



MOTHERS KNOWLEDGE AND FOLIC ACID INTAKE FOR NEURAL TUBE DEFECTS PREVENTION

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ABSTRACT

In the critical period of pregnancy for women and their unborn infants, nutritional status plays an important role. Taking folic acid supplementation before pregnancy can reduce neural tube defects up to 70% cases. The present study examined how much mother know about the importance of taking folic acid and whether they have taken folic acid for NTDs prevention. In addition, compared to two groups of mothers, we will determine what the risk factors for NTDs are, as well as what factors affect folic acid taking. **Methods:** This cross-sectional study included mothers (n39) of children with NTDs and mothers (n50) with healthy newborns. We interviewed both groups of mothers, and entered the data in a structured questionnaire containing characteristics of mothers and issues related to the information and prevention of NTDs with folic acid. **Results:** In the group of mothers with a child who has verified NTDs there were significantly more mothers with low levels of education ($p < 0,001$), and significantly more unemployed mothers ($p = 0,007$). Also in this group, mothers knew significantly less about folic acid ($p = 0,007$), and significantly less took folic acid during pregnancy ($p < 0001$). Folic acid taking was significantly influenced by the educational status of the mother ($p = 0,035$) and recommendation of health professionals during pregnancy ($p = 0,026$). **Conclusion:** More efforts should be made to increase women's knowledge and awareness of the importance of supplementation and the consequences of insufficient supplementation in order to improve community health. The media could play a significant role in spreading knowledge of the importance of folic acid for NTDs prevention. Promoting FA supplementation before pregnancy and during reproductive age is necessary for each community. Health professional education programmes would also be very significant, in order to improve preventive programmes.

INTRODUCTION

In the critical period of pregnancy for women and their unborn infants, nutritional status plays an important role.^[1] Folic acid is important for the synthesis of nucleic acids and the division, differentiation, and growth of embryonic cells.^[2] Natural sources of folate include dark green leafy vegetables, yeast, legumes, mushrooms, meat, oranges, walnuts, and bananas.^[2,3,4] The needs for folate in pregnancy are higher by 5-10 times (5), but these needs are difficult to achieve by normal food intake, supplementation is already required. Folic acid is the synthetic and most stable form of folate, and is often used in supplements and enriched foods. The bioavailability of folic acid is approximately 70% higher than folate naturally found in food.^[4] Folic acid deficiency during pregnancy may lead to health problems in infants, including congenital abnormalities and neural tube defects (NTDs).^[1]

Neural tube defects (NTDs) are multifactorial congenital anomalies of the central nervous system that results from failed neural tube closure between the 3rd and 4th weeks of embryonic development.^[6] NTDs are severe congenital anomalies that are accompanied by lifelong disability, high costs, and emotional difficulties for affected families^[7] and are preventable up to 70% cases taking folic acid.^[1] Inadequate folic acid taking can be influenced by various factors, such as: unplanned pregnancy, supplementation costs, maternal age, educational status, marital status, work status, number of previous pregnancies, income, smoker status and level of knowledge, attitude and awareness of the importance of folic acid supplements before and during pregnancy.^[1,8,9] Most women begin supplementation with folic acid when the pregnancy test is positive, which is usually at a time when the neural tube closes.^[10] Better socioeconomic status contributes to reducing NTDs prevalence.^[9,11]

Since 1993, national guidelines around the world have recommended that women of reproductive age take oral folic acid supplements for primary prevention at a dose of 400 µg/day, 3 months before conception and during the first 3 months of pregnancy. Women who have already had one pregnancy with NTDs should take 10 times the recommended dose.^[12,13]

In 1998, the United States introduced a program of mandatory fortification of cereal products using 140 µg of folic acid per 100 g of cereals, and The Institute of Medicine's Food and Nutrition Board of the National Academy of Sciences recommended that all women who could become pregnant consume 400 µg of folic acid per day in addition to consuming food with folate from a varied diet to lower the chance of having a baby with an NTD.^[14]

At present, around 85 countries, including the United States, have a program of mandatory enrichment of basic foodstuffs with folic acid, in contrast to Europe, where there are no mandatory fortification programs.^[7]

Although there are doubts in one part of the medical community in Europe that enriching foods would lead to an "overdose" of folic acid, there is no scientific basis for setting an upper level of intake for folate.^[15]

The present study examined how much mothers know about the importance of taking folic acid and whether they have taken folic acid for NTDs prevention. In addition, compared to two groups of mothers, we will determine what the risk factors for NTDs are, as well as what factors affect folic acid intake.

