

Prevention of neural tube defects: effect of an intervention aimed at implementing the official recommendations

Summary

Objectives: The periconceptional intake of 0.4 mg folic acid is recommended in many countries to prevent neural tube defects. This paper describes the poor implementation of corresponding guidelines in Germany, the effectiveness of an intervention-based on providing adequate information and the problems associated with the implementation.

Methods: Two cross sectional studies investigated knowledge, attitude, and behaviour of randomly sampled gynaecologists ($n = 24/27$), pharmacists ($n = 21/21$), and women in childbed ($n = 131/118$) before and after the information campaign.

Results: Before the intervention, 3.8% of the women implemented folic-acid-prophylaxis compared with 9.3% afterwards ($p = \text{n.s.}$). The awareness of the prophylaxis before pregnancy correlated with socio-economic status and rose from 28% (before) to 42% after intervention ($p < 0.05$). Before the intervention, 38% of the gynaecologists and 38% of the pharmacists recommended the prophylaxis compared with 74% ($p < 0.05$) and 43% ($p = \text{n.s.}$) afterwards.

Conclusions: The effect of the intervention was small. To improve the situation, fortification of specially selected and labelled food should be considered. An accompanying nationwide information campaign should focus on women with lower socio-economic status.

Keywords: Neural tube defect – Folic acid – Practice guidelines – Health promotion.

In the early 1990s, randomised trials showed that the periconceptional intake of folic acid reduced the risk of having a baby with a neural tube defect by 50–70% (MRC Vitamin Study Group 1991; Czeizel & Dudás 1992). Since then rec-

ommendations have been issued in many countries advising women of childbearing potential and no active contraception to take folic acid periconceptionally, i.e., at least four weeks before until four weeks after conception. In Germany the Societies of Nutrition, Gynaecology and Obstetrics, Human Genetics, Paediatrics, and Neuropaediatrics jointly issued corresponding recommendations. They were published in different scientific and professional journals in 1994 and 1995 (Koletzko & Kries 1995). The prevalence of neural tube defects in Germany is about 1 per 1000 live births, stillbirths and induced abortions after the 16th gestational week (Queisser-Luft et al. 1996). Thus, at least 800 pregnancies per year are affected by neural tube defects.

For many countries (Centers for Disease Control 1997; Chou et al. 1995; Clark & Fisk 1994; De Jong-Van den Berg et al. 1995; Milner et al. 1996) and for Germany (Genzel-Boroviczeny et al. 1997; Rösch et al. 1999), it has been shown that even years after the publication of guidelines very few women take folic acid periconceptionally to prevent neural tube defects. The present study, for the first time, presents an intervention aimed at increasing the very low rate of folic acid substitution in Germany, applying the conceptual framework of the *Public Health Action Cycle* of the American Institute of Medicine (National Academy of Sciences 1998) (*assessment – policy formulation – assurance – evaluation*). The study started with an *assessment* of the health problem. The awareness and/or behaviour regarding the prophylaxis not only of the women, but also of gynaecologists and pharmacists was checked. The *policy formulation* comprised planning a media campaign and information intervention directed at health professionals. The intervention was carried out (*assurance*) and its effects on the women and the health professionals were evaluated (*evaluation*). Our intervention focused on an information campaign. Acquiring knowledge is the first step on the way to behaviour

change. By analysing the specific problems which are barriers in putting knowledge into action this paper prepares the ground for further public health activities to improve the implementation of the prophylaxis.

Methods

In Germany, most women regularly see their office-based gynaecologist for screening check-ups or contraceptive prescription. Thus, the gynaecologist has the opportunity to inform women of childbearing age personally about folic acid and to distribute information material. Folic acid tablets, apart from multivitamins, are only sold in pharmacies in Germany. Pharmacists can promote the prophylaxis by displaying and distributing information brochures to their customers, especially when a woman asks for advice or buys a pregnancy test.

Study design

The basic study design was an intervention (information campaign) directed at health professionals, in particular gynaecologists and pharmacists, and the general public. To assess the effectiveness of the campaign, interviews were conducted before and after the intervention. For prior reports we assumed that the baseline proportion of women periconceptionally taking folic acid was 5%. For an increase to 15%, a sample size of 112 women per group was required using $\alpha < 0.05$ and a power of 80%. Figure 1 depicts the course of the study events.

Objectives

The objectives of the study were to ascertain, in a well-defined region, the proportion of physicians who were aware of the benefits of folic acid prophylaxis, the proportion of pharmacists who recommended the prophylaxis and the proportion of women who took folic acid periconceptionally. The reasons why knowledge of the prophylaxis did not result

in intake of folic acid were also analysed. In addition, the effectiveness of an information campaign was evaluated to assess whether it could increase knowledge and thus achieve a higher proportion of folic acid intake.

