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Fried food intake estimated by the multiple source method is associated with gestational weight gain☆

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ABSTRACT

This present study aimed to test the association between fried food intake estimated by a semiquantitative food frequency questionnaire (FFQ), multiple 24-hour dietary recalls (24hRs), and the application of the multiple source method (MSM) in relation to gestational weight gain at the second and third trimesters and weight gain ratio (observed weight gain/expected weight gain). We hypothesized that distinct relationships with weight gain would be found given the measurement errors of self-reported dietary approaches. A prospective study was conducted with 88 adult pregnant women. Fried food intake during pregnancy was assessed using a validated 85-item FFQ, two to six 24hRs per woman, and the MSM with and without frequency of food intake as covariate. Linear regression models were used to evaluate the relationship between fried food estimated by the methods and weight gain. For every 100-g increment of fried food intake, the β (95% confidence interval) for weight gain was β 1.87 (0.34, 3.40) and β 2.00 0.55, 3.45) for estimates using MSM with and without the frequency of intake as covariate, respectively, after multiple adjustments. We found that fried food intake estimated by the FFQ and 24hRs β 0.40 (–0.68, 1.48) and β 0.49 (–0.53, 1.52), respectively, was unrelated to weight gain. In relation to weight gain ratio, a positive association was found for estimates using the MSM with [β 0.29 (0.03, 0.54)] and without the frequency of intake as covariate [β 0.31 (0.07, 0.55)]; and no associations were found for estimates by the FFQ or 24hRs. The data showed that fried food intake estimated the MSM, but not by the FFQ and 24hRs, is associated with excessive weight gain during pregnancy.

1. Introduction

A high prevalence of women gains more weight during pregnancy than the recommended; and excessive weight gain during pregnancy is a relevant predictor for gestational diabetes, hypertensive disorders [1], long-term obesity in women [2], preterm birth and cesarean delivery [3], and obesity in offspring (in childhood and/or through adulthood) [4]. There are relatively few studies on usual dietary intake associated with excessive weight gain during pregnancy [5–8]. Adopting a reliable method to assess dietary exposure during pregnancy is highly relevant, yet challenging for epidemiological studies [9].

Short-term dietary methods are considered accurate in estimating nutrient and food intake when 2 or more measurements

Abbreviations: 24hRs, 24-hour dietary recalls; β (95% CI), regression coefficient (95% confidence interval); BMI, body mass index; FFQ, food frequency questionnaire; IoM, Institute of Medicine; MSM, multiple source method; R^2, coefficient of determination of the linear models.

☆ The authors declare that there is no conflict of interest.

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are available [10]. However, they may be inefficient for evaluating how occasional foods (not usually eaten) relate to health outcomes [11]. Moreover, many replicates are required to obtain accurate nutrient intake estimates during pregnancy [12]. In contrast, food frequency questionnaires (FFQs) may be limited because of finite food and portion size options, leading to measurement errors in food and nutrient intake estimates [13].

The multiple source method (MSM) is a new statistical method for estimating usual dietary intake based on short-term approaches that may incorporate dietary intake frequency data [14]. The method estimates usual intake using the probability of consumption and the amount consumed, removing the measurement error of the data. Previous studies have shown that this approach provides usual nutrient and food intake estimates among adults [15–17] and children [18]. However, data on this method's ability to estimate diet-disease relationships are scarce; and studies investigating if it accurately estimates usual food intake during pregnancy are nonexistent.

Fried foods are energy dense, and we hypothesize that their high intake is related to excessive weight gain during pregnancy. We also hypothesized that distinct relationships with weight gain would be found, according to the dietary method applied, given the measurement errors of self-reported dietary approaches. This present study aimed to test the association between fried food intake estimated by a semiquantitative FFQ, multiple 24-hour dietary recalls (24hRs), and the application of the MSM approach in relation to gestational weight gain at the second and third trimesters and to weight gain ratio (observed weight gain/expected weight gain).