METHODS

This cross-sectional study included mothers (n39) of children with NTDs and mothers (n50) with healthy newborns. Mother (n39) of children with NTDs who were hospitalized at the Pediatric Clinic, Clinical Centre University of Sarajevo during the period from 5 years. Data were collected retrospectively from the medical histories of hospitalized children. We used medical histories to determine information about the mothers and their phone number. The control group are mothers (n50) with a healthy newborn. We interviewed both groups of mothers, and entered the data in a structured questionnaire containing characteristics of mothers and

issues related to the information and prevention of NTDs with folic acid.

We interviewed mothers (n39) of children with NTD by phone, while we conducted an interview of mothers with a healthy newborns during hospitalization at the Maternity Clinic, Clinical Centre University of Sarajevo.

Statistical analysis

Data were analyzed using Microsoft Excel (version 11, Microsoft Corporation, Redmond, WA, SAD) and compared with Chi-squared test. The results were elaborated and documented in detail and presented as absolute numbers, relative numbers, and statistical values with the use of statistical indicators. All P-values ≤0.05 were considered statistically significant.

RESULTS

In the group of mothers with a child who has verified NTDs there were significantly more mothers with low levels of education ($p<0,001$), and significantly more unemployed mothers ($p=0,007$). We found no statistically significant differences in other characteristics of mothers, such as age, comorbidities, previous abortions, smoking and alcohol consumption (Table 1). In the group of mothers with a child who has verified NTDs there were more mothers who in the present knew significantly less about folic acid ($p=0,007$). Mothers' knowledge of folic acid before pregnancy was insufficient in both groups of mothers, as well as mothers' knowledge of the importance of folic acid in the present. Recommendations for planning the next pregnancy and folic acid intake have been left out in most mothers. Mothers with a child who has verified NTDs N 30/39 (76, 92%), and mothers with health newborns N 45/50 (90%) did not get recommendations for planning the next pregnancy. (Table 2). Statistically significant ($p<0,001$) mothers with healthy newborn intake folic acid if we observe taking before and during pregnancy, but very small number of mothers took folic acid before pregnancy: mothers with a child who has verified NTDs N 1/13 (7,69%) and mothers with healthy newborn N 5/42 (11,90%). Most mothers who took folic acid began their intake during pregnancy (Table 3). Folic acid intake was significantly influenced by the recommendation of health professionals ($p=0,026$) (Table 4). Folic acid taking is correlated with the degree of education of mothers. Mothers with a lower degree of education took less folic acid ($p=0.035$), but we didn't find that employment affects folic acid intake (Table 5).

Table 1: Characteristics of participants in the two groups of mothers.

| Characteristics of mothers | with child with NTD | | with a healthy newborn | | P value |
|-------------------------------|---------------------|-------|------------------------|----|---------|
| | Cases n=39 | | Cases n=50 | | |
| | n | (%) | n | % | |
| The age of the mothers | | | | | 0,999 |
| <20 years | 1 | 2,56 | 1 | 2 | |
| 20-30 years | 28 | 71,79 | 35 | 70 | |
| >30 years | 10 | 25,64 | 14 | 28 | |
| Education | | | | | <0,001* |
| Primary school | 25 | 64,11 | 1 | 2 | |

| | | | | | |
|---------------------|----|-------|----|-----|--------|
| High school | 14 | 35,89 | 35 | 35 | |
| University degree | 0 | 0 | 14 | 14 | |
| Employment | | | | | 0,007* |
| Yes | 7 | 17,95 | 27 | 54 | |
| No | 32 | 82,05 | 23 | 46 | |
| Comorbidites | | | | | 0,452 |
| Yes | 3 | 7,69 | 2 | 4 | |
| No | 36 | 92,31 | 48 | 96 | |
| Miscarriage | | | | | 0,907 |
| Yes | 5 | 12,82 | 6 | 12 | |
| No | 34 | 87,18 | 44 | 88 | |
| Smoking | | | | | 0,815 |
| Yes | 7 | 17,95 | 11 | 22 | |
| No | 32 | 82,05 | 39 | 78 | |
| Alcohol | | | | | N/A |
| Yes | 0 | 0 | 0 | 0 | |
| No | 39 | 100 | 50 | 100 | |

Chi-squared test was applied. In the group of mothers with a child who has verified NTDs there were significantly more mothers with low levels of education ($p < 0,001$), and significantly more unemployed mothers ($p = 0,007$).

