Maternal & Infant Nutrition Briefs

May/June 2005

A research-based newsletter prepared by the University of California for professionals interested in maternal and infant nutrition

Do Pregnant and Nursing Mothers Get Enough Iodine?

Iodine deficiency is recognized as a serious nutrition problem worldwide and prevention is feasible through the use of iodized salt. Iodine, which is converted to iodide in the gastrointestinal tract, is needed for normal thyroid function. The thyroid hormones, also referred to as thyroxine, regulate body temperature, metabolic rate, growth, red blood cell synthesis, and nerve and muscle function. During the first half of pregnancy, the fetus depends on the mother's thyroxine (1, 2). Thyroid insufficiency (hypothyroidism), which may occur as a result of iodine deficiency or for other reasons, increases the risk of miscarriage, pre-eclampsia, anemia, fetal growth retardation, early rupture of the membranes, perinatal morbidity, and neonatal death. Untreated hypothyroidism and/or iodine deficiency during pregnancy may also cause irreversible brain damage and results in a lower IQ scores. Low thyroid levels that occur late in pregnancy or during the postpartum period can also have adverse effects on development. Risk of poor health outcomes are greater and more consistent among women with overt hypothyroidism (high thyroid stimulating hormone, low free thyroxine), compared to milder, subclinical hypothyroidism.

In the United States, iodine deficiency may be re-emerging as a public health issue. Although many Americans consume excessive amounts of sodium, processed foods, a primary source of sodium, often do not contain salt in iodized form. Many prenatal vitamin supplements also do not provide iodine. Perchlorate, an environmental contaminant, prevents iodide from binding to the thyroid hormones. National nutrition surveys indicate that iodine status of the population may be lower now than it was 25 years ago. However, very little is known about the prevalence and consequences of mild iodine deficiency in U.S. women of child-bearing years. Two recent articles underscore the need for more attention to iodine nutrition of pregnant and nursing mothers.

Perchlorate and iodide in human milk The purpose of this study was to determine how widespread the occurrence of perchlorate is in human and dairy milk (3). Perchlorate, a

compound used in fertilizers and rocket fuels, has been found in lakes and rivers in several Western states. Plants, particularly lettuce and other leafy vegetables, accumulate perchlorate. Since food grown in the West is shipped to other states, perchlorate in the food supply can affect the entire nation. The authors of this study collected 47 dairy milk samples from grocery stores in 11states and breast milk from 36 women in 18 states. Two different labs independently analyzed the samples for perchlorate and iodide. All but one of the dairy milk samples contained perchlorate (mean content 2 µg/L, range 0-11 µg/L). Mean iodide content of dairy milk was 89.2 µg/L, range 9.6 to 382 µg/L). All of the breast milk samples contained perchlorate (mean 10.5 µg/L, range 1.4 -92.2 µg/L). Mean iodide level of breast milk was 63.3 µg/L (range 4.5-162).

Do the perchlorate levels in breast milk exceed levels considered to be safe? According to the National Academy of Science, the maximum daily dose should not exceed 0.7 µg per kg body weight. An average one-month old infant weighs 4.1 kg and consumes 673 ml of breast milk a day. Given a mean perchlorate level of 10.5 µg/L in breast milk, the average baby would consume about 1.7 µg/ kg/day, which exceeds the “safe” level of 0.7. The authors point out that these levels of intake may be of particular concern since none of the high perchlorate levels, in either breast or dairy milk, were counterbalanced by high iodine levels. The authors conclude that recommended intakes of iodine for pregnant and nursing mothers may need to be increased.

Attention deficit disorders and mild-moderate iodine deficiency The purpose of this observational study was to determine whether mild-moderate iodine deficiency during pregnancy is associated with attention deficit and hyperactivity disorders (ADHD) (4). The study involved a small sample of women who lived in two areas of Sicily, where iodine intakes were either moderately deficient (area A, n=16) or marginally sufficient (area B, n=11). The iodine status of the general population was known to differ in the two areas, based on the prevalence of goiter (24% in area A vs. 7.8% in area B) and urinary iodine excretion. The authors monitored thyroid function of the mothers during pregnancy and of the children at 18-36 months in 1994 and 8-10 years of age from 2001-2002. Two independent examiners, who were unaware of the mother’s thyroid status, conducted behavioral and neurological evaluations of the children at the same time points.

Thyroid failure occurred in early pregnancy among 50% (n=8) of the women in area A but only transiently among 9% (n=1) of the area B women. All children had normal thyroid function at birth and afterward at the two follow-up time points, and none showed any neurological signs typically seen in iodine deficiency disorders. However, 68.7% of the children from area A (11 of 16) were diagnosed with ADHD, compared to none of the children in area B. Total IQ scores were lower in area A than in area B (92.1 vs 110, $p < 0.00005$).