2. Methods and materials

2.1. Participants

We conducted a prospective study to test the accuracy of the FFQ using 103 pregnant women from the municipality of Ribeirão Preto, São Paulo State, Brazil. The study included pregnant women (between 18 and 35 years old) with pregravid body mass index (BMI) from 18.5 to 24.9 kg/m^2 [1]; with gestational age of less than 14 weeks at first interview; and free of self-reported pathological conditions such as diabetes, cardiopathies, nephropathies, and hypertension. The sample size was determined based on that necessary for assessing if FFQ corroborates the food recalls nutrient estimates by the Bland-Altman analysis [19] to conduct the validation study.

The women were evaluated at the first trimester (between 6 and 14 weeks' gestation), second trimester (between 14 and 28 weeks' gestation), and third trimester of pregnancy (between 28 and 36 weeks' gestation). Data collection was carried out at 4 basic health clinics situated in the Southern, Eastern, and Western regions of the municipality. The first evaluation was held between September 2009 and May 2010, during the first antenatal visit for each pregnant woman. The second and third evaluations were incorporated into antenatal checkups or during homecare visits. A total of 247 pregnant women were contacted between September 2009 and May 2010. Of this group, 5 (2%) declined to take part in the study; and 139 (56%) were excluded for not meeting the study criteria. Of the 103 pregnant women interviewed at study baseline (≤14 weeks' gestation), 88 (85.4%) underwent the second evaluation (between 14 and 24 weeks' gestation); and 72 (69.9%), the third evaluation (between 25 and 36 weeks' gestation). The mean time interval between the first and second interviews was 82 days (approximately 12 weeks), and that between the second and third interviews was 47 days (approximately 7 weeks).

This study meets the guidelines established by the Declaration of Helsinki; and all procedures involving human participants were approved by the Research Ethics Committee of the Centro de Saúde Escola, Ribeirão Preto School of Medicine, University of São Paulo, Brazil (protocol 239). We obtained written informed consent from all participants.

2.2. Gestational age, gestational weight gain, and weight gain ratio

Gestational age was calculated based on the date of the last menstruation and confirmed by the ultrasound scan. Self-reported pregravid weight was obtained at first evaluation (used only for the inclusion criteria). Height was measured with a portable stadiometer (Sanny model ES 2040, American Medical of Brazil Ltda, São Bernardo do Campo, São Paulo state, Brazil). Body weight was measured using an electronic scale (Tanita model HS 302, Tanita Corporation in Brazil, São Paulo, São Paulo state, Brazil) at the first, second, and third trimesters.

The criteria of the Institute of Medicine (IoM) [1] were used to calculate adequacy of pregravid BMI and weight gain during pregnancy. The weekly weight gain was calculated by subtracting the first weight value from the last and then dividing by the number of weeks between evaluations. Because all participants included in the present study had normal prepregnancy weight (BMI between 18.5 and 24.9 kg/m^2), excessive weight gain was defined as greater than or equal to 0.51 kg/wk. Weight gain between 0.35 and 0.50 kg/wk was considered adequate (optimal weight gain), and that below 0.34 kg/wk was considered inadequate (suboptimal weight gain).

To calculate the weight gain and weight gain ratio, the criteria proposed by Siega-Riz and colleagues [20] were adopted, excepting the data for the first weight. In the present study, we considered the first weight measured instead of the self-reported pregravid weight. The weight gain during the second and third trimesters of pregnancy was calculated by subtracting the first assessed weight value (at the first trimester of pregnancy) from the last assessed weight value. The expected weight gain was obtained using the following formula: [(gestational age at time of last weight assessed – gestational age at the first weight assessed) × rate of weekly weight gain expected for the second and third trimesters]. The rate of weekly weight gain expected for the second and third trimesters was 0.4 because all women included in the present study had normal prepregnancy weight [1]. The weight gain ratio was obtained by the following formula: observed weight gain/expected weight gain [20,8]. These rates amend for the fact that not all women have a weight measurement at the same time point at the last trimester of pregnancy.

2.3. Fried food intake during pregnancy

Fried food intake consisted of the following items: fried red meats, fried white meats, bacon, fried pork skin, fried eggs,