Table 2: Mothers' knowledge of folic acid.

| Mothers answers | with child with NTD | | with a healthy newborn | | P value |
|---|---------------------|-------|------------------------|----|---------|
| | Cases n=39 | | Cases n=50 | | |
| | n | (%) | n | % | |
| Did you know before pregnancy what folic acid is | | | | | 0,226 |
| Yes | 1 | 2,56 | 8 | 16 | |
| No | 38 | 97,44 | 42 | 84 | |
| Now do you know what folic acid is | | | | | 0,007* |
| Yes | 9 | 23,08 | 20 | 40 | |
| No | 30 | 76,92 | 30 | 60 | |
| Do you know benefit of folic acid intake | | | | | 0,419 |
| Yes | 9 | 23,08 | 5 | 10 | |
| No | 30 | 76,92 | 45 | 90 | |
| Did you get a recommendation to plan your next pregnancy and take folic acid | | | | | 0,419 |
| Yes | 9 | 23,08 | 5 | 10 | |
| No | 30 | 76,92 | 45 | 90 | |

Chi-squared test was applied. In the group of mothers with a child who has verified NTDs there were more mothers who in the present knew significantly less about folic acid ($p = 0,007$).

Table 3: Folic acid intake.

| Mothers answers | with child with NTD | | with a healthy newborn | | P value |
|---|---------------------|-------|------------------------|-------|---------|
| | Cases | | Cases | | |
| | n | (%) | n | % | |
| Have you been taking folic acid before or during pregnancy | | | | | <0,001* |
| Yes | 13 | 33,33 | 42 | 84 | |
| No | 26 | 66,67 | 8 | 16 | |
| Ukupno | 39 | 100 | 50 | 100 | |
| When you started taking folic acid | | | | | 0,981 |
| Before conception | 1 | 7,69 | 5 | 11,90 | |
| After conception | 12 | 92,31 | 37 | 88,10 | |
| Total | 13 | 100 | 42 | 100 | |

| | | | | | |
|---|----|-------|----|-------|-------|
| Start taking folic acid after conception | | | | | 0,605 |
| of 1 to 4 NG | 1 | 8,33 | 12 | 32,43 | |
| of 5 to 12 NG | 9 | 75 | 23 | 62,16 | |
| after 12 NG | 2 | 16,67 | 2 | 5,41 | |
| Total | 12 | 100 | 37 | 100 | |

Chi-squared test was applied. Statistically significant ($p < 0,001$) mothers in the healthy newborn group intake folic acid if we observe taking before and during

pregnancy, but very small number of mothers took folic acid before pregnancy 1/13(7,69%) and 5/42(11,90%).

Table 4: Influence of recommendation during pregnancy.

| Recommendation | mothers with child with NTD | | mothers with a healthy newborn | | P value |
|----------------------|-----------------------------|-------|--------------------------------|-------|---------|
| | Cases n=13 | | Cases n=42 | | |
| | n | (%) | n | % | |
| | | | | | 0,026* |
| Media | 1 | 7,69 | 7 | 16,67 | |
| Health professionals | 12 | 92,31 | 35 | 83,33 | |
| Total | 13 | 100 | 42 | 100 | |

Chi-squared test was applied. Folic acid taking was significantly influenced by the recommendation of health professionals ($p = 0,026$)

Table 5: Education and Employment in relation to folic acid intake.

