THE USE OF FOLIC ACID FOR THE PREVENTION OF BIRTH DEFECTS IN PUERTO RICO

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Introduction: The occurrence of neural tube defects (NTDs) varies by race/ethnicity, and the highest rates are among women of Hispanic ethnicity. Women of reproductive age are advised to use folic acid to prevent NTDs and other birth defects. Since 1994, Puerto Rico has had a campaign to promote the use of folic acid, and since 1998, enriched grain products have been fortified with folic acid. After fortification, the incidence of NTDs in the island decreased. The objective of this study was to assess the use of folic acid by women of reproductive age in Puerto Rico and determine factors associated with its use.

Methods: A self-administered questionnaire was answered by 964 women around the island.

Results: Folic acid consumption was reported by 30% of the participants, 21% reported consuming it at least 4 times per week, and only 14% consumed it the day before the survey. Knowledge about the recommendation for women to consume folic acid was reported by 97% of the participants. The use of folic acid was lower among women of lower education and lower social class. Women with higher education were 8.3 times more likely to consume folic acid.

Conclusion: The folic acid campaign has improved women's knowledge about the recommendation for folic acid supplementation. Nevertheless, its use is lower than is needed to continue reducing the incidence of birth defects in Puerto Rico. Education and social class continue to be barriers to eliminating the disparities in the preconception health of our population. (*Ethn Dis*. 2008;18[Suppl 2]:S2-168–S2-171)

Key Words: Folic Acid, Birth Defects, Neural Tube Defects

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INTRODUCTION

The occurrence of neural tube defects (NTDs) varies by race/ethnicity, and the highest rates are among women of Hispanic ethnicity.[1] Women of reproductive age are advised to use folic acid before conception to prevent NTDs and other birth defects. Since 1994, Puerto Rico has had a campaign to promote the use of folic acid, and since 1998, enriched grain products have been fortified with folic acid. After fortification, the incidence of neural tube defects in the island decreased. The objective of this study was to assess the use of folic acid by women of reproductive age in Puerto Rico and determine factors associated with its use.

METHODS

Participants were selected on the basis of the percentage of women of reproductive age living in each geographic area as reported by the 2000 Puerto Rico census. Eighty percent of the participants were recruited at Women and Infant Care clinics, since 80% of women who give birth in Puerto Rico receive services there. The remaining 20% were recruited at private clinics. Enrollment occurred from June 2005 through May 2006.

Exclusion criteria included the use of antiepileptic drugs (valproic acid, phenytoin, carbamazepine) and conditions associated with food intolerance, malabsorption, or wasting syndromes, since all can alter folic acid metabolism and increase the risk of congenital anomalies. Women with diabetes were excluded because of their higher risk of having a child with birth defects. Women whose parents were not Puerto Rican were also excluded.

The self-administered, validated questionnaire was designed with 28 questions that inquired about age, education, occupation, health conditions, family history of birth defects, folic acid and multivitamins use, and knowledge about preventing birth defects. Social class was determined by using the Hollingshead Index of Social Status.[2] Social class was coded in five social strata; class I was the highest.

Statistical Analysis

Frequency distributions and percentages were used to describe the categorical variables. Means and ranges were used to describe the continuous variables. Normal distribution of quantitative variables was performed by using Shapiro Wilk test. Pearson χ^2 or Fisher exact test, when appropriate, was used to determine the presence of statistical associations. Values were considered significant at $P<.05$. Data entry was performed by using Epi Info 6.04d (Centers for Disease Control and Prevention, Atlanta, Ga). Stata (StataCorp LP, College Station, Texas) was used for statistical analysis. The research proposal was approved by the institutional review board of the University of Puerto Rico School of Medicine, and all participants signed an informed consent.

RESULTS

The study included 964 nonpregnant Puerto Rican women with a mean age of 30 years (range 10–49 years). Table 1 shows the general characteristics of the participants. Folic acid consumption (including those who took a multivitamin containing folic acid) was reported by 30% of the participants, 21% reported consuming it ≥4

Table 1. General characteristics of women recruited at Women and Infant Care and private clinics, Puerto Rico (*N*=964)

Characteristic	%
Age group (years)	
10–19	13.5
20–29	39.8
30–39	30.6
40–49	16.1
Marital status	
Single	22.1
Married/living together	59.8
Divorced/separated	18.1
Education	
Less than high school	22.9
High school	22.2
University	54.9
Social stratum (Hollingshead)	
Class I	6.6
Class II	26.8
Class III	17.7
Class IV	12.5
Class V	36.3
Family history of neural tube defect	4.9

times per week, and only 14% consumed it the day before the survey. Knowledge about the recommendation for women to consume folic acid was reported by 97% of the participants. Knowledge about the role of folic acid in preventing birth defects was reported by 90% of the participants. Of those participants who had heard about folic acid, a gynecologist was mentioned as the most frequent source of information (62%). Other sources mentioned included television, newspaper, and magazines. Twenty-five percent of the respondents thought their diet was adequate and that they did not need to take a folic acid supplement. The use of folic acid was higher in the metropolitan area (38%) and lower in the south (23%) and northwestern areas (28%) (P=.011).

Table 2. Consumption of folic acid by age group, educational level, and social stratum among women recruited at Women and Infant Care and private clinics, Puerto Rico (*N*=964)

Characteristic	Use of Folic Acid (%)
Age group (years)	
10–19	25
20–29	25
30–39	32
40–49	42
Education	
Elementary school	9
Junior high	22
High school	24
Some university	28
Bachelor degree or higher	43
Social stratum	
Class I – professional	39
Class II – minor professional	38
Class III – skilled worker	26
Class IV – semiskilled worker	23
Class V – unskilled worker	25

Table 2 shows the association of folic acid consumption with higher age when analyzed by age groups (P<.001). Folic acid use was lower among women of lower education (P<.001) and those in lower social classes (P=.001). Table 3 summarizes the factors associated with consumption of folic acid supplements. Women with high school education or more were 8.3 times more likely to consume folic acid (P<.001). Women in upper social classes (I–III) were 1.5 times more likely to consume folic acid (P=.002). Marital status was not associated to the use of folic acid. Knowledge of the potential for folic acid to prevent birth defects also decreased with social class (P=.011) (Table 4).

