Micronutrients during pregnancy: the nutritive situation in Germany

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During pregnancy the demands for energy and nutrients are increased. Despite increasing awareness about nutrition in the population of a western country like Germany, there is a discrepancy between actual food intake and recommended quantities of certain nutrients, particularly during pregnancy. There are correlations between deficiencies in micro-nutrients such as iodine, iron and folic acid and the course and outcome of pregnancy. The consequences of an insufficient supply of these micronutrients during pregnancy are described and high-risk groups for an inadequate supply are defined. Recommendations for nutrition counselling during this period of life are given.

Key words: Pregnancy, nutrition, micronutrients, folic acid, iodine, iron

Introduction

About one third of the German health budget is spent on the treatment of diseases and metabolic imbalances caused by nutritive “dirt”-behavior; on the other hand only 3% is spent on preventive measures1. Medical thinking is becoming more preventive. There is an increase in requests for information about food and nutrition. The interest tends to be in these micronutrients in general, and in certain periods of life such as pregnancy2.

Critical micronutrients during pregnancy in Germany

Germany is classified as an iodine deficient country by the World Health Organization (WHO). Yet, it is accepted that it is possible to prevent the development of a struma by increasing iodine intake. During gestation, iron can be insufficient from food and thus often needs to be supplemented. Folic acid deficiency is the most common vitamin deficiency in the western world and it especially affects pregnant women.

This paper looks at these three critical micronutrients and their clinical importance during pregnancy.

Iodine

The overall goitre prevalence is 15.3%, with rates increasing from North to South4. The prevalence rate is especially high among girls and young women of childbearing age who thus start their pregnancies in deficiency. The daily iodine intake in Germany is only about 80 μg in contrast to the recommended intake of 200 μg/day2. Gestation requires an increase of 30 μg/d (Table 1). This results in a net deficiency of 150 μg/d for pregnant women.

What are the risks and consequences of such deficiency during pregnancy? The future mother may suffer from an enlargement of her thyroid or become infertile. Where pregnancy occurs there may be an increased risk of miscarriage in early to late pregnancy as well as preterm delivery5. Furthermore, the baby may be born with an enlarged thyroid gland (struma congenita). In up to 6% of the newborns in Germany a struma is diagnosed, mostly caused by iodine deficiency during pregnancy. Usually the struma is a compensatory euthyroid enlargement of the gland, but hypothyroid metabolism is found in 1/3200 births6.

Are there any preventive measures taken in our country?

In general, the knowledge of the population about iodine content of food is poor. Only seafood is rich enough to contribute effectively to the iodine supply. Salt is enriched with iodine in Germany; however, iodized salt is not generally used by the population and many convenience foods do not contain iodized salt. Furthermore, it is now recommended to reduce salt intake and, therefore, the impact of this measure is limited. To avoid the described risks, pregnant women in Germany are advised to take daily supplements containing 200 μg iodine.

Table 1. Recommended dietary allowances for women for selected micronutrients, (modified from 8)

<table>
<thead>
<tr>
<th>Basic allowance</th>
<th>Supplemenary allowance for</th>
<th>% increase during</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy intake</td>
<td>2200 kcal</td>
<td>300 kcal</td>
</tr>
<tr>
<td>Folic acid</td>
<td>200 μg</td>
<td>+ 150 μg</td>
</tr>
<tr>
<td>Iron</td>
<td>15 μg</td>
<td>+ 15 μg</td>
</tr>
<tr>
<td>Iodine</td>
<td>200 μg</td>
<td>+ 30 μg</td>
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</tbody>
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Iron

Pregnant women need 100% more iron than non-pregnant women.

This paper was presented at the International Workshop on ‘Modern Lifestyles and Micronutrient Deficiency’ in Nusa Dua, Bali on October 19-21, 1995.

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References
women if no regard is paid to pre-conception stores (Table 1). Due to a lack of knowledge about homozygous states of homozygous states of methionine from homocysteine. Folic acid functions as a cofactor of enzymes that require it in the process of methionine from homocysteine into methionine. Consequently, a lack of folic acid can lead to hyperhomocysteinemia with toxic effects on cells in general and impaired closure of the neural tube. Since folic acid supplementation has been effective in the prevention of neural tube defects in several intervention trials,[18,19] folic acid supplementation in the periconceptional period is recommended by several institutions in Germany[14]. Furthermore, there seems to be a correlation between folic acid levels in miscarriages and repeated abortions.[20] A study of Bonn University compared placental levels in pregnancies without complications with women suffering from miscarriages or repeated abortions. Significant differences were found between these groups. 18.9% of the women with abortion and 30.4% of the women with habitual abortion had a serum folate level < 5 ng/ml in contrast to 6.3% in the control group (uncomplicated pregnancies). Furthermore, the fact that 30% of the women with genetical induced mutations of homocysteinemia carriers from miscarriages indicates the key role of folic acid in early pregnancy.[24]

In the above mentioned study a high correlation between the socio-economic status of the pregnant women and their folic acid status was also observed: women from lower social classes were more often folate deficient and lacked knowledge of ways to obtain sufficient folic acid. In the course of gestation - particularly in pregnancies without serious problems - significant differences were observed for the plasma red cell folate and hypersegmentation of the neutrophilic granulocytes between women who took folic acid containing supplements compared to non-supplemented women.[30] Often this difference correlated with clinical parameters of gestation, age duration of gestation and weight and length of the newborn.

