

Maternal & Infant Nutrition Briefs



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



Poor Fetal Growth and Later Chronic Disease

When the fetus has to adapt to a limited supply of nutrients, certain physiological and metabolic changes occur. Increasingly, these changes have been linked to the incidence of chronic disease later in life, including coronary heart disease, diabetes, and stroke. A recent article in *Nutrition Today* reviews the evidence for linking poor fetal growth to chronic disease and describes some potential mechanisms.

What is the evidence linking poor fetal growth to later chronic disease? For some time, we have known that fetal growth occurs rapidly after 9 weeks of gestation but not uniformly. Different tissues of the body grow rapidly at different times, termed "critical periods". When oxygen or nutrients are lacking during gestation, the fetus adapts by slowing its growth. If undernutrition is confined to a particular critical period, those tissues experiencing rapid growth will be most vulnerable. Disproportionate growth can occur because different tissues have different critical periods. Insulin and growth hormone have important effects on cell division and may play a role in "programming" the body for later chronic disease.

Researchers in Britain observed that the geographic pattern of infant death rates during the early 1900's coincides with today's incidence of coronary heart disease (CHD) in that country. After discovering detailed birth records and 1-year weight records, Dr. Barker and his co-workers were able to examine the link between birth weight and coronary heart disease rates among 15,726 men and women born between 1911-1930. CHD rates were lowest among people who had weighed between 5.5 and 9.5 pounds at birth. Furthermore, babies who were small because they failed to grow were at increased risk of CHD, compared to babies who were small due to preterm births. Similar trends were found for birth weight and other conditions, including hypertension and diabetes. Moreover, these relationships were found to be independent of adult lifestyle factors, such as smoking and becoming obese.

What mechanisms could explain the link between fetal growth and chronic disease?

- When oxygenated blood is diverted from the trunk to spare the brain, both structure and function of the liver, which regulates cholesterol and blood clotting, may be affected. Disturbances of cholesterol metabolism and blood coagulation are features of CHD and have been found in people who had a short body in relation to head size as babies. There is also evidence that fetal overnutrition--as might occur during maternal diabetes--disturbs liver growth and is linked to later CHD risk.
- If the fetus becomes undernourished during mid- to late gestation, growth of muscle is sacrificed to spare glucose for the brain. The muscle may develop a resistance to insulin that persists into adulthood. Adult obesity, following on the heels of poor fetal growth, is associated with high rates of non-insulin dependent diabetes. Early undernutrition may partially explain why some immigrants have high rates of non-insulin dependent diabetes.
- Undernutrition during development may lead to loss of elasticity in the arteries. In Britain, persisting high blood pressure was found in people who were small, thin, or short babies. In animals, undernutrition weakens the placenta enzyme barrier that normally protects the fetus from excess maternal glucocorticoid. Excess glucocorticoid programs high blood pressure in the offspring.

These observations point to a new focus for research on the origins of chronic diseases, which comprise the major causes of mortality in the U.S. The possibility that poor prenatal nutrition is a contributing factor has important implications for the ways we motivate women to make dietary changes, as well as for our approaches to prevent chronic disease.

Source: Barker, D. J. P. 1996. Fetal Origins of Adult Disease. *Nutrition Today* 31 (3): 108-114.

Race and Ethnicity Influence Prenatal Risk Assessments

During pregnancy, obese Latinas are twice as likely as white women not to be correctly identified as obese. Yet, obese Latinas are 1.6 times more likely to gain too much weight, 2.7 times more likely to have high birth weight babies, and 2.1 times more likely to have Cesarean sections, compared to normal weight Latinas. These findings are from a study of Medicaid-eligible women who received Comprehensive Perinatal Services between 1989-90 in 28 California sites.

To examine the rates of weight misclassification for Latina, white, or African American women, the authors extracted the provider's nutritional assessments (obese, overweight, normal, or underweight) from the medical charts. Next, the authors compared these assessments to their own calculations of pre-pregnant weight status, using weights and heights from the medical records and the 1990 Institute of Medicine (IOM) standards. Women with diabetes or hypertension were excluded from the analysis, because some providers may enter these conditions as reasons for dietary counseling in lieu of noting obesity on the chart. Misclassification rates did not vary according to type of practice (public, private, or privately operated with public funding). Likewise, the credentials of the assessor (dietitian, nurse, midwife, nurse practitioner, or health worker) did not influence the accuracy of the assessments.

Providers may discount the risks of obesity in Latinas, based on data that some adverse birth outcomes are not more likely for Latinas compared to other ethnic groups. However, this

study shows that obesity, as defined by the IOM standards, is a significant risk factor during pregnancy for Latina women and needs to be assessed and monitored more carefully.

