RESEARCH

Original Research

Prepregnancy Dietary Patterns Are Associated with Blood Lipid Level Changes During Pregnancy: A Prospective Cohort Study in Rio de Janeiro, Brazil

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ABSTRACT

Background Physiologic adaptations lead to an increase in blood lipid levels during pregnancy, yet little is known about the influence of prepregnancy dietary patterns.

Aim To identify whether prepregnancy dietary patterns that explain the consumption of fiber, energy, and saturated fat are associated with blood lipid levels throughout pregnancy.

Design Prospective cohort study, with data collection at gestational weeks 5 to 13, 20 to 26, and 30 to 36. A food frequency questionnaire was administered at baseline (gestational week 5 to 13).

Participants/setting Women with singleton pregnancy (N=299) aged 20 to 40 years, without infectious/chronic disease (except obesity) were enrolled in the study. One hundred ninety-nine women were included in the final analysis. The study took place at a prenatal service of a public health care center in Rio de Janeiro, Brazil, during the period from 2009 to 2012.

Main outcome measures Total cholesterol, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol, and triglyceride levels, measured at all trimesters.

Statistical analyses performed Dietary patterns were derived by reduced rank regression. Fiber density, dietary energy density, and percent energy from saturated fat were response variables. Crude and adjusted longitudinal linear mixed-effects regression models were performed to account for confounders and mediators. Interaction terms between dietary pattern and gestational week were tested.

Results Fast Food and Candies; Vegetables and Dairy; and Beans, Bread, and Fat patterns were derived. Our Fast Food and Candies pattern was positively associated with triglyceride level (β=4.961, 95% CI 0.945 to 8.977; P=0.015). In the HDL-C rate of change prediction, significant interactions were observed between both the Fast Food and Candies and Vegetables and Dairy patterns and gestational week (β=−.053, 95% CI −0.101 to −0.004; P=0.035 and β=.055, 95% CI −0.002 to 0.112; P=0.060, respectively). The Beans, Bread, and Fat pattern was not associated with blood lipid levels.

Conclusions Prepregnancy dietary patterns were associated with gestational blood lipid levels; that is, higher scores for the Fast Food and Candies pattern were associated with higher triglyceride and slower HDL-C rates of change during pregnancy, whereas higher scores for the Vegetables and Dairy dietary patterns were associated with faster HDL-C rates of change over gestational weeks.
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PREGNANCY IS A PARTICULAR PERIOD IN A WOMAN'S life where she is exposed to several physiologic adaptations, such as peripheral insulin resistance and increased hormone circulation.[1,2] These alterations contribute to an increase in blood lipid concentrations that is needed to supply maternal energy requirements and to spare glucose and other nutrients to provide adequate intrauterine growth, especially during the second half of pregnancy.[1,3-6] Although increased blood cholesterol and triglyceride levels are expected during pregnancy, there are no valid cutoffs to indicate whether the increase represents a physiologic adaptation or whether it characterizes an excess that might be potentially harmful to a pregnant woman. High-density lipoprotein cholesterol (HDL-C) is recognized for its protective effect against adverse perinatal outcomes and also has implications for future cardiovascular health.[7-10] On the other hand, higher concentrations of low-density lipoprotein cholesterol (LDL-C) and triglyceride during pregnancy have been associated with adverse maternal and fetal outcomes, such as prematurity, hypertensive disorders of pregnancy, and gestational diabetes.[9,11,12]

Gestational blood lipid level changes are influenced by maternal characteristics such as estrogen and progesterone concentrations, insulin resistance, prepregnancy body mass index (BMI; calculated as kg/m^2), and socioeconomic characteristics.[1,5,11,13] Nevertheless, little is known about the role of food intake in this context.[14,15] Considering that preconception diet may influence perinatal complications such as preterm birth, hypertensive disorders of pregnancy, and gestational diabetes,[16-18] it is plausible to hypothesize that it has the potential to be a modifiable factor associated with blood lipid changes throughout pregnancy.

