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Original Article

Validation of a food frequency questionnaire for Japanese pregnant women with and without nausea and vomiting in early pregnancy

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ABSTRACT

Background: No previous study has shown the validity of a food frequency questionnaire (FFQ) in early pregnancy with consideration of nausea and vomiting during pregnancy (NVP). The aim of this study was to evaluate the validity of a FFQ in early pregnancy for Japanese pregnant women.
Method: We included 188 women before 15 weeks of gestation and compared estimated nutrient intake and food group intake based on a modified FFQ with that based on 3-day dietary records (DRs). Spearman's rank correlation coefficients, adjusting energy intake and attenuating within-person error, were calculated. Subgroup analysis for those with and without NVP was conducted. We also examined the degree of appropriate classification across categories between FFQ and DRs through division of consumption of nutrients and food groups into quintiles.
Results: Crude Spearman's correlation coefficients of nutrients ranged from 0.098 (sodium) to 0.401 (vitamin C), and all of the 36 nutrients were statistically significant. In 27 food groups, correlation coefficients ranged from −0.015 (alcohol) to 0.572 (yogurt), and 81% were statistically significant. In subgroup analysis, correlation coefficients in 89% of nutrients and 70% of food groups in women with NVP and 97% of nutrients and 74% of food groups in women without NVP were statistically significant. On average, 63.7% of nutrients and 60.4% of food groups were classified into same or adjacent quintiles according to the FFQ and DRs.
Conclusions: The FFQ is a useful instrument, regardless of NVP, for assessing the diet of women in early pregnancy in Japan.

Introduction

Nutrition during early pregnancy plays an important role in normal fetal development, contributing to organ development as well as long-term health of the offspring.[1] Fetal organ development can be inhibited by unbalanced or inadequate nutrient intake in early pregnancy. For example, folic acid deficiency increases the risk of neural tube defect,[2] and excess vitamin A increases the risk of central-neural-crest defects.[3] Unbalanced nutritional intakes during this period can also show their effects later in life, such as the associations of iodine deficiency with low child intelligence quotient[4] and overall malnutrition with coronal heart disease and obesity in adulthood,[5,6] and epigenetic changes that persist throughout the child's life.[7]

Food records or 24-h dietary recalls may provide accurate information on diet during pregnancy; however, they are expensive to administer and difficult to analyze in epidemiological studies. On the other hand, food frequency questionnaire (FFQ) is useful for assessing habitual diet in large epidemiological studies due to the low cost and ease of administration. Several studies have demonstrated the validity of FFQ in mid or late gestation.[8–11]

Nonetheless, using a FFQ to measure diet in early pregnancy may be challenging compared to doing so in the normal population,

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as a significant proportion of pregnant women could experience alteration in food preference due to nausea and vomiting during pregnancy (NVP). The FFQ queries food consumption during a period (usually the past 1–2 months) that may include time before and after this preference change. In addition to intra-individual changes over the assessment period, preference for women with NVP may be differ from that for women without NVP (inter-individual difference), for instance one study found that dietary intake in women with NVP differed from that in women without NVP in the consumption of carbohydrate and sugar.[12] Therefore, FFQ should ideally be validated in both women with NVP and women without NVP before using it in early pregnancy. To the best of our knowledge, none of the previous studies that validated the FFQ in early pregnancy did so.[8,13,14]

To that end, we conducted a validation study of a 167-item FFQ in women during early pregnancy, with consideration of the influence of NVP. We compared estimated intakes based on the FFQ with those based on a 3-day dietary record (DR).

Methods

Study design and subjects

This is a prospective cohort study conducted at the National Center for Child Health and development (NCCHD; Tokyo, Japan) to assess the validity of the FFQ for Japanese pregnant women. Participants were randomly recruited at the outpatient department during their first prenatal care visit in the early pregnancy period between April 2011 and March 2012. Participants were asked to complete a 3-day DR and subsequently fill out a questionnaire on social characteristics and the FFQ. A 3-day DR was chosen as the reference method because of its reliability in measuring actual food consumption and because the measurement errors of DR do not correlate with those of FFQ. A total of 248 women agreed to participate in our study. Sixty women were excluded because of incomplete FFQ or DR (n = 37), withdrawal (n = 21), and inability to eat due to NVP (n = 2). Ultimately, we analyzed 188 women. Since the sample size was similar or even larger than previous studies that validated the FFQ,[10,11,15] the current size can be considered sufficient for this validation study.