There are other consequences of inadequate dietary folic acid like reduced fertility, higher incidence of PTE (pre-term delivery) and abortion, placenta.

Folic acid deficiency in pregnancy is nearly unavoidable for those women who begin pregnancy with a low folic acid status. Risk groups are women with poor knowledge about nutrition, young women whose folate stores are exhausted by puberty, women with pregnancies in quick succession or multiple pregnancy.

Informing about nutrition is the best way to increase folic acid intake. Vegetables, especially green leafy vegetables, liver and wholemeal bread are rich in folic acid. The risk of folic acid is water-soluble and sensitive to light and heat so there may be loss of folic acid during food preparation. Therefore, supplementation with folic acid might be necessary in pregnancy when folate stores are depleted. Furthermore, for the prevention of NTDs it is recommended by several Health Authorities and Societies in Europe and the United States that all women of childbearing age should consume 400 µg folic acid in addition to their normal diet. Those women who have already had a NTD affected child should consume 4mg/d additionally.[31,32]

Other microelements

Extra needs for other microelements probably exist in the second half of pregnancy for the growing fetus. But, apart from high risk groups, supplies by the daily diet seems to be otherwise adequate in Germany.
women if no regard is paid to pre-conception stores (Table 1). Due to a lack of knowledge about food composition and preferred eating patterns to increase bioavailability, this extra need is seldom met with diet alone. The average daily iron intake of women in Germany is about 15 mg. The high demand for iron during pregnancy is not only caused by maternal tissue growth and the increasing need of iron for oxygen transport and oxygen-carryers, but also by fetal demands. The consequences of anaemia during gestation are multiple and well-known. They include increased maternal and fetal morbidity and mortality10 and the risk of delivering children with low birth weight.11

Which nutritional recommendations can be given to the general population and especially to pregnant women? Iron from meat is absorbed much better than iron from plant sources. Dietary fibre or tannins can reduce the absorption of non-heme iron by forming insoluble complexes with iron. Tannins are, for example, contained in black tea. Also, there are substances which promote iron absorption such as ascobic acid. One can profit from this by drinking a glass of orange juice together with iron containing food. In Germany, it is common to use iron supplements during pregnancy to avoid iron deficiency (eg 100-200mg of iron sulfate).

Folic acid
The results of the National Nutrition Survey from 1991 indicate that the folate intake in large parts of the German population does not meet the recommendations of the German Society for Nutrition12. Comparing the recommendations for pregnant women with those for mensturating women, there is an increased energy demand of about 15% (300 kcal/d) for the second and third trimester of gestation. In contrast to the iron recommendations, recommendations are increased by 100% very early in pregnancy (Table 1).

What is the function of folic acid? The effective form of folic acid is 5,6,7,8-tetrahydrofolate (THF). THF is, for instance, essential for the synthesis of pyrimidines and purines in nucleic acid metabolism. It is also necessary for the synthesis of amino acids, neurotransmitters, myelin and phospholipids. Therefore, folic acid is indispensable for cell division, erythropoiesis and epithelial growth. In consequence, it is also essential for the process of cell differentiation in the embryo and the fetus. The increase of folic acid requirements during pregnancy is caused by the accelerated cell multiplication of the enlarged uterus and the mammary glands, the developing placenta, the expansion of the blood volume and, of course, by the growing fetus. In addition, there are increased renal losses and reduced absorption of folic acid during pregnancy.13,14

What are the risks of a deficient folic acid supply during pregnancy? The most dramatic symptom arising in the very early embryonal period. A defect in the early stages of the development of the central nervous system leads to a neural tube defect (NTD). The incidence in Germany is estimated to be between 0.5-2 cases per 1000 births. The spectrum of this disorder ranges from anencephaly to different forms of spina bifida. The pathogenesis of NTDs is not completely understood, but most cases result from an interaction between genetic and environmental factors such as nutritional status and maternal smoking.15 Other studies16-19 and prospective studies20-22 have shown a relationship between folic acid insolv and NTDs. One possible metabolic disturbance causing NTDs may be a defect in the synthesis of methionine from homocysteine.21 Folic acid functions as a cofactor of enzymes that catalyze the conversion of homocysteine into methionine. Consequently, a lack of folic acid can lead to hyperhomocysteinaemia with toxic effects on cells in general and impaired closure of the neural tube. Since folic acid supplementation has been effective in the prevention of NTDs in several intervention studies, folic acid supplementation in the periconception period is recommended by several institutions in Germany.14

Furthermore, there seems to be a correlation between folic acid levels and miscarriages and repeated abortions.23 A study performed at Bonn University compared plasma folate levels in pregnancies without complications with women suffering from miscarriages or repeated abortions. Significant differences were found between these groups. 18% of the women with abortion and 30.4% of the women with habitual abortion had a serum folate level < 5 ng/ml in contrast to 6.3% in the control group (uncomplicated pregnancies). Furthermore, the fact that 50% of the women with genetically induced hyperhomocysteinaemia from miscarriages indicates the key role of folic acid in early pregnancy.24

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