Studies in women have shown that food intake and dietary patterns are associated with blood lipid concentrations.[19-23] However, evidence is still scarce during pregnancy, and unknown with regard to prepregnancy diet. Results from randomized clinical trials indicate that food intake habits, such as adherence to a low glycemic load diet[15] or a diet with low saturated fat and cholesterol and high micronutrient content[14] may influence blood lipid concentrations during pregnancy. A recent cross-sectional study conducted with North American women uniquely considered dietary patterns in this context, and verified that women with high scores on the Dietary Approach to Stop Hypertension (DASH) pattern (characterized by high intakes of fruits, vegetables, nuts and legumes, low-fat dairy, and whole grains and low intakes of sodium, sweetened beverages, and red and processed meat) during early pregnancy had lower triglyceride concentrations at gestational week 26 to 29, when compared with women with low scores on this pattern.[24]

The assessment of dietary patterns is a broad approach to the study of nutrition compared with the evaluation of one specific food item or nutrient, because it allows for cumulative effects and interactions between foods and nutrients.[25,26] In addition, compared with methods more frequently used to derive dietary patterns, reduced rank regression (RRR) is a relatively new method that maximizes the explained variation in intermediate variables between food intake and the outcome of interest, thus enhancing the likelihood of finding meaningful associations between diet and health outcomes.[27]

As far as we know, the association between prepregnancy dietary patterns and serum blood lipid level changes has not been studied previously. Thus, the aim of the present study was to identify whether prepregnancy RRR patterns that explain dietary energy density as well as fiber and saturated fat intake are associated with blood lipid level changes throughout the gestation period. In this context, the hypothesis of this study is that women with high scores on a prepregnancy dietary pattern characterized by high energy and saturated fat and low fiber content will have a greater change in blood lipid concentrations during pregnancy than women with low scores on this pattern.

METHODS

Study Design and Population

A prospective cohort of pregnant women was followed in a public health care center in Rio de Janeiro, Brazil, between November 2009 and July 2012. Three waves of data collection occurred during pregnancy, as follows: gestational weeks 5 to 13, 20 to 26, and 30 to 36.

To be eligible for the study, women were required to be between ages 20 to 40 years at gestational week 5 to 13 at baseline, with a singleton pregnancy, without chronic and/or infectious disease (except obesity), and planning to carry out prenatal care in the public health care center. A total of 322 eligible women were recruited and 299 agreed to participate. After recruitment, participants were excluded from the analysis according to the criteria detailed in the flow chart (see the Figure). The dietary pattern analysis included 250 women because the whole cohort sample was considered and the exclusion criteria of the present study were not applied. For the final analyses of this study, cases of miscarriage and missing gestational weight gain information were further excluded. Women with missing gestational weight gain information were excluded because this variable was used in the fully adjusted models. The final sample of the present study was composed of 199 women with at least one blood lipid measurement during pregnancy (n=198, 186, and 186 at first, second, and third trimesters, respectively) (see the Figure). It is worth noting that although the percentage of current smokers was higher among excluded women (13.2%) when compared with 6.0% for those included, no baseline characteristic was statistically different between women included and those excluded from the analysis (Table 1, available online at www.jandonline.org); that is, no potential selection bias was identified in this study.

Blood Lipid Measurements

The study outcomes were total cholesterol, LDL-C, HDL-C, and triglyceride concentrations at each stage of pregnancy. Blood samples were collected by a trained professional after a 12-hour fast. Samples were then centrifuged at 5,000 rpm for 5 minutes. Serum was separated and kept at $-80°C$ until biochemical analysis. Serum total cholesterol, HDL-C, and triglyceride concentrations were measured by a trained lab technician by the enzymatic colorimetric method, using an automated analyzer (Labmax plenno, Labtest Diagnostica) and commercial kits (Labtest Diagnostica) whereas LDL-C was calculated according to Friedewald formula.[28]

Dietary Intake Assessment

A semiquantitative food frequency questionnaire (FFQ), previously validated for the adult population of Rio de Janeiro, Brazil,[29] was administered by interviewers during the first gestational trimester, when the women were asked about their usual dietary intake during the 6 months before pregnancy. This FFQ was composed of 82 food items and eight frequency options with two or three household measure portion options. For statistical analysis, portion sizes were converted into grams or milliliters using a Brazilian household measures table[30] and frequency into daily frequency. The daily amount consumed (grams per day or milliliters per day) of each food item of the FFQ, calculated by multiplying portion size per daily frequency, was used to identify prepregnancy dietary patterns.

Food items that were consumed by 80% or more women or with unique nutrition-related compositions were kept separate (ie, rice, beans, bread, sugar, fish, coffee, and tea).[31] Foods consumed by <20% of the sample (lard; dried meat/codfish;