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Effect of Prenatal DHA Supplements on Infant Behavior

Docosahexaenoic acid (DHA) is an n-3 fatty acid found in high concentrations in the brain. DHA accumulates at particularly high rates in the fetus during the last trimester of pregnancy. Animal studies show that deficiency of DHA during pregnancy can affect brain development. In the United States and Canada, maternal intake of DHA during pregnancy is far below the recommended levels of 300 mg/day, raising concerns about the effects on infant neurological development. Because cell differentiation occurs during pregnancy and is largely completed by birth, adequate intake of DHA during the prenatal period may be particularly important. The purpose of this study was to determine the long-term effects of DHA on cognitive function of infants at 9 months of age.

The study involved a double-blind, placebo-controlled, randomized trial with a small sample (n=29) of pregnant women, ages 18-35 yrs. From 20 weeks gestation until delivery, the mothers consumed about 5 cereal bars a week, containing 1.7 g per bar of DHA (intervention) or 1.7 g corn oil (control). Total intake of DHA from the usual diet and cereal bar in the intervention group was about 313 mg/day, compared to 99 mg in the control women. At nine months of age, the babies participated in two simple tests to measure their problem-solving abilities and recognition memory skills. The problem-solving activity tested the infant's ability to pull a toy within reach and uncover it. This test requires that the infant remember the toy is hidden under the cloth and be able to pay attention while attempting to retrieve the toy. As an indicator of memory, the researchers used the Fagan Test of Infant Intelligence that captures the infant's time spent in looking at familiar and unfamiliar or novel pictures. The assessments were done in the home at a time when the babies were most active or alert and in good health.

Baseline characteristics of the two groups were similar, as were their infant feeding practices. Length of gestation was significantly longer in the DHA group, compared to the controls (mean: 39.9 vs. 39.0 weeks, p=0.019). The treatment had significant effects on improving total problem-solving scores, after adjusting for gestational length, maternal hematocrit, maternal body mass index, education, and infant feeding practices. Because the number of infants who were able to pull the cloth within reach was the same in both groups, the higher scores in the treatment group appear to be due to better mental processing rather than motor skills. No effects were observed on memory skills. However, when administered at nine months of age, the Fagan test may not be as sensitive an indicator as it is in slightly younger infants.

Conclusions and Implications. This study is the first randomized controlled trial to report an effect of prenatal DHA supplementation on infant problem-solving abilities. Since the

sample size was small and not representative of all women, additional studies providing different doses are needed before a definitive recommendation can be made.

Source: Judge Mp, Harel O, Lammi-Keefe CJ. Maternal consumption of docosahexaenoic acid-containing functional food during pregnancy: benefit for infant performance on problem-solving but not on recognition memory tasks at 9 mo. AJCN 2007; 85: 1572-1577.

Obesity Linked to Lower Breastfeeding Rates in Danish Mothers

Other researchers have observed a relationship between greater pre-pregnancy weight and shorter duration of breastfeeding. Animal and human studies point to some potential biological mechanisms, including a lower prolactin response to suckling and delays in producing milk in heavier mothers. Strong social support for breastfeeding may be able to override the biological effects of maternal obesity on breastfeeding. Using a population from Denmark where social support for breastfeeding is strong and maternity leave is generous (24 weeks), the authors of this paper examined the effects of maternal overweight and obesity on rates of full and any breastfeeding.

The data came from the Danish National Birth Cohort, which has a prospective cohort design and includes women recruited throughout Denmark. For this study, the researchers used data from phone interviews with 37,459 pregnant women at 12 and 26 weeks of pregnancy and 6 and18 months postpartum. The women self-reported pre-pregnancy weight and height, as well as their weight gain during pregnancy. Mother's pre-pregnancy weight status was categorized as one of the following based on body mass index (BMI): underweight, normal weight, overweight, obesity class I, obesity class II, and obesity class III. Rates of full breastfeeding and any breastfeeding in the first week, at 16 weeks, and at 20 weeks were the main outcomes.

With a sample size as large as this one, virtually all differences would be expected to be significant. Risk of stopping full and any breastfeeding rose progressively with greater maternal pre-pregnancy. For example, by the end of the first week, 14.4% of the obese women (class III) had stopped full breastfeeding, compared to 3.5% of the normal weight women. At 16 weeks, the proportion of women continuing full or any breastfeeding was lower among women with higher BMIs. By 20 weeks of age, many women have already introduced solid foods, so that only differences remained in rates of any breastfeeding across BMI categories. These findings remained significant, even when controlling for smoking, primaparity, education, occupation, and cesarean deliveries. Gestational weight gain was not a factor, independent of pre-pregnancy weight status.

Conclusions and implications In this large sample of Danish women, heavier women stopped full or any breastfeeding earlier than normal weight mothers. Since this observation was made in a context where social support for breastfeeding is strong, biological mechanisms may explain the relationship.