Interviews

Health professionals: Interviews with *gynaecologists* and *pharmacists* were carried out two to three years after the publication of official recommendations and five to six years after randomised controlled trials had been published. The first interview series was carried out 1996 and the second one approximately 16 months later – after the intervention had taken place.

Correct knowledge or behaviour according to the official guidelines was defined as the recommendation to take 0.4 mg folic acid daily (4.0 mg folic acid in cases with a family history of neural tube defect) from four weeks before conception, at least, to four weeks after conception. Since the neural tube closes about four weeks post conception, prophylactic measures after that time are ineffective.

Thirty *gynaecologists* were randomly sampled from a list of all office-based gynaecologists of Munich (n = 311) and interviewed by telephone. They were asked whether they recommended any kind of vitamins or minerals to women who planned to become pregnant. In each interview series, one of the initially selected doctors had to be excluded because he/she did not see pregnant women. Of the remaining 29 doctors, 24 participated in the first series and 27 in the second one.

Twenty-one pharmacies in Munich were randomly chosen, stratified by region, for each interview series. The *pharmacists* were visited by a young woman telling them she wanted to become pregnant and that she had heard about certain vitamins or minerals she should take in order to have a healthy baby. She asked which substances might be advisable and, if folic acid was mentioned, when to start the intake. During the interview the pharmacists were not aware

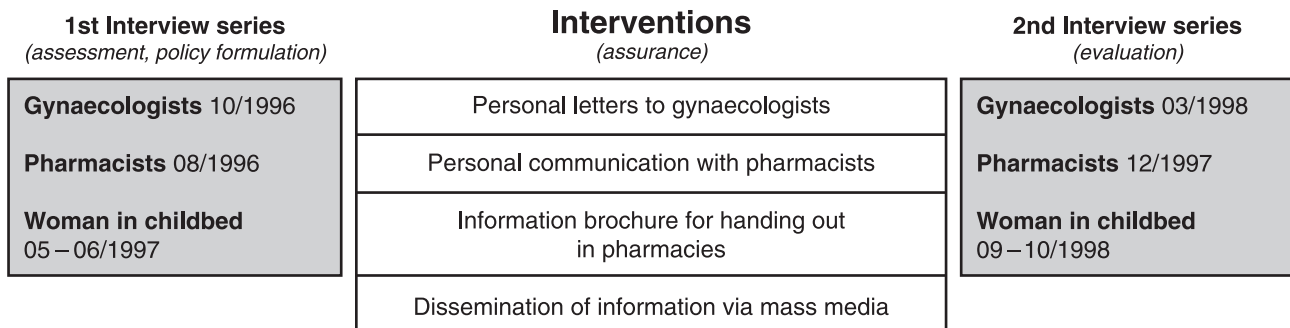


Figure 1 Study plan

of being in a test situation. The woman was intensively trained, especially in adopting a uniform approach. Immediately following the interaction with the pharmacists, she noted down in the prepared report form, whether folic acid was recommended or not and if yes, then also the time to start it.

Different random samples of gynaecologists and pharmacists were chosen for the two interview series to avoid recall or learning bias. In addition, the interview could have made the gynaecologists or pharmacists receptive to the information on the prophylaxis compared to the colleagues not interviewed.

The telephone interviews with the gynaecologists measured their awareness of the prophylaxis whereas the pharmacy visit measured the actual behaviour of the pharmacist in a real world situation.

Women in childbed: To assess the extent to which the recommendations were actually followed, all *women* giving birth within a pre-specified two week period at one ward each of three major hospitals in Munich were interviewed by one of the authors (V.E.), using a standardised questionnaire. This questionnaire included questions about the planning of pregnancy, folic acid supplementation, and demographic data. A total of 131 out of 154 women participated in the first interview series and 118 out of 152 women participated in the second one. Reasons for non-participation were poor proficiency of the German language, severe illness or death of the child, refusal or the fact that the mother went home shortly (< six hrs) after delivery.

Socio-economic status of the women was defined according to the "Winkler-Index" (Winkler 1998); a score of education, occupation, and income.

Intervention

The intervention was aimed at improving the awareness of gynaecologists and pharmacists and motivating them to promote the prophylaxis. Additionally, the lay public was informed via the media in order to increase awareness of and stimulate a demand for the prophylaxis.

All 311 office-based *gynaecologists* in Munich received two personalised letters within a ten month period informing them about the ability to prevent neural tube defects with folic acid and asking for their support in this matter. To avoid the impression of commercial information, the University of Munich research group on drug use in pregnancy was clearly pointed out on the letterhead and envelope as sender of the letters. A copy of the official recommendations and a list of folic acid medicines available on the market was enclosed.

All 418 *pharmacies* in Munich were visited and personally informed about the prophylaxis. They were given material for themselves and brochures for their customers, e.g., when selling a pregnancy test. In the official pharmacists' journal, which every pharmacy obtains once a week, an article about folic acid and its implications for the closure of the neural tube was published.

