The fields of obstetrics and nutrition have changed over the last few decades, greatly affecting the field of prenatal nutrition. The importance of nutrition in pregnancy cannot be overstated. It maintains maternal energy requirements, provides substrate for the development of new fetal tissues, and builds energy reserves for postpartum lactation.

The demands of pregnancy necessitate additional dietary requirements. Obviously, additional energy (caloric) intake is required to support recommended weight gain. Inadequate maternal nutrition and low birth weight almost go hand in hand.

Recent data from human populations shows that maternal nutrition does influence size at birth. The timing of maternal nutritional changes is also important. Maternal undernutrition in late pregnancy is associated with reduced birthweight and increased postnatal risk of diabetes. However maternal undernutrition around conception is associated with other risks including obesity, heart disease and reduced birthweight in the second generation. Multinutrient supplementation - including zinc, iodine, choline and long-chain polyunsaturated fatty acids (LCPUFAs), especially n-3 - may have advantages over single-nutrient supplements, for example, iron or folate.

While folic acid plays a fundamental role in cell division and differentiation, docosahexaenoic acid (DHA) has been associated with infantile neurological and cognitive development. Thus, optimal intrauterine development and growth requires adequate supply of these nutrients during pregnancy.

Folic acid supplementation has been shown to decrease the occurrence and recurrence of neural tube defects (NTDs) at doses of 0.4 mg for primary occurrence and 4 mg for recurrence prevention. Folic acid deficiency at conception and during pregnancy may contribute to abnormal development. Metabolic forms of folate are involved in synthesis of nucleotides and in the methionine cycle, which generates methyl groups that are essential for DNA methylation.

A recent study evaluated the effects of regular use of folic acid, multivitamin/minerals, vitamin A, vitamin C, zinc, calcium and iron at preconception and/or the first trimester of pregnancy on child development at 3 years of age. Data from the 1988 National Maternal Infant Health Survey and the 1991 follow-up supplement was used. Performance indicators were formed based on 16 developmental assessment items completed by the mother to measure overall as well as domain specific (language, personal-social, gross-motor and fine-motor) development. Folic acid use was associated with improved gross-motor development with a more pronounced effect among African-American children, but there was marginally significant poorer performance for the personal-social domain. Study results suggest that while prenatal folic acid supplementation might improve development at 3 years of age, further research is needed in this regard.

Folic acid supplementation at 5-12 weeks from last menstrual period has also been shown to reduce the risk of congenital abnormalities in children exposed in utero to carbamazepine, phenobarbital, phenytoin, and primidone. A low blood level of folate has also been associated with an increased risk of miscarriage.

Diabetes mellitus is a major cause of perinatal morbidity and mortality, and of maternal morbidity. Following correct dietary advice during and after pregnancy will help to achieve good diabetic control and reduce the risk of complications. Pregnant women (and those intending to become pregnant) should be informed that dietary supplementation with folic acid, before conception and up to 12 weeks’ gestation, reduces the risk of having a baby with neural tube defects (anencephaly, spina bifida). The recommended dose is 400 µg per day.

DOCOSAHEXAENOIC ACID SUPPLEMENTATION: ROLE IN SECOND AND THIRD TRIMESTERS OF PREGNANCY

LCPUFAs such as DHA and arachidonic acid (AA) are essential for proper development of fetal brain and retina. DHA, the most important omega-3 fatty acid, is an important...
component of neural and retinal membranes, and rapidly accumulates in the brain during gestation and the postnatal period. These LCPUFAs are selectively enriched in the fetal circulation compared with the maternal circulation. The role of DHA in increasing cognitive function and vision in infants has been well documented in various studies.

Adequate DHA intake is especially important during pregnancy, because it accumulates in fetal tissue at a particularly high rate during the third trimester. The supply of DHA, important for fetal/infant neurodevelopment, depends on the maternal fatty acid (FA) status. Bergmann RL, et al investigated the effect of a daily vitamin/mineral supplement with and without 200 mg DHA from mid-pregnancy through lactation on the DHA concentrations in maternal and infant red blood cell phospholipids (RBC%), and in breast milk FA (%). A dose of 200 mg/day DHA from mid-pregnancy through lactation seemed appropriate to improve the DHA status of mothers and infants. A placebo controlled, randomized, double blind trial was conducted where pregnant women received from the 20th week of gestation onwards either 500 mg DHA, 400 mg 5-methyl-tetra-hydr0-folate (5-MTHF), or placebo, or a combination of 500 mg DHA and 400 mg 5-MTHF. DHA supplementation resulted in significant enhancement of the contribution of DHA to maternal, placental and venous cord blood lipids.

The fetus has an absolute requirement for the n-3/n-6 fatty acids and DHA, in particular, is essential for the development of the brain and retina. Most of the fat deposition in the fetus occurs in the last 10 weeks of pregnancy. The likely rate of DHA utilization during late pregnancy cannot be met from dietary sources alone in a significant proportion of mothers. DHA supplementation, thus, becomes mandatory during the second and third trimesters of pregnancy. Sanjurjo P, et al analyzed total plasma fatty acids in first trimester pregnant women, second trimester pregnant women, women at delivery and non-pregnant women. Eleven fatty acids were studied by capillary gas chromatography SP-column. Compared with non-pregnant women, in the first trimester there was a significant percentual increase in palmitic, palmitoleic, stearic and docosahexaenoic acids, whereas linoleic and eicosapentaenoic percentually decreased. Between the first and second trimester a significant increase in the proportion of palmitic acid and a significant percentual decrease in arachidonic acid was detected. Between the second trimester and delivery the aforementioned changes were more marked. It was thus suggested that the intake in polyunsaturated fatty acids should be increased during pregnancy, especially in the third trimester.