| Education and employment of all mothers | Have you been taking folic acid before or during pregnancy | | | | | | P value |
|---|--|-------|---------|-------|------------|-------|---------|
| | Yes n=55 | | No n=34 | | Total n=89 | | |
| | n | (%) | n | % | n | % | |
| Education | | | | | | | 0.035* |
| Primary school | 10 | 11,23 | 16 | 17,98 | 26 | 29,21 | |
| High school | 32 | 35,96 | 17 | 19,10 | 49 | 55,06 | |
| University degree | 13 | 14,61 | 1 | 1,12 | 14 | 15,73 | |
| Employment | | | | | | | 0,124 |
| Yes | 27 | 30,34 | 26 | 29,21 | 53 | 59,55 | |
| No | 28 | 31,46 | 8 | 8,99 | 36 | 40,45 | |

Chi-squared test was applied. Folic acid taking is influenced with the degree of education of mothers. Mothers with a lower degree of education took less folic acid ($p = 0.035$).

DISCUSSION

In this study, a very small number of mothers took folic acid before pregnancy. Most mothers did not know what folic acid is, before pregnancy, indicating the fact that Bosnia and Herzegovina are a developing country that lacks health programs. There are no official guidelines for taking folic acid in prenatal period.^[16] Significant number of mothers in this study start taking folic acid after their first visit to a gynecologist, after they have found out they are pregnant. At this time the neural tube is usually closed, and folic acid intake during this period is ineffective in preventing NTDs what they have published and other studies.^[2,9,11] The main source of information on folic acid among women was from healthcare workers, similar to the study in Switzerland.^[17] Although folic acid is most affected in pregnancy by the recommendation of health

professionals, the fact remains that in a group of mothers who gave birth to a child with NTD, a large number of mothers n30/39 do not know what folic acid is, which indicates low level of recommendation practice of health professionals, because it is recommended that these women need plan for the next pregnancy and take ten times the amount of folic acid for NTD prevention. This indicated the need for greater involvement of health professionals in promoting FA among women, especially in their preconception period, and this is recommended by other authors.^[2]

Awareness of the key role of folate before and during pregnancy it was low, in both group of mothers. This indicates the fact that a very small number of mothers are explained the importance of folic acid by health workers.

As an important predictor for taking folic acid was mothers' education similar as in other studies.^[1,8,9] Although a large number of unemployed mothers in a group of mothers who gave birth to NTD, looking at all mothers' employment in this study did not affect folic

acid taking which are different from other studies.^[8,9] Even unemployed mothers took folic acid if they received a recommendation from health care workers. Physicians playing a large role in promoting appropriate use of FA supplements.^[18] These results highlight the need to strengthen public health strategies and future better coordination of existing measures aimed at improving awareness and ensuring adequate folate intake, especially in women planning pregnancy. We also found that in contact with mothers' health care workers, planning for the next pregnancy is not recommended, nor have they been given recommendations for FA intake. Only a small number of mothers received a recommendation for planning the next pregnancy, especially in a group of mothers who had already given birth to a child with NTD. Other study reported that physicians lack knowledge regarding periconceptional FA, which is associated with their attitude and practice, prevents most physicians from adhering to guidelines.^[18] This study supports the fact that Bosnia and Herzegovina are a developing country that lacks health programs. There are no official guidelines for taking folic acid in prenatal period.^[16]

Other authors have pointed that is needed to educate communities about the importance of folic acid such as the use of digital media or the introduction of a topic at an earlier age through the school program. They think that there is great potential to raise awareness of folate and nutrition needs during pregnancy at routine examinations in gynecologists, attended by most women, and that it would be essential to make strategies such as reminders for health professionals, to promote folic acid as much as possible.^[17]

Although the study has limitations due to the small number of interviewed mothers, it is evident that a significant number of mothers in the group of mothers who have a child with NTDs are unemployed and with a lower level of education.

In addition it is important to make national recommendations for folic acid supplementation for women of reproductive age, but also change the public health policy that includes mandatory fortification of basic foods as this is the best measure for primary prevention of NTDs in the whole population regardless of employment and education status.^[16]

CONCLUSION

More efforts should be made to increase women's knowledge and awareness of the importance of supplementation and the consequences of insufficient supplementation in order to improve community health. For each community promoting FA supplementation before pregnancy and during reproductive age is necessary. Health professionals and the media could play a significant role in spreading knowledge of the importance of folic acid for NTD prevention. Health

professional education programmes would also be very significant, in order to improve preventive programmes.

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