At a press conference, journalists working for press, radio and television were informed about folic acid prophylaxis. Consequently, all daily newspapers, including the tabloids covering Munich, a women's magazine and a scientific journal published articles on the topic, and two radio stations and one television station broadcasted features. In several journals and magazines, publications were launched, e.g., in the magazine of a major health insurance company.

Statistics

The data were analysed with the statistical package "JMP 3.1.5.". For analysis, the χ^2 -Test for comparison of proportions was used ($\alpha = 0.05$).

Results

Gynaecologists

In the first interview series, prior to the intervention, nine of the 24 gynaecologists recommended the periconceptional supplementation of folic acid, as officially recommended (Fig. 2). Just as many gynaecologists gave no recommendation to take folic acid. Two of them had already heard of the prophylaxis but did not practise it. Four of 24 physicians recommended the prophylaxis only to women with a family history of neural tube defects. Two physicians advised starting folic acid at the beginning of pregnancy.

Fifteen months later, in March 1998, 20 of the 27 gynaecologists recommended periconceptional intake of folic acid (Fig. 2). The increase of 36.5% relative to the first interview series was statistically significant (DF 1, $p = 0.019$). Three physicians out of 27 advised women with a family history of neural tube defect to use folic acid. Four physicians out of 27 recommended starting folic acid intake only at the beginning of pregnancy.

Pharmacists

In the first interview series, eight of the 21 pharmacists recommended taking folic acid periconceptionally (Fig. 3). Just as many stated that it would be sufficient to start at the beginning of pregnancy. The remaining five out of 21 pharmacists did not mention folic acid at all.

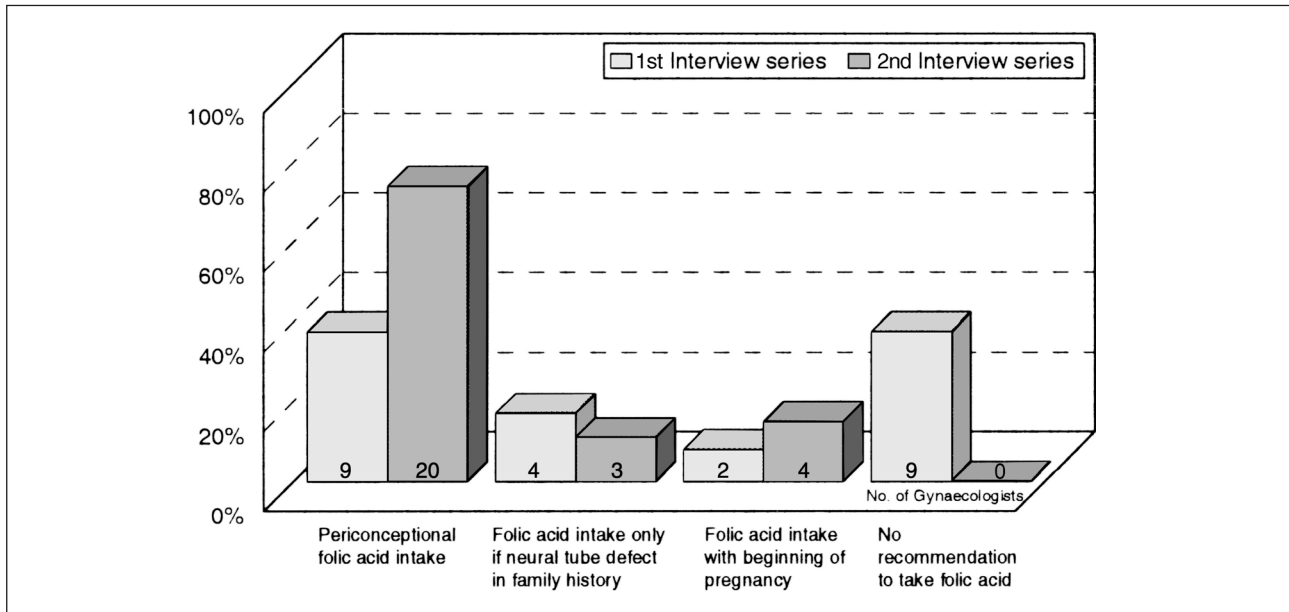


Figure 2 Gynaecologists: recommendations concerning folic acid prophylaxis, interview series 1 (n = 24) and 2 (n = 27)

Sixteen months later, in December 1997, nine of the 21 pharmacists recommended the periconceptual intake of folic acid (Fig. 3). Six pharmacists considered it sufficient to start the intake of folic acid at the beginning of pregnancy and a further six pharmacists did not mention folic acid at all. Without being asked, three pharmacists handed out the information brochures that all pharmacies had received five months previously in the course of the intervention campaign. Seven pharmacists gave the brochure to the interviewer by request. All others claimed they had no information brochures, even though the brochures were on display in one case.