All participants provided written informed consent at recruitment. The study protocol was approved by the Hospital Ethics Committee at NCCHD (#467).

Dietary assessment methods

FFQ

The FFQ, which is self-administrated questionnaire consisting of 167 food and beverage items and nine frequency categories, was derived from the food list initially developed for the Japan Public Health Center-based Prospective Study (JPHCPS).[16] Response items ranged from “almost never” to “7 or more times per day” (or “10 glasses per day” for beverages), and questions asked about the habitual consumption of listed foods within the past 2 months. For the purpose of our study, we removed regional food items from the list (e.g., bitter melon) and substituted these with six food items that were more likely to be consumed by young women (ground meat, pastry, cornflakes, pudding, jelly, and alcoholic cocktail). Portion size was specified for each food item using three standard sizes: medium (the standard amount), small (50% smaller), and large (50% larger). Intake of energy, 36 nutrients, and 27 food groups was calculated using a food composition table developed for the FFQ based on the Standardized Tables of Food Composition in Japan (2010 edition).[17]

3-Day DR

The 3-day DR was completed based on two weekdays and one day of the weekend, which were not always consecutive. Food portions were measured by each participant during meal preparation using digital scales and measuring spoons and cups, with detailed descriptions of each food, including the methods of preparation and recipes. Trained dietitians checked the records with the examinee via telephone and coded the food and weights. Food intakes were calculated for 27 food groups, and nutrient intakes were calculated using the Standard Tables of Food Composition in Japan (2010 edition)[17] for energy and 36 nutrients.

Definition of variables

Assessment of NVP

Information on NVP was collected based on answers to a question with a 7-point scale querying the degree of dietary intake and nausea in a questionnaire administered with the FFQ: “How did your appetite or food intake change because of nausea and vomiting during pregnancy?”. We classified mothers according to whether they had NVP based on the answer, that is, we defined “with NVP” if dietary intake decreased 50% or more (10%–40%, 50%–80%, or ≥80%), and “without NVP” if dietary intake did not decrease (increased due to NVP, did not experience NVP, had NVP but intake did not change). Participants who answered “they could not eat at all due to NVP” (n = 2) were excluded from the analysis.

Validity of the question for NVP was checked by comparing body weight change (kg) during pregnancy, and we confirmed that women with NVP showed significantly less body weight change during pregnancy than women without NVP (−0.25 vs. +0.82 kg, $p < 0.001$).

Other covariates

Information on socioeconomic status, including education and household income; pre-pregnancy BMI; and maternal smoking (never, former, current) was obtained from a questionnaire administered as an adjunct to the FFQ. Maternal age, parity, and past medical history were retrieved from medical records. Maternal age was categorized into four groups: “29 years and below”, “between 30 and 34 years”, “between 35 and 39 years”, and “40 years and above”. Parity was collapsed into two groups: “0” and “≥1”. Gestational week at the time of participation in this study was categorized into four groups: “under 8 weeks”, “8–10 weeks”, “11–12 weeks”, and “13–15 weeks”. Maternal educational level was categorized into three groups: “junior high school, high school or vocational training school”, “junior college”, and “college or more” Annual household income was categorized into four groups: “under 4 million yen”, “4–5 million yen”, “6–7 million yen”, “8–9 million yen”, and “above or equal 10 million yen”. Pre-pregnancy BMI was grouped as “<18.5 kg/m^2”, “18.5–25 kg/m^2”, and “above 25 kg/m^2”.

Statistical analysis

Mean and standard deviations for nutrients intakes and food group consumption were estimated using the FFQ and DR and calculated separately. We did not include nutritional intake from supplementation in either the FFQ or the DR. To meet normal distribution, all nutrients and food groups were log-transformed before analysis. We used formula log(x + 1) transform, because not all participants consumed each food group. The relationship between the FFQ and the DR were assessed using two statistical approaches.

First, we assessed the relationship between estimated intake of each nutrient and food group according to the FFQ and the DR using

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