Source: Baker JL, Michaelson KF, Sorensen TIA, Rasmussen KM. High pre-pregnancy body mass index is associated with early termination of full and any breastfeeding in Danish women. AJCN 2007; 86: 404-411.

Food Insecurity and Maternal and Infant Outcomes

Food insecurity is defined as "the limited or uncertain availability of nutritionally adequate and safe foods or limited and uncertain ability to acquire food in socially acceptable ways." Food insecurity is monitored annually in the Current Population Survey through use of an 18-item validated scale and has also been included in other national, state, and local nutrition surveillance. When the full 18-item scale is used, households can be identified as having high, marginal, low or very low food security. Two recent articles have examined the relationship of food insecurity to maternal, infant, and child outcomes.

Impact of food insecurity on parenting and infant feeding practices

This study examined the relationship of food insecurity to toddler nutritional status and health, specifically asking whether effects on maternal depression and parenting/infant feeding practices are involved. In other words, does food insecurity affect child outcomes directly or does it act through these other variables?

The authors used data from the Early Childhood Longitudinal Survey-Birth Cohort study, which is a rich, national dataset following individuals from birth to entry in school. In a sample size of 8,693, the following data were available:
1) Food insecurity (previous 12 months);
2) Maternal depression at 9 month postpartum from 12 item validated scale;
3) Infant feeding practices (duration of breastfeeding, infant's age at starting solid foods);
4) Use of positive parenting practices (i.e., sensitivity to infant's cues, maternal response to stress from videotaping at 9 months);
5) Overweight (wt-for length $\geq$ 95th percentile) and short stature (length-for-age < 5th percentile) at 24 months of age; and
6) Potentially confounding variables such as maternal age, education, occupation, smoking, participation in food assistance, family structure, poverty, well-baby visits. However, ethnicity was not included as a variable.

The analysis examined the pathways through which food insecurity might be related to the mediating variables (depression, parenting, and infant feeding) and the outcomes (toddler health and growth). Findings include the following:

- Greater food insecurity is associated with maternal depression at 9 months postpartum, which in turn is related to report of poorer toddler health at 24 months;
- Greater food insecurity is associated with lower use of positive parenting practices, which in turn are related to less optimal infant feeding practices (i.e., short duration of breastfeeding, early introduction to solids;)
- Better infant feeding practices are related to less overweight at 24 months; and
- No relationships were observed between maternal depression, parenting, and infant feeding practices.

Conclusions and Implications Although the study found an association between food insecurity and depression and parenting practices, we cannot conclude whether a causal relationship exists. Nonetheless, efforts to promote optimal infant feeding and prevent childhood obesity might need to consider ways to improve food security to achieve better results.

Food insecurity and birth defects

The second paper examines whether food insecurity is a risk factor for certain types of birth defects. Using a case-control study design, the authors conducted interviews, primarily by phone, of English or Spanish-speaking mothers in California. The cases, identified through hospital records, were infants with certain types of birth defects, excluding those caused by single gene disorders or chromosomal abnormalities. Selected randomly from the same area hospitals, the controls included infants without birth defects. The authors were able to interview about 80% of the eligible case mothers and 77% of the control mothers, yielding a sample of 1189 cases and 695 controls. To estimate level of food insecurity, the authors used a short subset of 5 questions, taken from the 18-item scale.

The analysis examined food insecurity occurring during the 2 months before and immediately after conception as a risk factor for birth defects, controlling for race/ethnicity; education, pre-pregnancy body mass index; dietary intake of energy and folate; use of folic acid supplements; neighborhood crime; and stressful life events. Greater food insecurity is associated with increased of cleft palate, spina bifida, anencephaly, and certain heart defects but not with cleft lip (with or without cleft palate). Risk of anencephaly was greater where levels of neighborhood crime and food insecurity were both relatively high (that is, interaction effects were observed).

Conclusion and implications: The authors consider their study "exploratory" and acknowledge that other, unmeasured variables could account for the findings. Among these are exposure to substance and domestic abuse and young maternal age. More research is needed to examine the relationships between food insecurity and birth defects.

Source: Bronte-Tinkew J, Zaslow M, Capps R, Horowitz A, McNamura M. Food insecurity works through depression, parenting, and infant feeding to influence overweight and health in toddlers. J Nutr 137: 2160-2165.

Source: Carmichael SL, Yang W, Herring A, Abrams B, Shaw GM. Maternal food insecurity is associated with risk of certain birth defects. J Nutr 137:2087-2092

***Maternal and Infant Nutrition Briefs* is a research-based newsletter prepared by Dr. Lucia Kaiser, 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. Back issues of this newsletter are available on-line at: http://nutrition.ucdavis.edu/briefs/.**