Observational and interventional studies indicate a significant association with prolonging gestation and reducing the risk of preterm delivery both in low-risk and in high-risk pregnancies. Further benefits have been suggested for intrauterine growth restriction, preeclampsia and postpartum depression. Higher maternal docosahexaenoic acid intake both in pregnancy and lactation is associated with positive infant neurodevelopmental outcomes. Women of reproductive age should achieve an average dietary docosahexaenoic acid intake of at least 200 mg/day.

Consensus recommendations and practice guidelines for health-care providers supported by the World Association of Perinatal Medicine, the Early Nutrition Academy, and the Child Health Foundation have suggested that the fetus and neonate should receive LCPUFA in amounts sufficient to support optimal visual and cognitive development. Moreover, the consumption of oils rich in n-3 LCPUFA during pregnancy reduces the risk for early premature birth. Pregnant and lactating women should aim to achieve an average daily intake of at least 200 mg DHA. For healthy term infants, the guidelines recommend breastfeeding. Oken E, et al sought to examine associations of intake of calcium, n-3 and n-6 fatty acids, trans fatty acids, magnesium, folate, and vitamins C, D, and E during pregnancy, with preeclampsia (PE) and gestational hypertension (GH). 3% women developed PE, and 7% developed GH. Researchers found a somewhat-lower risk of PE associated with higher intake of the elongated n-3 fatty acids docosahexaenoic and eicosapentaenoic acids. The results thus supported a potential benefit for elongated n-3 fatty acids in preventing preeclampsia.

Another case-control study was conducted from June 1997 through January 1998 to assess whether alteration in maternal erythrocyte omega-3 (n-3) and omega-6 (n-6) fatty acids was associated with increased risk of preeclampsia. A total of 99 preeclampsia and 100 normotensive pregnant women were included. n-3 fatty acids were consistently lower in preeclampsia cases than controls. After adjusting for confounders, the corresponding ORs for preeclampsia across decreasing quartiles of sum of long-chain n-3 fatty acids were 1.0, 3.3, 2.4, and 3.3, respectively. A similar pattern was observed for eicosapentenoic acid (20:5n-3, EPA) and docosahexaenoic acid (22:6n-3, DHA). It was thus concluded that low erythrocyte n-3 fatty acids appeared to be associated with an increased risk of preeclampsia.

Perinatal depression refers to major depression in the context of pregnancy and postpartum. Omega-3 fatty acids are attractive for consideration in perinatal women, due to known health benefits for the mother and baby. Antidepressant medications may pose risks in utero and in breastfeeding. MEDLINE and manual searches were, therefore, conducted by investigators. Epidemiological and preclinical data supported a role of omega-3 fatty acids in perinatal depression. Two pilot studies suggested good tolerability and potential efficacy of
omega-3 fatty acids in the acute treatment of perinatal depression. Additionally, there is evidence that the availability of DHA in the postpartum period is less in women developing depressive symptoms. Although further studies are needed for confirmation, increasing the dietary DHA intake during pregnancy and postpartum, seems prudent.

CALCIUM SUPPLEMENTATION

Increased dietary calcium intake has been associated with lower blood pressure among children, adults and pregnant women. Some recent experimental and observational studies in humans and animals have reported an association between maternal calcium intake during pregnancy and blood pressure in the offspring, but others have not.

Bergel et al, therefore, conducted a systematic review of the literature to summarize the evidence supporting an association between maternal dietary calcium intake during pregnancy and blood pressure in the offspring. They found evidence in the literature to support an association between maternal calcium intake during pregnancy and offspring blood pressure. However, more research is needed to confirm these findings. Calcium supplementation during pregnancy is simple and inexpensive and may be a way to reduce the risk of hypertension and its sequels in the next generation. It has also been observed that in pregnant women at high risk for pregnancy-induced hypertension (PIH), calcium plus conjugated linoleic acid supplementation decreases the incidence of PIH and improves endothelial function.

Calcium intake is especially crucial during pregnancy and lactation because of the potential adverse effect on maternal bone health if maternal calcium stores are depleted. There is often a transient lowered bone mineral density and increased rate of bone resorption, with the greatest consequence during the third trimester and throughout lactation. Because many women experience heartburn during pregnancy, calcium-based antacids are ideal for providing heartburn relief, and they offer a calcium supplement to ensure maternal and fetal bone health.

Pre-eclampsia and eclampsia are common causes of serious morbidity and death. Calcium supplementation appears to almost halve the risk of pre-eclampsia, and to reduce the rare occurrence of the composite outcome ‘death or serious morbidity.’ A more recent study has also put forward that calcium supplementation might reduce the occurrence of pre-eclampsia and preterm delivery in primigravidas who have a daily dietary calcium intake less than the recommended dietary allowances.

Calcium and DHA supplementation can thus provide huge benefits to the neonate as well as the mother, starting from mid pregnancy and throughout lactation.

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15. Cetin I, Koletzko B. Long-chain omega-3 fatty acid supply in pregnancy and lactation. Curr Opin Clin Nutr Metab

Docosahexaenoic acid: Fact sheet

- DHA supplementation becomes mandatory during the second and third trimesters of pregnancy as it aids in the development of fetal brain and retina
- DHA has a significant association with prolonging gestation and reducing the risk of preterm delivery both in low-risk and in high-risk pregnancies
- Higher maternal DHA intake in pregnancy is recommended to prevent intrauterine growth restriction and preeclampsia
- Increasing the dietary DHA intake during pregnancy and postpartum prevents perinatal depression

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