Women in childbed

In the first series, 5 out of 131 (3.8%) women interviewed had started the intake of folic acid four weeks before pregnancy or earlier and continued until four weeks after the beginning of pregnancy. In the second series, with 118 women, this increased to 9.3% (n = 11) (Fig. 4). This increase, however, was not statistically significant (DF 1, p = 0.077). Further 10.7% (n = 14) and 20.4% (n = 24) of the women, respectively, had supplemented folic acid during a part of the relevant eight-week periconceptual period, in most cases beginning in the third or fourth week after conception. Considering planned pregnancies only, 5 out of 94 (5.3%) women in the first series and 11 out of 75 (14.7%) women in the second series (DF 1, p = 0.039) took folic acid during the whole eight-week period.

The regular intake of multivitamin preparations or juice - independent of pregnancy - hardly plays a role in the context of preventing neural tube defects. Less than 3% of the women in this study had supplemented at least 0.4 mg folic acid per day this way.

Twenty-seven of the 35 women (77%) (2nd interview series) who took folic acid, in at least a part of the periconceptual period, had received the information from their gynaecologists. Five women had read about it, two knew about it since they were health professionals themselves (physicians, pharmacists), and one had been advised by a genetic counselling centre.

The proportion of women who knew about folic acid prophylaxis already before pregnancy significantly increased from 28% (n = 37) (1st interview series) to 42% (n = 50) (2nd interview series) (DF 1, p = 0.02). Women of average socio-economic status were better informed after the intervention, however, there was almost no knowledge gain for women of low or high socio-economic status. In both interview series women of higher socio-economic status were better informed than lower socio-economic status women (DF 2, p < 0.05). A considerable proportion of the women had not taken folic acid periconceptually despite their knowledge. The reasons mentioned were that the pregnancy had not been planned (23%), 17% became pregnant earlier than planned or it was uncertain whether or when pregnancy would occur, and 11% had not thought of the prophylaxis at the right time. Further reasons were lack of confidence in

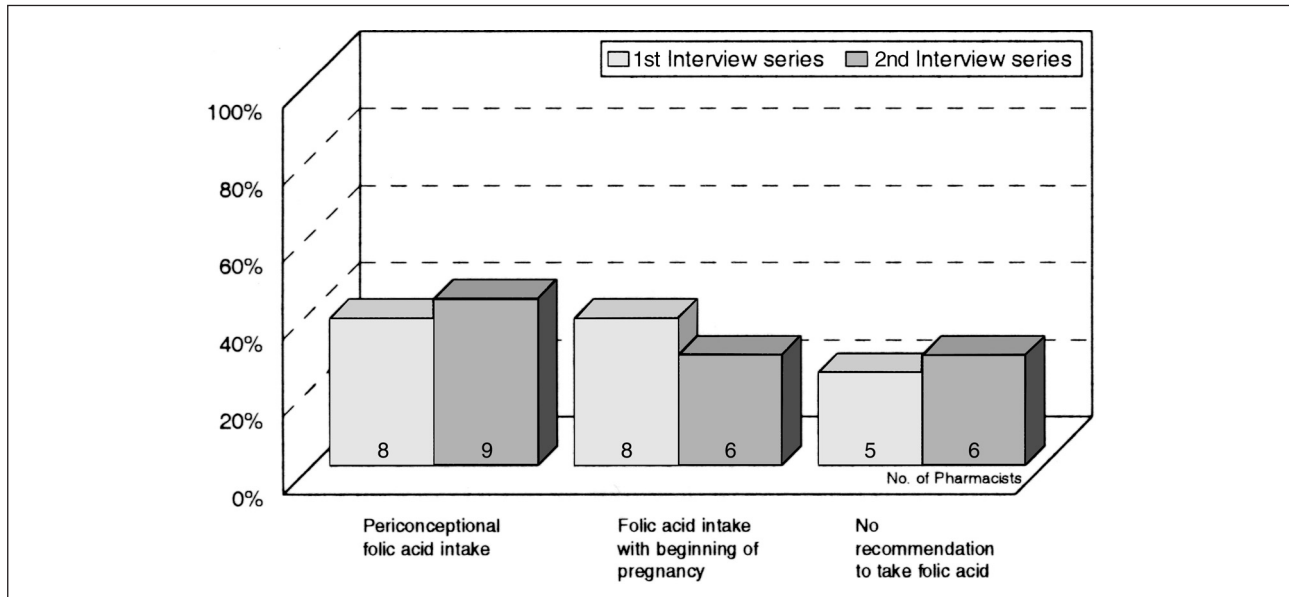


Figure 3 Pharmacists: recommendations concerning folic acid prophylaxis, interview series 1 and 2 (n = 21)