A high prevalence of ADHD has been reported before in children with genetic traits that interfere with thyroid function. The authors suggest that varying and mild degrees of thyroid failure occurring early in pregnancy as a result of iodine deficiency may affect fetal brain development and result in the ADHD syndrome. However, the study involved a very small, nonrandom sample, and it is doubtful, on ethical grounds, that a clinical trial could be conducted to confirm these results.

Conclusions and Implications: Iodine deficiency is a problem worldwide and may be re-emerging as an issue in the U.S. due to environmental perchlorate contamination and use of uniodized salt in processed foods. National surveys should continue to monitor iodine status of the population, with particular attention to women of child-bearing age. Public health strategies, which may include adding iodine to prenatal supplements or iodizing all

commercial salt, can then be formulated. In the meantime, some experts recommend iodine supplements of 150 µg per day for pregnant women.

Sources:
1) Lao, TT. Thyroid disorders in pregnancy. Current Opinions in Obstetrics and Gynecology 2005; 117: 123-127.
2) Hollowell JG, LaFranchi S, Smallridge RC, et al. 2004 Where do we go from here? Summary of working group discussions on thyroid function and gestational outcomes. Thyroid 2005; 15: 72-76.
3) Kirk AB, Kalyani Martinelango P, Tian K, et al. Perchlorate and iodide in dairy and breast milk. Env Sci Technol 2005; 39: 2011-2017
4) Vermiglio F, Lo Presti VP, Moleti M et al. Attention déficit and hyperactivity disorders in the offspring of mothers exponed to mil-moderate iodine deficiency: a possible novel iodine deficiency disorder in developed countries. J Clin Endocrinology and Metabolism 2004; 89: 6054-6060.

Nutritional Rickets among US Children

Recent reports of vitamin D deficiency in the United States have drawn attention to the needs for this nutrient in infants and children. In vitamin D deficiency, absorption of calcium is low. As a result, parathyroid hormone increases and mobilizes calcium from bone to restore the levels of calcium in the blood. Levels of serum alkaline phosphatase also increase and 25-hydroxyvitamin D levels fall, as rickets develops. Clinical signs of rickets include poor growth and certain bone deformities, such as bowing of the legs and a bead-like formation—also known as the “rachitic rosary”-- on the rib cage. Dietary sources of vitamin D include vitamin D-fortified milk and formula; fish liver oils; and fatty fish, but the body can also make vitamin D when exposed to sunlight or ultraviolet radiation. However, melanin in dark-colored skin, sunscreen use, and even environmental pollutants can reduce the amount of ultraviolet photons available to make vitamin D. Since the prevalence of vitamin D deficiency in the US is not known, the authors of this purpose reviewed the literature from 1986 to 2003 to explore the characteristics associated with its occurrence in this country.

Over that time period, 166 cases of vitamin D deficiency occurred in 17 states among US children under 18 years of age. Age ranged from 4 to 54 months but most cases occurred in children under 30 months of age. Clinical signs typically included: poor growth and motor development; inability to walk; bone abnormalities; and seizures. About 83% of children were African American. All of the white children with rickets lived in northern states. Ninety-six percent of all cases were breast-fed, and only 5% had been supplemented with vitamin D. Most had not been weaned to a vitamin D-fortified milk or beverage. In studies that reported treatment, all cases improved with vitamin D supplements; only one child responded to calcium without vitamin D.

Conclusions and Implications: Health professionals need to get the word out to parents about the risk of vitamin D deficiency. This message is particularly important among the groups at greatest risk of deficiency such as breast-fed infants with dark skin and those who receive little or no exposure to sunlight. Breast milk contains only 22 IU of vitamin D/L and the requirement for infants is 200 IU/day. Therefore, the American Academy of Pediatrics recommends that all breast-fed infants be supplemented with vitamin D by 2 months, unless they consume at least 500 ml/ day of vitamin D-fortified formula.

Source: Weisberg P, Scanlon KS, Ruowei L, Cogswell ME. Nutritional rickets among children in the United States: review of cases reported between 1986 and 2003. Am J Clin Nutr

2004;80 (supple): 1697S-70S.

Maternal and Infant Nutrition Briefs is a research-based newsletter prepared by Dr. Lucia Kaiser (*llkaiser@ucdavis.edu*), a Cooperative Extension Specialist in the Department of Nutrition, University of California at Davis. This newsletter is written for health professionals interested in nutrition of mothers and young children.