scores. The Mantel-Haenszel test was used to calculate P values for trends across the tertiles of dietary patterns. Dietary intakes were compared using ANOVA. We performed multivariable logistic regression to find the relation between either DASH or MED diets and GDM risk. Theses associations were examined in both crude and adjusted models. In logistic regression models, we used crude models without adjustment and two adjusted models to control for the effects of potential confounders. We controlled the confounding effects of age and energy in the first model and additionally controlled for the number of children and socioeconomic status (SES; education, occupation, and economic status) [21] in the second model. Statistical analyses were performed using the SPSS for Windows software (version 16.0). $P < 0.05$ was considered as statistically significant.

Results

We found that cases had lower adherence to the DASH diet than the controls (22.73 ± 4.06 versus 25.03 ± 4.92; $P < 0.0001$), but observed no significant differences in adherence to the MED diet (4.01 ± 1.57 versus 4.92 ± 1.49; $P = 0.81$). Additionally, serum levels of FBG, HbA_{1c}, LDL-C, and TGs were significantly higher in cases than controls. No differences were observed between cases and controls for demographic variables. Characteristics of participants across the tertiles of dietary patterns are shown in Table 1. Participant BMI and SES did not differ across tertiles of adherence to the MED and DASH diets. We found that women in the highest tertiles of DASH and MED scores had significantly lower levels of FBG, BP, and HbA_{1c} ($P < 0.05$). Serum levels of HDL-C were substantially higher among participants with scores in the top tertile of DASH diet scores in comparison to those in the lowest (48.35 ± 9.22 versus 46.40 ± 9.83 mg/dL, $P = 0.004$). Also, serum total cholesterol (TC) level was significantly lower in women with maximum adherence to the MED