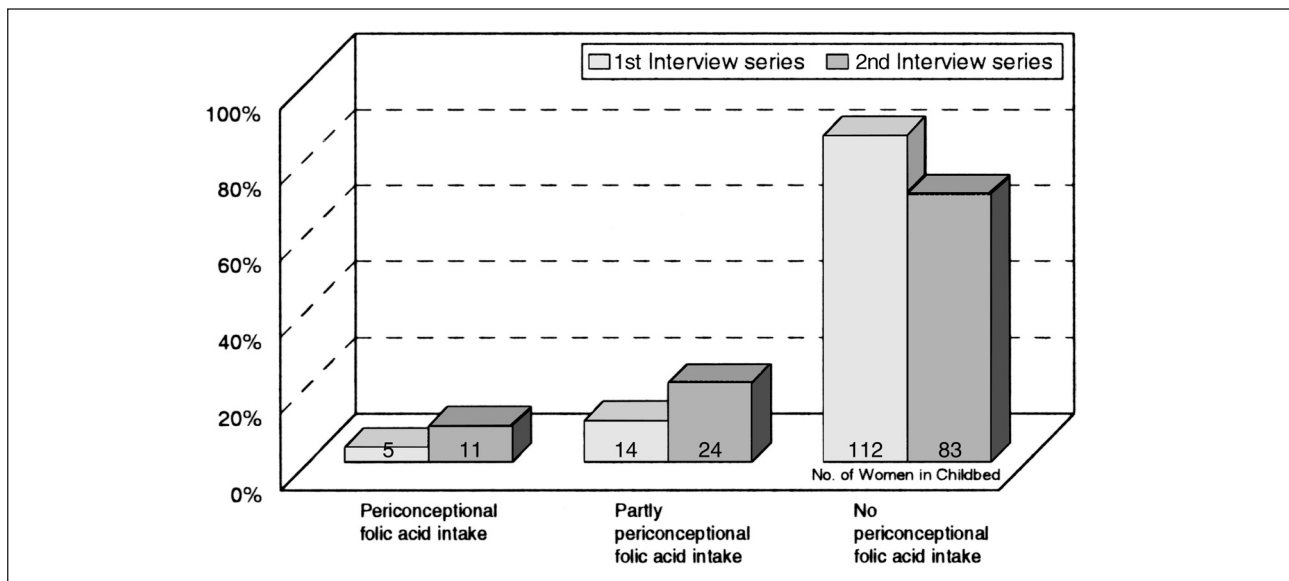


Figure 4 Women in childbed: periconceptual intake of folic acid, interview series 1 (n = 131) and 2 (n = 118)

the credibility of scientific research or its relevance for the individual (17%), insufficient support by the gynaecologist (9%) and the notion of getting an adequate amount of folic acid with the usual diet (11%).

These women's information sources are listed in Table 1.

In the second interview series, the brochure given to the pharmacists for display and distribution was shown to the women. Only five women (4%) remembered reading it. In addition, the women were asked which source of information

Table 1 Sources of information before pregnancy (n = 49)

Source of information	% of women
The media (e.g., magazines, newspapers, TV, books)	47%
Health professionals (mostly gynaecologists)	33%
Relatives and friends	20%
Information brochures	16%
Profession of the women	12%

for folic acid prophylaxis they considered most trustworthy. Gynaecologists alone or together with other physicians were mentioned most often (84%). Thirteen percent of the women mentioned magazines dealing with medical issues and 8% paediatricians. Only about 5% of the women had confidence in each of the other sources, i.e., midwives, pharmacists, (parent) magazines, books, information brochures as well as friends and relatives.

When asked about their preferred folic acid format, 31% of the women considered the question as irrelevant, 41% preferred to take tablets and 28% favoured fortified food. Convenient handling, the certainty to take the right dose and fear that fortified food might taste bad were arguments for preferring tablets. Women favouring fortified food mentioned their dislike for tablets, partly due to difficulties in swallowing, and the possibility of combining tasty food with the supplementary intake of folic acid.

In the second interview series 103 (87%) women indicated they would take folic acid if they became pregnant again. Apart from two, one of high and one of average socio-economic status, all 103 women said they were willing to pay up to five Euro per month for the folic acid prophylaxis.

Discussion

The finding that folic acid supplementation can protect against neural tube defects is a milestone in preventing congenital malformations. Nevertheless, the data show that even years after the publication of official recommendations neither health professionals nor women sufficiently implement these guidelines.

The study results suggest that women considered the *gynaecologist* the most significant and reliable person regarding questions about pregnancy. Consequently, poor knowledge about folic acid prophylaxis among gynaecologists considerably impeded the implementation. Some women even reported that they had not taken folic acid because their gynaecologist regarded it as unnecessary, despite their desire to do so. There is evidence that our information campaign was successful in raising the awareness among gynaecologists. In the interviews, the gynaecologists were asked directly what they recommended to women planning a pregnancy in order to have a healthy baby. Thus, the results reflect the knowledge and attitude of the gynaecologists but probably overestimate the percentage of gynaecologists actively implementing the folic acid guidelines. Our data show that considerably improved knowledge did not result in a corresponding increase of folic acid intake.