Source: Fuentes-Afflick, E., C. C. Korenbrot, J. Greene. 1995. Ethnic disparity in the performance of prenatal risk assessment among Medicaid-eligible women.

Failure of Iron Therapy to Reverse Developmental Effects of Anemia

Several studies have shown that infants with iron-deficiency anemia score lower on mental and motor development tests than infants with better iron status. Even with a full course of iron therapy for 2-3 months, test scores often remain lower in formerly anemic infants, compared to nonanemic controls. Some evidence suggests that longer term iron therapy might be needed to reverse the developmental effects of iron-deficiency anemia. The purpose of a recent study from Costa Rica was to determine whether extended iron therapy can correct the lower developmental test scores due to iron-deficiency during infancy.

The study was carried out in a lower middle-class community near San Jose, Costa Rica (elevation of 1185 m). Eligible children between 12-23 mos. were brought to the hospital to determine their iron status. Iron deficiency anemia was defined as a hemoglobin < 100 gm/L and two of three other measures indicating iron deficiency (i.e., transferrin saturation, serum ferritin, and erythrocyte protoporphyrin levels). Nonanemic children had hemoglobin levels > 12.5 gm/L. All anemic children received iron therapy (3 mg/kg body wt., twice a day) for 6 months. Nonanemic children were randomly assigned to receive either iron therapy (same dose as anemic group) or a placebo. The intervention was conducted in a double-blind fashion, with the project staff personally administering the dose 3 times per week. At baseline, 3 months, and 6 months, the project personnel staff assessed development using the Bayley Scales of Infant Development. Iron status was also collected at each time point. By 3 months, 100% of the anemic children had increased their hemoglobin levels (aver. increase of 34 gm/L) and maintained that increase at 6 months. Iron status also improved in the nonanemic group given iron (aver. increase of 7 gm/L). Anemic children had Bayley mental test scores that were significantly lower than the scores of nonanemic infants and continued to test lower after 3 and 6 months of therapy. Motor scores were not significantly different among the groups. The study also found that anemic children were more disadvantaged compared to the nonanemic group.

These results are consistent with previous studies in Costa Rica, Chile, and England. In an Indonesian study where iron therapy was effective in improving developmental test scores, the children were from less disadvantaged families than in Costa Rica. While there may be some circumstances that iron therapy can reverse the negative effects of anemia on development, preventing iron-deficiency anemia still remains the best course.

Source: Lozoff B., A. Wolf, and E. Jimenez. 1996 Iron-deficiency anemia and infant development: effects of extended oral iron therapy. *J. Pediatr.* 129: 382-389.

Does Supplementation of Breast-feeding Women Shorten Amenorrhea?

The effects of maternal dietary supplements on the duration of lactational amenorrhea have been debated for some time. This issue is important, because policy-makers have been concerned about shortening birth intervals as a consequence of improving maternal nutritional status. Infants of malnourished mothers might need to feed more frequently or for longer periods to get the same amount of milk as infants of better nourished mothers, thus

stimulating prolactin and ovarian function. Alternatively, the nutritional status of the mother could affect estrogen and other reproductive hormones directly. To date, the studies looking at this question have yielded conflicting results. A recent article and editorial in the American Journal of Clinical Nutrition provide an update on the relationship of maternal supplementation to lactational amenorrhea.

A study in Sri Lanka randomly assigned 30 pairs of healthy exclusively breast-feeding mothers at 4 weeks postpartum to either a control or supplemented group (182 kcal/d of skim milk powder). Because the pairs were matched by nutritional status, parity, and previous experience of lactational amenorrhea, no significant differences were found between the groups at baseline. Supplementation of the mother's diet had no significant effect on the return of menstruation or ovulation, maternal prolactin levels, maternal body mass index, or infant weight. Supplemented mothers breast-fed "nearly" exclusively for a longer period than the controls.

As Dr. Kathryn Dewey points out in her editorial, this difference in duration of "nearly full" breast-feeding cannot definitively be linked to the intervention, because the study was not double-blinded. Mothers who received the supplement may have been more confident of their ability to breast-feed and therefore, less likely than controls to introduce other foods. Furthermore, the fact that the supplemented mothers tended to begin ovulating sooner than the control mothers could be important from a public health perspective, although no statistical differences were found. As is often the case, the results raise more questions to be answered.

Sources:

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Dewey, K.G. 1996. Does maternal supplementation shorten the duration of lactational amenorrhea. *AJCN* 64: 377-378.

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