



# Maternal and Infant Nutrition Briefs

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## **How much prenatal weight gain is enough in obese mothers?**

The 1990 Institute of Medicine weight gain guidelines for pregnancy recommend a minimum of 15 lbs for obese women. Given the risks these women face during pregnancy, many practitioners have questioned this particular guideline.

The purpose of this study was to examine the relationship between prenatal weight gain and birth outcomes in a large sample of obese mothers.

Using population-based data from birth certificates and the mothers' medical records, the researchers were able to examine prenatal weight and birth outcomes in 120,170 obese mothers giving birth in Missouri from 1999-2001. The sample only included women who gave birth to single, live born infants. According to the National Institute of Health definitions, 59% of the women had a body mass index (BMI) of 30-34.5 (class I); 25% had a BMI of 35.0-39.9 (class II) and 16% had a BMI  $\geq 40$  (class III). The main outcomes included small-for-gestational-age (SGA), preeclampsia, c-section, and large-for-gestational-age. The researchers estimated the risk of each of these outcomes associated with different weight gains for each of the three classes of obesity, controlling for maternal age, hypertension, education, race, poverty, tobacco use, and parity.

Like other studies, they found higher risk of c-section, preeclampsia, large-for-gestational-age and lower risk of small-for-gestational-age with higher weight gain in these obese women. They observed the lowest risks for all four outcomes at weight gains of 10-25 lbs for class I obesity; 0-9 lbs for class II obesity, and a weight loss of 0-9 lb for class III obesity. A chief limitation of the study is its reliance on mother's recall of her weight.

*Conclusions and Implications: Rather than setting a single minimal weight gain for all obese, pregnant women, the authors have identified different optimal ranges for class I, II, and III obesity. Little or no prenatal weight gain can have favorable outcomes in some very heavy women.*

Source: Kiel DW, Dodson EA, Artal R, Boehmer TK, Leet TL. Gestational weight gain in obese women. *Obstet and Gynecol* 2007;110 (4): 752-758

## **Birth weight and rapid infant growth predict childhood obesity**

The purpose of this study was to determine how birth weight and rapid growth during infancy influence risk of overweight in childhood.

Conducted in Mexico, this longitudinal study examined growth of 256 children of Mexican mothers who had participated in a micronutrient supplementation intervention during pregnancy. The researchers measured weight and length or height of the children at birth, one year, and between four to six years. The main outcome was body mass index-for-age (BMI for age) > 85<sup>th</sup> percentile at four-to-six years of age. