Clinical Nutrition xxx (2015) 1–7

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Original article

Lifestyle patterns in early pregnancy linked to gestational diabetes mellitus diagnoses when IADPSG criteria. The St Carlos gestational study

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ARTICLE INFO

Article history:
Received 9 December 2014
Accepted 28 April 2015

Keywords:
Gestational diabetes mellitus
IADPSG
Diagnosis
Lifestyle

SUMMARY

Early-pregnancy lifestyle (EPL) could influence the development of gestational diabetes mellitus(GDM), depending on the diagnostic criteria used.

Objective: We studied EPL in 1750 pregnant women using Carpenter-Coustan criteria(CCc), and in 1526 with the International Association of Diabetes and Pregnancy Study Groups criteria(IADPSGc).

Methods: GDM risk factors were assessed in women between 24 and 28 weeks of gestational age during two consecutive years. A semiquantitative frequent-food-consumption questionnaire was used to evaluate lifestyle during pregnancy. Multiple logistic regression analysis was conducted to assess GDM risk with different lifestyle patterns.

Results: Using IADPSGc, the GDM ORs (95%CI) for intake/week were: nuts >3 times: 0.59 (0.39–0.91; $p < 0.015$), refined cereals ≤1 serving: 0.72(0.58–0.89; $p < 0.003$), juices <4 servings: 0.77 (0.62–0.95; $p < 0.017$), cookies and pastries <4 servings: 0.71(0.57–0.89; $p < 0.003$) as compared to opposite habits. No significant nutritional patterns were found to be significant using CCc. The OR (95%CI) for GDM with none of the four risk patterns as compared to having three-four risk factors was 0.21(0.07–0.62; $p < 0.005$), remaining significant after stratification by BMI, age, obstetric events, parity and family history. The multiple logistic regression model including nutritional categories and pregestational BMI, age, obstetric history, parity, personal/family history, had an area under the curve(AUC) of the receiver operating curve(ROC) for the probability to predict GDM of 0.66 (CI 95%: 0.63–0.69; $p < 0.001$).

Conclusion: Our study is the first to identify four early-pregnancy nutritional patterns associated with the GDM when using IADPSGc. Adherence to a low-risk nutritional pattern from early pregnancy on could be an effective strategy for GDM prevention.

1. Introduction

The introduction of the new IADPSG criteria (IADPSGc) for the diagnosis of Gestational Diabetes Mellitus (GDM) is accompanied by an increase in the prevalence of GDM [1–5]. This increment can be of the order of 3.5, as compared to Carpenter-Coustan criteria (CCc), as recently reported by our group [5], whereas other groups have found lower rates of increase, as low as 5.7% of prevalence [6]. The marked increase we observed could be explained in part by genetic variations associated insulin resistance together with unhealthy lifestyle patterns found in different ethnic groups living in our country. The treatment of the women diagnosed using IADPSGc resulted in the improvement of pregnancy and fetal outcomes,

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http://dx.doi.org/10.1016/j.clnu.2015.04.017
0261-5614/

accompanied by significant economic savings. And these results which support the widespread use of the IADPSGc for the diagnosis of GDM [5]. In this new context, the implementation of strategies directed towards prevention of GDM is of great importance, and must be based on the identification of risk factors for development of GDM. Previously identified non-modifiable established risk factors for GDM include maternal age, parity, ethnicity, family and personal history of GDM. The main modifiable established risk factor is the pregestational Body mass index (BMI) [7–9]. However, the impact of lifestyle has yet to be fully established. Nutritional risk factors for GDM using the previous CCc include prepregnancy diets with a high intake of red meat, as well as foods with a low -fiber content, and/or a high glycemic load, as well as an elevated consumption of sugar-sweetened drinks and juices, as compared with the opposite [9–12] as we have previously reported [9,13]. Yet nutritional patterns in early pregnancy were not associated with a risk of GDM. A sedentary lifestyle can also contribute to GDM risk [14,15]. Nutritional status before pregnancy, as reflected in prepregnancy BMI, appears to be more important for the development of GDM than pregnancy lifestyle per se [16,17]. However, several early pregnancy GDM lifestyle risk factors emerge consistently [18,19], despite substantial heterogeneity between studies. The recognition of lifestyle risk factors during early pregnancy may be the cornerstone to planning preventative strategies aimed at reducing the burden of GDM when applying the new criteria. We hypothesize that the adoption of more strict diagnostic criteria could permit identification of modifiable GDM risk factors.

The object of this study is to assess GDM risk factors, particularly those that can be modified, in a large population of pregnant women after the 1st year of introduction of the new IADPSGc as compared to what has been observed in women diagnosed with GDM using CCc.

2. Population and research design

2.1. Study population

We performed a retrospective cohort study conducted in two time periods over two consecutive years, from April 2011 to March 2013. Analysis was performed to compare the two diagnostic strategies (CCc and AIDPSGc) in terms of total maternal-fetal events (those with and without GDM). Inclusion criteria included all women who received prenatal care at St Carlos Hospital, at 24–28 weeks of gestation, when universal screening takes place. Prior to the implementation of IADPSGc in our center, CCc were used for screening of GDM. The screening with CCc was conducted in two steps: at 24–28 weeks of gestation, women with no previous history of diabetes were evaluated by the O'Sullivan test after fasting for at least 12 h. If plasma glucose levels 1 h following glucose load were equal to or above 7.8 mmol/L ($\geq$140 mg/dL), an OGTT was performed with 100 g, and fasting glucose levels and one hour, two and three hours after intake were measured. In April 2012, the new IADPSG criteria were adopted, and universal screening was performed using an oral glucose tolerance test, measuring fasting serum glycemia and 1- and 2-h following administration of 75 g of glucose. The exact dates of the study were chosen to reflect the number of pregnant women before and after entering IADPSGc. In the era of CCc (from April 2011–March 2012) 1750 women were included, with an average age of 31.5 (SD5.6) years, pregestational BMI 23.6 (SD4.4) kg m^{-2}, gestational BMI 25.8 (SD 4.3) kg m^{-2}, with an medium weight gain of 5.89 (SD4.89) kg and 185 (10.6%) were identified as having GDM. In the era of IADPSGc (from April 2012–March 2013), 1526 pregnant women were included, average age of 31.7 (SD5.8) years, pregestational BMI 23.5(SD4.1) kg m^{-2}, gestational BMI 25.8 (SD 4.1) kg m^{-2}, with a medium weight gain of 6.08 (SD4.01) kg and 542 (35.5%) were diagnosed as having GDM. The population characteristics have previously been reported [5].

2.2. Variables and procedures

The information was collected using a semi-quantitative frequent food consumption questionnaire, as previously described [5,9,13], to assess EPL during the first prenatal visit and at the time of screening for GDM at 24–28 week of gestation. The participants completed the questionnaire under the supervision of a trained nurse. After each interview, a physical examination was performed to collect patient's anthropometric data. Age, Obstetric events, Personal history, Parity, Family history, Pre-gestational BMI, Weight gain at 24–28 weeks, were used in the analysis.

2.3. Food frequency questionnaire and MedDiet score

A qualitative food frequency questionnaire was administered face-to-face by a trained nurse. The following lifestyle data were classified in a semi-quantitative manner:

A) Gestational physical activity, including walking -duration and frequency, stairs climbed daily, and the frequency of moderate-intensity sports lasting a minimum of 30 min.
B) Gestational intake (servings/week) of vegetables and salads, pieces of fruit, dried fruits and nuts, fatty fish, refined cereals, whole-wheat breads and cereals, legumes, skimmed dairy products, red and processed meats, sauces, juices and sugared drinks, cookies and pastries, and coffee (cups a day) consumption.
C) In addition, dark-chocolate intake (servings of 20 g a day) was assessed in the IADPSG group.

This prospective study was designed to evaluate non-modifiable risk factors, including age, ethnicity, obstetric history and parity, personal and family medical history, as well as smoking habits and modifiable lifestyle risk factors for GDM in a period of two consecutive years as a function of the change in diagnostic criteria. The Ethical Committee of St. Carlos Hospital approved the study, and it was conducted according to the Helsinki Declaration principles.

2.4. Statistical study

The following non-modifiable risk factors were stratified: Maternal age (<35 and $\geq$ 35), obstetric history (no risk factors versus at least one miscarriage, prior GDM or gestation-induced hypertension), parity (primiparous versus multiparous), personal history (no risk factors versus at least one hypertension, dyslipemia or overweight), family history (no risk factors versus at least one of diabetes, hypertension, dyslipemia or high BMI were present in one first-degree relative), smoking habit (never versus sometimes).

Lifestyle variables are presented as frequency distribution, and continuous variables are presented as average with standard deviation (SD). The statistical difference between the averages of continuous variables was determined with the Student *t* test or nonparametric Mann–Whitney test and the one-way variance test. Categorical data are expressed as numbers and percentages. To analyze the effects of non-modifiable risk factors and lifestyle items, a generalized lineal model of binary logistic type was performed. The dependent variable was the diagnosis or not of GDM. The association between non-modifiable risk factors and lifestyle variables on the one hand and GDM on the other hand was evaluated with the chi-square test or the Fisher exact test, and relative-risk for GDM was estimated.

Please cite this article in press as: Ruiz-Gracia T, et al., Lifestyle patterns in early pregnancy linked to gestational diabetes mellitus diagnoses when IADPSG criteria. The St Carlos gestational study, Clinical Nutrition (2015), http://dx.doi.org/10.1016/j.clnu.2015.04.017