Maternal & Infant Nutrition Briefs

May/June 1996

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

Advice for the Working Mother: Tips on Storing Breast Milk

Most of the research on storage of breast milk has focused on optimal conditions for storing donor milk to be given later to sick or preterm infants. Relatively, little is known about the effects on breast milk quality of storage under usual household and working conditions. The purpose of a recent study was to examine the effects of temperature and time on bacterial growth and protein and lipid breakdown in breast milk.

Two groups of breast-feeding women were recruited into the study: 1) exclusively breast-feeding women who were at home with their infants (n=11) and 2) breast-feeding women who worked in a hospital (n=5) or were spending most of their time in the hospital with their sick infants (n=2). Between 8 to 10 am, the mothers collected breast milk from both breasts using Egnell pumps. Breast milk samples were stored at either 15°C (equivalent of a Styrofoam container with blue ice), 25°C (room temperature), or 38°C (warm conditions). Under each of these conditions, bacterial growth and protein and lipid breakdown was examined during the first 24 hours of storage.

Almost no bacteria grew in the milk of the home group during storage at 15°C for up to 24 hours. At 25 °C, only nonpathogenic bacteria grew in the milk samples stored for 8 hours. Some pathogens (Bacillus coliformis, S aureus, and Enterococci) were found in breast milk stored at 25°C for 24 hours or 38°C for 8-24 hours. Bacterial growth in the milk of mothers who spent most of their time in the hospital appeared similar to that in breast milk of mothers at home. However, the number of subjects in the hospital group was low.

Protein breakdown was minimal during storage at 15°C or 25°C for 24 hours. In contrast, lipid breakdown was considerable, amounting to a fivefold to sixfold increase in free fatty acids above baseline levels. These patterns observed in protein and lipid breakdown are probably beneficial in protecting the infant from infection. Intact proteins, such as lysozyme and lactoferrin, have antimicrobial functions. On the other hand, the products of lipid breakdown, free fatty acids and monoglycerides, have antiviral, antibacterial, and antiprotozoan effects.

The authors conclude that breast milk can be safely stored in a cool box (15° C) for 24 hours. Storage of breast milk at room temperature (25°C) may not be safe beyond 4 hours. However, even 4 hours of storage in hot climates (38° C) is probably too long. An important caveat is that these recommendations might only be valid for those who live and work in relatively clean environments.

Source: Hamosh, M., L.A. Ellis, D. R. Pollock, T.R. Henderson, and P. Hamosh (1996) Breast-feeding and the working mother: effect of time and temperature of short-term storage on proteolysis, lipolysis, and bacterial growth in milk Pediatrics 97(4): 492-498.

Obesity and the Risk of Neural Tube Defects

Two recent studies found an increased risk of delivering babies with neural tube defects among obese pregnant women. In both studies, the risk of neural tube defects for different pre-pregnant weight categories was calculated using case-control comparisons. The association of maternal obesity with neural tube defects was apparently not explained by either intake of folic acid or diabetes.

The first study (Werler et. al., 1996) tracked birth data from Boston, Philadelphia, and southeastern Ontario during 1988-94. The ethnicity of the cases and controls was 88-90% White, 4-6% African-American, and 6% Other. The analysis was done on 604 cases of infants or fetuses with neural tube defects, 1658 controls with other malformations, and 93 nonmalformed controls. Compared to control mothers, case mothers were younger, less educated, poorer, and less likely to have taken folic acid supplements at the time of conception. When occurrence of neural tube defects was examined across different categories of pre-pregnant weight, the relative risk of neural tube defects was 1.9 times higher (95% C.I. 1.2-2.9) among women who weighed between 80-89 kg compared to women weighing 50-59 kg prenatally (reference weight). For women weighing 110 kg or more, the risk of neural tube defects was four-fold higher, compared to the reference weight. For the heaviest women, the risk of neural tube defects was high, regardless of diabetes or folate intakes.

The second study (Shaw et. al., 1996) used data from the California Birth Defects Monitoring Program collected between 1989-91. Ethnicity of the total sample was not stated in the article, but 74% of the interviews were conducted in English and 26% in Spanish. The analysis was done on 653 cases (infants and aborted fetuses with neural tube defects) and 644 controls. The authors found relative risk of neural tube defects to be 1.9 times higher among women who were obese before pregnancy (Body Mass Index, BMI > 29 kg/m 2) compared to nonobese women (BMI < 29 kg/m 2). This relationship was seen, even when differences in maternal age, education, gravidity, vitamin use, and alcohol use were controlled. Other dietary variables, including folate, zinc, and percentage of diet calories from fat, were not related to the increased risk of neural tube defects among women with high pre-pregnant weights.

The reason why maternal obesity is associated with increased risk of neural tube defects is not known. However, with the increasing rates of obesity in this country, more research in this area will be needed.