DISCUSSION

The prevalence of NTD-affected pregnancies declined significantly among Hispanic women after folic acid fortification in the United States.[1] The same trend has been observed in Puerto Rico, with a decrease in the occurrence of NTDs after mandatory fortification of enriched grain products. Nevertheless, the current prevalence (7.66/10,000 live births)[3] is still higher than that reported for Hispanics (4.18/10,000) and non-Hispanic Whites in the United States (3.3/10,000) in the years after mandatory fortification.The observed disparity in the reduction of NTDs may reflect differences in genetic factors, such as in the genes associated with folate metabolism.[1]

National campaigns to promote the use of folic acid have been established in different countries. In 2000, the Dutch folic acid campaign reported an increase in the use of folic acid for any period around conception from 25.1% in 1995 to 53.5% in 1996, one year after starting the campaign. Appropriate use (four weeks before until eight weeks

Table 3. Factors associated with consumption of folic acid among women recruited at Women and Infant Care and private clinics, Puerto Rico (*N*=964)

Factor	Use of folic acid (%)	unadjusted OR (95% CI)	*P* value
Age group			
Adolescent (10–19 years)	25	.1669 (.48–1.1)	NS
Nonadolescent (20–49 years)	30		
Education			
High school or beyond	94	8.3 (5.1–13.4)	<.001
Less than high school	64		
Social stratum			
Higher (classes I–III)	34	1.58 (1.2–2.1)	.002
Lower (classes IV–V)	25		
Marital status			
Married/living together	29	.87 (.66–1.16)	NS
Widow/divorced/single	32		

OR = odds ratio, CI = confidence interval, NS = nonsignificant.

after conception) increased from 4.8% in 1995 to 21.0% in 1996.[4] Canfield et al[5] reported that 78% of women of childbearing age knew about folic acid, 28% knew that folic acid prevents birth defects, and 25% knew to take folic acid before pregnancy. The prevalence of daily folic acid supplementation among all women of childbearing age was 33%. More recently, a telephone survey conducted through the California Teratogen Information Service showed that 53.2% of pregnant women did not take folic acid-containing supplements in the periconceptional period.[6] The Puerto Rico folic acid campaign was established in 1994 and through the years has used different educational strategies to encourage the consumption of folic acid, including written material, magazines, and television ads and distribution of folic acid pills. Folic acid use to prevent birth defects has also been included in the health education curriculum of public schools.

The results of this study show that the folic acid campaign has succeeded in improving women's knowledge about the recommendation for folic acid use, but the rates of consumption are still poor. This disparity between knowledge and consumption of folic acid is of concern, since this is a population ethnically/genetically at high risk for NTDs and other birth defects. The need to take the supplement daily must also be stressed, since half of the women using supplements in this study had not taken it the day before the survey. The fact that 70% of pregnancies in Puerto Rico are not planned makes preconception supplementation a priority in the quest to decrease the incidence of NTDs and other birth defects on the island.

Also of concern is the fact that 25% of the participants thought their diet was adequate and they did not need to take a folic acid supplement. A study by Boushey et al[7] after fortification showed that 61% of women of childbearing age had intakes of folic acid below the recommended levels, and those who met the guidelines were those who took supplements. Before the mandatory fortification of grains, the average consumption of folic acid was estimated to be .25 mg/day, and the fortification added an estimated .1 mg/day, which leaves many women of childbearing age under the recommended levels.[8]

Brent and Oakley[9] have suggested that the amount of folic acid in fortified grains should be increased. The Food and Drug Administration disagrees, since fortification is nonspecific and must be safe for all groups.[10] With fortification, certain segments of the population may benefit less and may even experience some adverse effects from increased folic acid intake. For now, increasing the amount of folic acid in fortified grains is not possible. We need to continue efforts toward increasing consumption of folic acid and creating awareness about its benefits in women of reproductive age.

Canfield[5] reported that education was the strongest predictor of folic acid awareness. In a study comparing Spanish-speaking and English-speaking women in Arizona, a mere 1.2% of women with fewer than four years of high school education were taking a multivitamin supplement compared with 46% of those with any education beyond high school.[11] Our study shows that Puerto Rican women with more education are 8.3 times more likely to consume folic acid. The fact that lower education and lower social class were barriers against the use of folic acid demonstrates that the strategies currently used to encourage folic acid consumption need to be reevaluated so that women of all socioeconomic backgrounds will benefit from supplementation. In seeking solutions for these disparities, all health professionals must

Table 4. Knowledge about folic acid role in preventing birth defects by social stratum among women recruited at Women and Infant Care and private clinics, Puerto Rico (*N*=964)

Social Stratum	Knowledge (%)
Class I – professional	100
Class II – minor professional	95
Class III – skilled worker	92
Class IV – semiskilled worker	89
Class V – unskilled worker	84

be aware of the importance of motivating their patients to change behaviors. Knowledge is not enough if it does not translate into action.

Implications for Improving Health Disparities

This study found poor rates of folic acid consumption among women of reproductive age in Puerto Rico, and lower education was the most important associated factor. Strategies to target this population will help improve the preconceptional health disparities shown and will help reduce birth defects that are preventable with adequate folic acid supplementation.

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