

Relative and biomarker-based validity of a food frequency questionnaire that measures the intakes of vitamin B₁₂, folate, iron, and zinc in young women

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Abstract

Folate, vitamin B₁₂, iron, and zinc are particularly important nutrients for women of childbearing age. We tested the hypothesis that an electronic, 235-item, semiquantitative food frequency questionnaire (FFQ) is a valid measure of dietary intake when compared with repeat dietary 24-hour recalls. Biomarkers of folate, vitamin B₁₂, iron, and zinc were determined because their measurement errors are unrelated to errors in dietary questionnaires. Female adults (N = 256) aged 18 to 35 years completed the FFQ, and a representative subset (n = 53) completed repeat dietary 24-hour recalls. The FFQ estimates (mean ± SD) were 315 ± 132 μg for folate, 3.1 ± 2.1 μg for vitamin B₁₂, 15.4 ± 5.6 mg for iron, and 15.1 ± 6.4 mg for zinc. The percentage of women classified within the same ±1 quartile for energy intake by the 2 methods was 77.3%. There was moderate agreement between the 2 dietary methods, and no systematic bias was noted for energy, folate, vitamin B₁₂, and zinc. The deattenuated energy-adjusted correlation coefficients ranged from 0.41 (dietary folate equivalents) to 0.60 (folate). Significant correlations between biomarker and nutrient intakes were found for folate ($r = 0.37$, $P < .01$) and vitamin B₁₂ ($r = 0.27$, $P < .01$). The electronic FFQ developed in the present study is a relatively valid tool that was able to adequately assess and rank individuals according to their nutrient intakes.

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Abbreviations: BMI, body mass index; BMR, basal metabolic rate; DFE, dietary folate equivalents; EI, energy intake; FFQ, food frequency questionnaire; MMA, methylmalonic acid; RBC, red blood cell; 24HR, 24-hour recall.

1. Introduction

Women of childbearing age are at risk for nutrient deficiencies because of their higher requirement for nutrients such as zinc, iron, folate, and vitamin B₁₂. Suboptimal status of these nutrients can lead to adverse health for both mothers and their infants. Deficiencies of both folate and vitamin B₁₂ are associated with neural tube defects [1,2]; iron deficiency is common in fertile women in developed countries [3,4],

and approximately half of the world's population is at risk for inadequate zinc intake [5], especially those with increased needs such as during pregnancy and those consuming diets low in zinc bioavailability.

The food frequency questionnaire (FFQ) is the most widely used dietary assessment tool that can obtain intake for an extended period [6]. It is low cost, easy to administer, and has minimal participant burden. The consensus document on the development, validation, and use of FFQs suggests that 2 reference methods be used in validity studies. One of the reference methods is usually dietary, such as repeat 24-hour recalls (24HR), weighed food records, or food diaries [7].

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