Sources:
Werler, M., C. Loulk, S. Shapiro, A. Mitchell (1996) Prepregnant weight in relation to risk of neural tube defects. Journal of the American Medical Association 275(14): 1089-1092.
Shaw, G., E. Velie, D. Schaffer (1996) Risk of neural tube defect-affected pregnancies among obese women. Journal of the American Medical Association 275(14): 1093-1096.

Another Good Reason Not to Smoke During Pregnancy

Smoking during pregnancy has been linked to low birth weight, sudden infant death syndrome, perinatal mortality, and cognitive deficits. However, relatively little attention has been given to possible effects of maternal smoking on mental retardation. The purpose of a recent case-control study was to explore the relationship between prenatal exposure to cigarette smoke and mental retardation among children with no known cause for their disability and no other central nervous system defects.

The authors identified as cases 10 year-old White or African-American mentally retarded children in or near Atlanta (n=221). Children with other disabilities or known causes of mental retardation were excluded. Controls, randomly selected from the same counties, were other White or African-American 10-year olds without mental retardation or other disabilities (n=400). The authors interviewed parents of cases and controls to collect data on prenatal exposure to cigarettes and alcohol, as well as reproductive history. After adjusting for other risk factors related to mental retardation, the authors found that women who smoked during pregnancy were 50% more likely to have children with mental retardation (odds ratio= 1.56 ; 95% C.I. 1.01-2.41). Also, rates of mental retardation increased significantly as the number of cigarettes smoked increased. About half of the mothers quit or decreased their smoking during their first trimester. However, for those who continued smoking in the second trimester, smoking increased the likelihood of mental retardation by 60% (odds ratio = 1.65; 95% C.I. 1.05-2.60). These findings are in contrast to at least 3 other studies that failed to find a significant link between maternal smoking and mental retardation. Limited sample size, different IQ cutoffs to define mental retardation, and different eligibility criteria are some possible reasons why those other studies did not find a relationship.

How prenatal exposure to cigarettes might be linked to mental retardation is still unknown. Possible mechanisms may include any of the following: 1) effects on maternal nutrition; 2) a direct toxic effect on the fetus; 3) increases in maternal complications; and 4) fetal hypoxemia. Alternatively, there may be other differences in the parenting behavior between cases and controls not measured in the study. The authors conclude that smoking prevention efforts could provide another way to lower rates of mental retardation.

Source: Drews, C., C. Murphy, M. Yeargin-Allsopp, and P. Decouflé (1996) The relationship between idiopathic metal retardation and maternal smoking during pregnancy. Pediatrics 97(4): 547-553.

Do Iron Supplements Affect Iron Levels in Breast Milk?

Iron deficiency is one of the most common nutritional problems world-wide, particularly among infants, young children, and women in their reproductive years. Despite low levels of iron in breast milk, iron deficiency anemia is rare among nursing infants less than 6 months old who receive adequate amounts of breast milk. Lactoferrin, the main iron-binding protein in breast milk, may increase the bioavailability iron to the infant. Lactoferrin is also thought to play a protective role against infections. Exactly how lactoferrin levels in milk are controlled is not known. The purpose of this study was to determine whether iron supplements given to anemic mothers could affect lactoferrin and iron levels in breast milk.

The study was carried out in Peru among mothers delivering healthy infants at term. Nineteen mothers were anemic at 2 days postpartum (Hgb < 110 g/L; Hct < 33%) and 10 mothers were nonanemic. The anemic mothers took iron supplements (100 mg elemental Fe per day) for 30 days. Milk and blood samples from the mothers were collected at 2 and 30 days post partum. The analyses included milk and serum iron, % transferrin saturation, serum ferritin, hemoglobin, hematocrit, and lactoferrin in milk.

By the end of the 30 days, maternal iron status of the anemic group had improved significantly (Hgb: from 92 g/L to 105 g/L and Hct: from 28.2 % to 32.6%). However, there were no significant differences in breast milk iron or lactoferrin between the two groups at either stage of lactation. Likewise, no correlations were found between hemoglobin, serum iron or ferritin and milk iron or lactoferrin.

These results suggest that iron supplements given to the mother do not affect lactoferrin or iron levels in milk. Breast milk iron and lactoferrin levels appear to be regulated by factors other than maternal hemoglobin, serum iron, or ferritin stores. The authors suggest that anemic mothers may be able to increase the number of transferrin receptors in the mammary gland to
to continue providing adequate levels of iron to their babies.

Source: Zavaleta, N., J. Nombera, R. Rojas, L. Hambraeus, J. Gislason, and B. Lönnerdal (1995) Iron and lactoferrin in milk of anemic mothers given iron supplements. Nutrition Research 15 (5): 681-690.

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