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The use of folic acid for the prevention of birth defects in Puerto Rico

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Abstract

Introduction—The occurrence of neural tube defects (NTD) has been shown to vary by race/ethnicity, with the highest rates among women of Hispanic ethnicity. Women of reproductive age are advised to use folic acid to prevent NTD and other birth defects. Since 1994, Puerto Rico has a campaign to promote the use of folic acid and since 1998 there is fortification of enriched grain products. After fortification, there has been a reduction in the incidence of NTD in the island. The objective of this study is to assess the use of folic acid by women of reproductive age in Puerto Rico and determine factors associated to 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 to consume 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 desired to continue reducing the incidence of birth defects in Puerto Rico. Education and social class continue to represent barriers to eliminate the disparities in the pre-conception health of our population.

Keywords

Folic acid; Birth defects; Neural tube defects

Introduction

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

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Research Methods

The selection of subjects was performed based on the percent of women of reproductive age living in each geographical area as reported by the 2000 PR census. Eighty percent of the participants were recruited at Women and Infant Care (WIC) clinics all over the island since 80% of the female population giving birth in PR receives 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 due to 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 birth defects prevention. The Social class was determined using the Hollingshead Index of Social Status.[2] Social class was coded in 5 social strata with class I being the highest.

Statistical Analysis

Frequency distributions and percents were used to describe the categorical variables. Means and ranges were used to describe the continuous variables. Normal distribution of quantitative variables was performed using Shapiro Wilk test. Pearson's chi-square or Fisher's exact test, when appropriate, was used to determine the presence of statistical associations. The level of significance was $p<0.05$. Data entry was performed using Epi-Info 6.04d. The STATA package was used to perform the statistical analysis. The research proposal was approved by the Institutional Review Board and all participants signed an informed consent.

Results

The study included 964 non pregnant Puerto Rican women with a mean age of 30 years. Table 1 shows the general characteristics of the participants. Folic acid consumption (including those consuming a multivitamin containing folic acid) was reported by 30% of the participants, 21% reported to consume 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. Knowledge about the role of folic acid in preventing birth defects was reported by 90% of the participants. Of those participants who heard about folic acid, the gynecologist was mentioned as the most frequent source of information about it (62%). Other sources mentioned included television, newspaper, and magazines. Twenty-five percent (25%) of the respondents thought their diet was adequate and there was no 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%) ($p=0.0105$).

Table 2 shows the association of folic acid consumption with higher age when analyzed by age groups ($p=0.0006$). There was lower use of folic acid among women of lower education ($p=0.0000$) and those in lower social classes ($p=0.0013$). Table 3 summarizes the factors associated with consumption of folic acid supplements. Women with high school education or beyond were 8.3 times more likely to consume folic acid ($p=0.0000$). Women in upper social classes (I–III) were 1.5 times more likely to consume folic acid (0.0016). Marital status was not associated to the use of folic acid. Also notice (Table 4) that knowledge about the potential for folic acid to prevent birth defects was also lower with lower social class ($p=0.0105$).

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 NTD 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 USA (3.3/10,000) in the years after mandatory fortification. It has been suggested that the observed disparity in the reduction of NTD 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 (4 weeks before until 8 weeks after conception) increased from 4.8% in 1995 to 21.0% in 1996.[4] Canfield and co-workers[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 for the prevention of 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 still the rates of consumption are poor. This disparity between knowledge and consumption of folic acid is of concern since this is a population ethnically/genetically at high risk for neural tube defects and other birth defects. The importance of daily use of the supplement must also be stressed since half of the women using supplements in this study did not take it the day before the survey. The fact that 70% of the pregnancies in Puerto Rico are not planned makes preconception supplementation a priority in the quest to decrease the incidence of NTD and other birth defects in the island.

Also of concern is the fact that 25% of the participants thought their diet was adequate and there was no need to take a folic acid supplement. A study by Boushey and colleagues[7] showed that 61% of women in childbearing age after fortification had intakes of folic acid below the recommended levels and those who achieved the guidelines were those who consumed supplements. Before the mandatory fortification of grains, the average consumption of folic acid was estimated to be 0.25mg/day and the fortification is estimated to add 0.1 mg/day, leaving many women of childbearing age under the recommended levels.[8]

Brent and Oakley[9] have suggested that there is a need to increase the amount of folic acid in the fortification of grains. The Food and Drug Administration disagrees since fortification is nonspecific and must be safe for all groups.[10] With fortification, the possibility remains that certain segments of the population may benefit less and may even experience some adverse effects from increased folic acid intakes. For now, increasing the fortification with folic acid in the diet is not possible. We need to continue the efforts towards 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 < 4 years of high school education were consuming a multivitamin supplement compared

with 46% of those with any education beyond high school[11]. This study shows that women with higher education are 8.3 times more likely to consume folic acid. The fact that lower education and lower social class showed to be barriers towards the use of folic acid demonstrates that the strategies currently used to encourage folic acid consumption need to be re-evaluated in order for women of all socio-economic backgrounds to benefit from the proven advantages of the supplementation. In seeking solutions for these disparities, all health professionals must 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 with lower education being the most important associated factor. Strategies to target this population group will help improve the preconceptional health disparities shown and will help reduce birth defects shown to be preventable with adequate folic acid supplementation.

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Table 1

General characteristics of the participants (N=964)

Characteristics	Participants
Age in years, mean	30 (10–49)
Age goup	
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 Strata (Hollingshead)	
Class I	6.6%
Class II	26.8%
Class III	17.7%
Class IV	12.5%
Class V	36.3%
Family history of NTD	4.9%

Table 2

Consumption of folic acid by age group, educational level, and social strata

Characteristics	Use of folic acid
Age group	
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 strata	
Class I – Professional	39%
Class II – Minor professional	38%
Class III – Skilled workers	26%
Class IV – Semiskilled workers	23%
Class V – Unskilled workers	25%

Table 3
Factors associated with consumption of folic acid

Factor	Use of folic acid	unadjusted OR (95% CI)	p value
Age group			
Adolescent (10–19)	25%	0.1669 (0.48–1.1)	NSS
Non-adolescent (20–49)	30%		
Education			
High school or beyond	94%	8.3 (5.1–13.4)	0.0000
Less than high school	64%		
Social strata			
Higher (classes I–III)	34%	1.58 (1.2–2.1)	0.0016
Lower (classes IV–V)	25%		
Marital status			
Married/living together	29%	0.87 (0.66–1.16)	NSS
Widow/divorced/single	32%		

OR – odds ratio, CI-confidence interval, NSS- non statistically significant

Table 4

Knowledge about folic acid role in preventing birth defects by social strata

Characteristics	Knowledge
Class I – Professional	100%
Class II – Minor professional	95%
Class III – Skilled workers	92%
Class IV – Semiskilled workers	89%
Class V – Unskilled workers	84%