Eight and 15%, respectively, of the gynaecologists advised their patients to start prophylaxis only at the beginning

of pregnancy. About two thirds of first antenatal visits take place after the sixth week of pregnancy (Köster et al. 1996). Therefore, if the gynaecologists do not routinely inform their patients before pregnancy during their visits for screening check-ups or prescription of contraceptives, the information at the first antenatal visit in most cases is too late.

Since during the interview the *pharmacists* were not aware of being in a test situation, the study reflects the way pharmacists act when information is actively requested. The setting of the counselling situation was optimal in that they were dealing with an interested, intelligent, very neat woman without communicational or language problems. Even so, in both interview series only about 40% of the pharmacists recommended periconceptional intake of folic acid. There was no difference between the two interview series, i.e., before and after the intervention. The conclusion is that neither the information visit at the pharmacies nor the reports in the pharmacists' official journal have significantly improved the counselling quality. About half of the pharmacists, however, actually used the brochures they received. The knowledge of the gynaecologists improved much more than the behaviour of the pharmacists, despite the pharmacists being informed by a personal visit. This reflects the well known fact that changes in behaviour are harder to achieve than changes in knowledge.

A crucial factor for the success of folic acid prophylaxis is the proportion of *women* actively acting according to the recommendations. Four years after the official recommendations had been published in Germany, only 9.3% of the women in the sample had taken folic acid periconceptionally. The increase compared to the rate the year before (3.8%) was not statistically significant. Neural tube defects, which can be prevented, are still bound to occur.

A considerable number of the women who had already heard of the prophylaxis before pregnancy did not act accordingly. Some women did not remember the information or did not think of it at the right time. Obviously, it is essential that the women be reminded again and again of the prophylaxis. Other women had not planned their pregnancy, became pregnant earlier than planned or were uncertain whether or when the pregnancy occurred. About one third of the women had not planned their pregnancy. Therefore, an optimal strategy of neural tube defect prophylaxis seems to require that all women of childbearing age who are "at risk" of becoming pregnant take folic acid daily. Adequate information can be helpful in persuading women with a lack of conviction, women whose support from the gynaecologist is insufficient, or women who think that their usual diet contains an adequate amount of folic acid.

In order to improve the unsatisfactory situation, press reports were launched and information brochures distributed. Since most women did not remember where they had read about folic acid prophylaxis, the effect of the intervention could not be measured exactly.

In Germany, only 0.7% to 2.6% of the women between 18 and 34 years take multivitamin preparations daily (Heseker et al. 1994) compared to about 20% in the USA (Subar & Block 1990). It was no surprise, therefore, that less than 1% of the women interviewed had taken the recommended 0.4 mg folic acid per day in this way. Multivitamin juice was also rarely a sufficient source of folic acid.

Over 90% of the German population have health insurance subject to legislative regulations. The insurers have decided not to reimburse for folic acid supplements (Anonymous 1999). Financial considerations do not seem to be a main barrier for most of the women to implement the prophylaxis because nearly all the women who had a positive attitude to the prophylaxis stated their readiness to pay for the supplements themselves.

The women in childbed were interviewed in three major hospitals in Munich. A comparison with the population based perinatal surveillance program, covering about 90% of all births in Bavaria, showed that the women in this study were a representative sample of women delivering in Munich, as far as mean age and percentage of primipara were concerned. The proportion of foreigners in this study, however, was 5% lower, as women with poor proficiency in German were not included. On the other hand it was 7% higher compared to all deliveries in Germany because the percentage of foreigners in Munich is above-average.

A limitation of the study was the uncontrolled study design. It is possible that other information unrelated to our information campaign also influenced the study results. No such activity, however, came to our attention. A strength of the study was its ability to elucidate the reasons why or why not women comply with the guidelines, thus pointing out which obstacles have to be overcome in order to successfully implement the folic acid prophylaxis. Our study focused on an information campaign. We did not aim to analyse further barriers hindering health professionals actively implementing the recommendations, e. g., lack of conviction, lack of time, organisational or financial restraints, and perception of responsibility. Further research is needed to explore these barriers and to develop and test standard procedures to implement folic acid prophylaxis in the daily routine of gynaecologists and pharmacists.

Conclusions

The level of awareness among health professionals and women of folic acid prophylaxis remains too low. Our information campaign was only partially successful. Intensified information and motivation activities are necessary. The Netherlands set a good example with a national folic acid campaign starting in September 1995 (De Walle et al. 1999). The intensive mass media campaign of the government was accompanied by several private initiatives, e. g., information on oral contraceptive packs and advertising by producers. Due to this comprehensive approach, considerable public awareness was achieved and use of folic acid during the entire recommended period rose from 4.8% in autumn 1995 to 35.5% in autumn 1998.

