Research and Professional Briefs

Folate Intake and Food-Related Behaviors in Nonpregnant, Low-Income Women of Childbearing Age

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ABSTRACT

Information about folate intake among low-income women of childbearing age remains limited. This report presents results from a cross-sectional study of folate intake and food-related behaviors in a sample of low-income, nonpregnant women of childbearing age in California. One hundred fifty-seven nonpregnant, low-income (≤185% federal poverty level) women of childbearing age (18 to 45 years) were evaluated for usual intake of natural food folate and synthetic folic acid, as well as specific food-related behaviors. Eighty-five percent of participants met the Recommended Dietary Allowance for folate, but only 37% met the current synthetic folic acid recommendation for reducing the risk of neural tube defects. Intake of naturally occurring food folate and intake of synthetic folic acid from supplements were positively associated with overall healthful food-related behaviors. Nutrition education that includes information about folic acid may be one way to improve folate intake and other healthful food behaviors among low-income women of childbearing age.

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Folate status in the United States has increased substantially since fortification began in 1998 (1,2), but the observed 26% reduction in neural tube defects (3) is less than the predicted 50% to 70% reduction (4). The Centers for Disease Control and Prevention recently reported that blood folate levels in nonpregnant women of childbearing age actually decreased from 2000 to 2004, posing concerns about the continued effectiveness of fortification (5).

Information about folate status of low-income women of childbearing age remains limited. Women of low socioeconomic status have lower blood folate levels than women of higher socioeconomic status (6), and a considerable proportion of low-income women of childbearing age may not be meeting current intake recommendations (7). Because low-income women are less likely to take supplemental folic acid than women with higher incomes (8), it is particularly important for this population to consume enough folate from food. The Food Stamp Program and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) aim to help low-income families gain access to a healthful diet, but it is unclear whether receiving food stamps or WIC benefits is enough to ensure that nutrient needs are met.

This report presents results from a cross-sectional study of folate intake and food-related behaviors among low-income, nonpregnant women of childbearing age in California. The study was conducted by the Department

of Nutrition at the University of California, Davis, and the Food Stamp Nutrition Education (FSNE) Program of California.

METHODS

Study Participants

Participants were recruited by trained FSNE staff in four California counties/regions, representing urban and rural settings: Fresno, San Diego, Sonoma, and Shasta/Trinity (combined because one staff administers the program in these two counties). Eligible subjects were 18- to 45-year-old, nonpregnant, low-income (≤185% of federal poverty level) women. Each participant had to be able to read English or Spanish and be the primary food purchaser/preparer in her household. Women were excluded if they had completed the FSNE Program or if they reported participating in any nutrition education programs during the previous year. Recruitment sites included food stamp offices, WIC clinics, low-income schools, and community programs serving low-income individuals.

Of 203 women screened for eligibility, 157 met the inclusion criteria and were enrolled. The remaining 46 were outside the age range, unable to attend the data-collection session, or had recently received nutrition education. Participants were recruited for a nutrition education intervention study. This report presents cross-sectional data collected at baseline (before the intervention).

The Institutional Review Board at University of California, Davis, approved the study, and written, informed consent was discussed and obtained from all participants prior to enrollment.

Data Collection

Each participant completed three surveys, in English or Spanish: (a) a demographic questionnaire, (b) the Block Dietary Folate Equivalents Screener (DFE Screener, Block Dietary Data Systems, Berkeley, CA), and (c) a food behavior checklist (California FSNE Program, Davis, CA, 2006). The demographic questionnaire collected information about age, ethnicity, food stamp participation, and WIC participation. The DFE Screener measured usual folate intake from natural food sources, fortified foods, and supplements. This screener has been shown to reflect red blood cell folate in low-income women of childbearing age (9) and to correlate strongly with a longer traditional food frequency questionnaire (10). The food behavior checklist asks how often the respondent does each of 21 food-related behaviors. It is used by California's FSNE Program to evaluate program effectiveness.

Statistical Analysis

Differences in folate intake were investigated for each demographic variable, using independent sample *t* tests for dichotomous variables (language, receipt of food stamps, WIC participation) and one-way analysis of variance with Tukey's post hoc tests for categorical variables (county, ethnicity). Pearson correlations were computed to assess relationships between folate intake and age, and between folate intake and food-related behaviors. The Mann-Whitney U test was used to compare frequencies of food-related behaviors between food stamp recipients and nonrecipients and between WIC participants and nonparticipants.

All statistical analyses were done using SPSS Version 15.0 (2006, SPSS, Inc, Chicago, IL), with statistical significance defined as $P<0.05$. Data are shown as mean±standard error.

RESULTS

Mean age of participants was 31.6 years (range, 18 to 45). Ethnicities included Hispanic (n=89), white (n=56), Native American/Alaskan Native (n=6), Asian/Pacific Islander (n=2), and mixed ethnicity (n=4). All participants from Fresno (n=39) and San Diego (n=41) were Hispanic and completed the surveys in Spanish, whereas the participants from Shasta/Trinity (n=36) and Sonoma (n=41) represented multiple ethnicities and completed the surveys in English. Forty percent of participants received food stamps, 53% received WIC benefits, and 73% received food stamps and/or WIC benefits.