Even a very intensive information campaign has its limitations due to the gap between knowledge and behaviour, illustrated in the present study. Although women knew about the beneficial effects of the folic acid prophylaxis, they could not or did not want to act accordingly, e. g., because the pregnancy was unplanned or they were not convinced of the benefit. So the neural tube defect prophylaxis by periconceptional folic acid supplementation may not be used by – at least nearly – all women as desirable in the view of the individual and of public health.

An alternative to tablets is general fortification of staple food, e. g., flour. The advantage of food fortification is that no change in behaviour is needed. It also supplies the prophylaxis to lower social-economic status women who appear less well informed. The disadvantage of this strategy, which includes the general population, is the possible risk of masking a vitamin B12 deficiency – a problem among the elderly but not for women of childbearing age. To keep the percentage of persons who take more than 1.0 mg (the critical dose to mask a vitamin B12 deficiency) very low, the USA, for example, fortifies grain products only with 140 µg folic acid per 100 g. This fortification level provides only a few women a daily intake of 0.4 mg folic acid (Cornel & Erickson 1997). Thus, most women would need supplementary folic acid tablets.

An alternative to the fortification of staple food is the fortification of specially selected and labelled food, e. g., breakfast cereals. Thus, on a voluntary basis women could select food enriched with folic acid during childbearing age. In this way, unplanned pregnancies would also be protected. It can be expected that enriched food as source of folic acid would be well accepted because 28% of the women preferred fortified food to taking tablets and 41% had no preference. An advantage of this strategy is that the general population is not involved by force. An increase of multiple births after the intake of folic acid is under discussion (Mathews et al.

1999). By choosing fortified food or not, the woman can decide whether she wants to accept this for lowering her risk of having a child with a neural tube defect. The fortification has to be accompanied by an information campaign to increase public awareness of the importance of the prophylaxis, thus

providing social support for women to adequately apply the neural tube defect prophylaxis. The information campaign should be especially focused on groups with lower socio-economic status.

Zusammenfassung

Prävention von Neuralrohrdefekten: Effekt einer Intervention zur Umsetzung der offiziellen Empfehlungen

Fragestellung: In zahlreichen Ländern wird um den Zeitpunkt der Konzeption herum die Einnahme von 0,4 mg Folsäure zur Prävention von Neuralrohrdefekten empfohlen. Vorliegende Studie untersucht die Umsetzung der entsprechenden deutschen Empfehlungen, die Effektivität einer Intervention zur Information der Zielgruppen und die Probleme der Umsetzung.

Methoden: In zwei Querschnittsstudien wurde das Wissen und Verhalten von niedergelassenen Gynäkologen (N=24/27), Apothekern (N=21/21) und Frauen im Wochenbett (N=131/118) untersucht. Zwischen diesen Studien wurden in einer spezifischen Region die Gynäkologen durch persönliche Anschreiben, die Apotheker bei einem persönlichen Besuch und die Öffentlichkeit durch die Medien über die Prophylaxe informiert.

Ergebnisse: Die perikonzeptionelle Folsäureeinnahme der Frauen stieg von 3,8 % auf 9,3 % ($p = n.s.$), die Kenntnis der Prophylaxe vor der Schwangerschaft war mit dem sozioökonomischen Status korreliert und stieg von 28 % vor auf 42 % nach der Intervention ($p < 0.05$). Vor der Intervention empfahlen 38 % der Gynäkologen und der Apotheker die perikonzeptionelle Folsäureeinnahme, verglichen mit 74 % ($p < 0.05$) bzw. 43 % ($p = n.s.$) nachher.

Schlussfolgerungen: Der Effekt der Intervention war gering. Zur Verbesserung der Situation sollten ausgewählte und entsprechend gekennzeichnete Nahrungsmittel mit Folsäure angereichert werden. Eine begleitende landesweite Informationskampagne sollte insbesondere auf Bevölkerungsgruppen mit niedrigem sozio-ökonomischem Status ausgerichtet werden.

Résumé

Prévention des anomalies du tube neural: efficacité d'une intervention pour réaliser les recommandations officielles

Objectifs: L'apport péri-conceptionnel de 0,4 mg d'acide folique est recommandé dans de nombreux pays pour prévenir les anomalies du tube neural. Cet article décrit les lacunes d'exécution de ces recommandations en Allemagne, l'effet d'une intervention basée sur une campagne d'information appropriée, et les problèmes associés à sa mise en pratique.

Méthodes: Deux études transversales dans une région spécifique ont été menées. Ces études ont porté sur la connaissance et le comportement d'un échantillon randomisé de gynécologues en cabinet ($n = 24$ et 27), de pharmaciens d'officine ($n = 21$ et 21), et de femmes recrutées à la Maternité ($n = 131$ et 118), avant et après intervention visant à informer chaque gynécologue par lettre personnelle et chaque pharmacien par une visite. Le grand public a été informé par les médias.

Résultats: Avant cette intervention, 3,8 % des femmes avaient pris des suppléments d'acide folique en période péri-conceptionnelle, en comparaison avec 9,3 % après l'intervention ($p = n.s.$). La connaissance de l'intérêt prophylactique d'une supplémentation avant la grossesse était corrélée au niveau socio-économique des femmes, et a augmenté de 28 % (avant) à 42 % après l'intervention ($p < 0,05$). Avant l'intervention, 38 % des gynécologues et 38 % des pharmaciens recommandaient l'apport péri-conceptionnel d'acide folique, en comparaison avec 74 % ($p < 0,05$) et 43 % ($p = n.s.$) après l'intervention.

Conclusions: L'efficacité de cette intervention a été faible. Pour améliorer cette situation, l'enrichissement en acide folique d'aliments spécialement sélectionnés et étiquetés en conséquence devrait être envisagé. Une campagne parallèle d'information nationale devrait se focaliser plus spécialement sur les femmes de niveau socio-économique plus faible.

References

- Anonymous (1999). Sonstige-Hilfen-Richtlinien. Änderung der Sonstige-Hilfen-Richtlinien. Dt Ärztebl 96: A-231-2.
- Centers for Disease Control (1997). Knowledge and use of folic acid by women of childbearing age - United States, 1997. MMWR Morb Mortal Wkly Rep 46: 721-3.
- Chou S, Forman R, Hoffman L, Parkin P, Koren G (1995). Folic acid and prevention of neural tube defects: those who should know about it haven't heard yet. In: Koren G, ed. Folic acid for the prevention of neural tube defects. Toronto: The Motherisk Program: 131-44.
- Clark NAC, Fisk NM (1994). Minimal compliance with the Department of Health recommendation for routine folate prophylaxis to prevent fetal neural tube defects. Br J Obstet Gynaecol 101: 709-10.
- Cornel MC, Erickson JD (1997). Comparison of national policies on periconceptional use of folic acid to prevent spina bifida and anencephaly (SBA). Teratology 55: 134-7.
- Czeizel AE, Dudás I (1992). Prevention of the first occurrence of neural-tube defects by periconceptional vitamin supplementation. N Engl J Med 327: 1832-5.
- De Jong-Van den Berg LTW, Cornel MC, Tymstra T, Buitendijk SE (1995). Folate prophylaxis in pregnancy. Lancet 346: 1227-8.
- De Walle HEK, de Jong-van den Berg LTW, Cornel MC (1999). Periconceptional folic acid intake in the northern Netherlands. Lancet 353:1187.
- Genzel-Boroviczeny O, Hachmeister A, von Kries R (1997). Unverändertes Risiko für Neuralrohrdefekte. Kinderärztliche Praxis 68: 6-9.
- Heseker H, Adolf T, Eberhardt W, et al. (1994). Lebensmittel- und Nährstoffaufnahme Erwachsener in der Bundesrepublik Deutschland. Niederkleen: Wissenschaftl. Fachverlag Dr. Fleck: 3: 44.
- Köster I, von Ferber L, Schubert I (1996). Häufigkeit und Umfang der ärztlichen Inanspruchnahme während der Schwangerschaft. Frauenarzt 37: 1242-50.
- Koletzko B, von Kries R (1995). Prävention von Neuralrohrdefekten durch Folsäurezufuhr in der Frühschwangerschaft. Kinderarzt 26: 187-90.
- Mathews F, Murphy M, Wald N, Hackshaw A (1999). Twinning and folic acid use. Lancet 353: 291-2.
- Milner M, Selvin J, Morrow A, Fawzy M, Clarke T, Mc Kenna P (1996). Suboptimal compliance with periconceptional folic acid in an Irish hospital population. Ir Med J 89: 28-30.
- MRC Vitamin Study Research Group (1991). Prevention of neural tube defects: results of the Medical Research Council Vitamin Study. Lancet 338: 131-7.
- National Academy of Sciences. Institute of Medicine (1998). The future of Public Health. Washington: NAS.
- Queisser-Luft A, Wolf HG, Schlafer K, von Kries R (1996). Häufigkeiten von Neuralrohrdefekten in Deutschland. Monatsschr Kinderheilkd 144: 136-40.
- Rösch C, Lehmann R, Kötz K, Steinbicker V (1999). Folsäure und Schwangerschaft. Ernährungs-Umschau 46: 10-12.
- Subar AF, Block G (1990). Use of vitamin and mineral supplements: demographics and amounts of nutrients consumed. The 1987 National Health Interview Survey. Am J Epidemiol 132: 1091-101.
- Winkler J (1998). Die Messung des sozialen Status mit Hilfe eines Index in den Gesundheits-survey der DHP. In: Ahrens W, Bellach B-M, Jöckel K-H, eds. Messung soziodemographischer Merkmale in der Epidemiologie. München: MMV Medizin Verlag: 69-74.

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