Mean daily intakes for each type of folate were as follows: 180.7±8.3 μg natural food folate, 253.4±10.5 μg synthetic folic acid from fortified foods, and 148.6±21.7 μg synthetic folic acid from supplements. Total mean intake of synthetic folic acid was 402.0±23.5 μg/day. Adjusting for bioavailability differences between natural and synthetic forms, mean total folate intake from all sources was 864.0±44.0 μg dietary folate equivalents/day. Table 1 compares these mean intakes with current recommendations and shows how many participants met each recommendation. Approximately 85% of participants met or exceeded the Recommended Dietary Allowance (RDA), but only 58 (37%) of the 157 participants met the recommendation for reducing neural tube defect risk. Four participants exceeded the Tolerable Upper Intake Level (UL) of 1,000 μg synthetic folic acid/day (data not shown).

There were no differences in natural food folate intake, synthetic folic acid intake, or total folate intake from all sources for any of the demographic variables. When analysis was restricted to Hispanic and white participants (due to small sample sizes of other ethnic groups), a difference approaching statistical significance was observed for natural folate. On average, Hispanic women consumed 195.5±11.0 μg natural food folate/day, compared with 161.5±13.8 μg/day for white women ($P=0.06$). Compared with white participants, Hispanic participants, on average, consumed more oranges and orange juice ($P< 0.01$) and more beans ($P< 0.001$), which are all good sources of folate.

Ninety-seven participants reported taking folic acid–containing supplements once per month or less or not at all, compared with 41 who reported using supplements five or more times per week. Of the 58 participants who met the recommendation for reducing neural tube defect risk, 39 reported using supplements frequently (≥five times/week), and 13 reported using them occasionally (>once/month and <five times/week). Of the 24 participants with folate intakes less than the RDA, 23 used supplements once per month or less or not at all. The four subjects who exceeded the UL for synthetic folic acid were

Table 1. Folate intake recommendations for nonpregnant women of childbearing age, mean folate intakes of study participants, and percentage of study participants meeting the recommendations (n=157)

Intake recommendations from the Institute of Medicine	Intake	Subjects Meeting Recommendation	
		n	%
	← *mean±standard error* →		
Recommended Dietary Allowance: ≥400 μg DFE[a]/day (from all sources)	864.0±44.0 μg DFE/day[b]	133	84.7
Recommendation for reducing NTD[c] risk: ≥400 μg synthetic folic acid/day (from supplements and fortified foods)	402.0±23.5 μg synthetic folic acid/day	58	36.9

[a]DFE=dietary folate equivalents, a standard unit of folate intake that accounts for differences in bioavailability between natural food folate and synthetic folic acid.
[b]Calculation of mean folate intake from all sources: (180.7 μg natural food folate/day)+(253.4 μg synthetic folic acid from fortified foods/day+148.6 μg synethetic folic acid from supplements/day)×(bioavailability factor of 1.7)=864.0 μg DFE/day.
[c]NTD=neural tube defect, such as spina bifida or anencephaly.

Table 2. Correlations between behaviors on the Food Behavior Checklist and each of three types of folate intake for a sample of nonpregnant, low-income women of childbearing age (n=157)[a]

Food-related behavior[b]	Natural food folate	Synthetic folic acid from fortified foods	Synthetic folic acid from supplements
Plan meals ahead of time	0.155	0.056	0.058
Compare prices before buying food	0.134	0.181*	−0.030
Run out of food before end of month	0.046	0.109	−0.026
Shop with a grocery list	−0.003	0.031	0.105
Let meat and dairy foods sit out for more than 2 hours	−0.068	0.000	−0.028
Thaw frozen foods at room temperature	−0.182*	−0.044	−0.071
Think about healthy food choices when deciding what to feed family	0.193*	0.041	0.096
Prepare foods without adding salt	−0.008	−0.045	0.047
Use Nutrition Facts label to make food choices	0.182*	0.055	0.220**
Children eat something within 2 hours of waking up	−0.063	0.030	0.046
Eat more than one kind of vegetable each day	0.143	−0.037	0.149
Take skin off chicken before eating it	−0.057	−0.088	−0.066
Buy packaged foods that are low in salt	−0.041	−0.119	0.047
Drink regular soda (not diet) every day	−0.034	0.153	−0.121
Worry whether food will run out before able to buy more	0.052	0.151	−0.033
Eat low-fat foods instead of high-fat foods	0.036	−0.041	0.226**
Use reduced-fat, low-fat, or nonfat milk	0.088	0.019	0.082
Eat more than one kind of fruit each day	0.276**	0.151	0.173*
Choose whole-wheat bread when eating bread	−0.036	−0.054	0.254**
Believe it's too expensive to eat a lot of nutritious foods	0.024	0.125	0.111
Number of restaurant meals eaten per week	0.142	0.178*	0.076

[a]Values are Pearson correlation coefficients (*r*).
[b]Scored on a Likert-type scale.
*$P<0.05$.
**$P< 0.01$.

frequent supplement users, taking both multivitamin supplements and folic acid pills, and three of them reported taking these supplements at least twice per day.

Pearson correlations between folate intake and food-related behaviors are shown in Table 2. Intake of natural folate was negatively associated with thawing frozen foods at room temperature ($r=-0.182$, $P<0.05$), which is one of the food behavior checklist items used to assess food safety skills. Natural folate intake was positively associated with thinking about healthful food choices when deciding what to feed one's family ($P<0.05$), using the Nutrition Facts label ($P<0.05$), and eating more than one type of fruit each day ($P<0.01$). Intake of synthetic folic acid from fortified foods was positively associated with comparing prices before buying food ($P<0.05$) and with restaurant meals ($P<0.05$). Supplemental folic acid was positively associated with using the Nutrition Facts label ($P<0.01$), eating low-fat foods ($P<0.01$), eating more

than one type of fruit each day ($P<0.05$), and eating whole-wheat bread ($P<0.01$).

Folate intake did not differ between food stamp recipients (n=62) and nonrecipients (n=95), or between WIC participants (n=83) and nonparticipants (n=74). There were, however, significant differences in responses to items on the food behavior checklist (data not shown). Food stamp recipients, compared with nonrecipients, more frequently prepared foods without adding salt ($P<0.01$), but food stamp recipients also reported removing skin from chicken less frequently than did nonrecipients ($P<0.01$). WIC participants were less likely than nonparticipants to run out of food before the end of the month ($P<0.05$). WIC participants also reported more frequent consumption of more than one kind of fruit each day ($P<0.01$).

DISCUSSION

This study investigated folate intake and food-related behaviors of low-income, nonpregnant women of childbearing age. Although mean intakes were adequate and 85% of participants achieved the RDA for total folate, 63% did not meet the recommended 400 μg of synthetic folic acid per day to reduce neural tube defect risk. This is consistent with a previous study in which 58% of low-income women of childbearing age in California had folic acid intakes less than current recommendations (7). Together, these studies suggest that this segment of the population may not be meeting the folic acid recommendation in the *Dietary Guidelines for Americans, 2005* (11), even with fortification of the food supply.

This study demonstrates that, although excessive use increases the likelihood of exceeding the UL, daily use of a multivitamin or a folic acid supplement can help women of childbearing age meet the recommendation for reducing neural tube defect risk. Analysis of the National Health and Nutrition Examination Survey (NHANES) 1999-2000 dataset (collected after food supply fortification started) similarly showed that women of childbearing age who did not take supplements tended to have red blood cell folate levels in the range associated with higher neural tube defect risk (12). This is of particular concern in low-income populations because financial constraints may prevent women from buying supplements. Our finding that 26% of participants reported using folic acid–containing supplements five or more times per week is consistent with a report from the Centers for Disease Control and Prevention indicating that 27% of 18- to 45-year-old women in the lowest income bracket use folic acid–containing supplements daily (8). Nutrition education about food sources of synthetic folic acid may help low-income women meet the recommendation.

Food assistance programs, such as the Food Stamp Program and WIC, aim to help low-income households gain access to a healthful diet by providing benefits that can be used to purchase food. Results from this study and a previous study (13) indicate that simply increasing food purchasing power does not guarantee a healthful diet. We hypothesize that nutrition education about folate targeted to low-income women of childbearing age may improve folate intake. Because folate intake was associated with favorable food behaviors (thinking about healthful food choices, using the Nutrition Facts label, eating more than one kind of fruit each day, safely thawing frozen foods), an effective folate-focused nutrition education program may also influence other food behaviors. Nutrition education for low-income families, through programs such as FSNE, has been shown to improve dietary habits (14,15).

This study is limited by its reliance on self-reported food intake and behaviors and the fact that the DFE Screener does not capture 100% of a subject's folate intake. Instead, the screener focuses on the most common food, beverage, and supplement sources of folate for most of the US population, and therefore may underestimate consumption for some individuals. It was selected because of its simplicity, low participant burden, strong correlation with a traditional food frequency questionnaire, and because it reflects red blood cell folate status in the population of interest.

The purpose of this study was to assess folate intake and food-related behaviors in nonpregnant, low-income women of childbearing age. The majority (63%) of study participants did not meet the folic acid intake recommendation for reducing neural tube defect risk, and participation in the Food Stamp Program or WIC had no impact on folate intake. Folic acid–containing supplements were an important contributor to folate intake, but a minority of participants reported using such supplements, possibly due to limited income. Finally, folate intake was higher among women who engaged in certain favorable food-related behaviors. Together, these findings suggest that targeted nutrition education may be one avenue for improving folate intake and overall diet quality among low-income women of childbearing age. Examples of such education may include emphasis on why folic acid is important for women of childbearing age, label-reading exercises to identify food sources, hands-on cooking demonstrations of low-cost recipes using folate-rich foods, or suggestions for finding low-cost folic acid supplements.

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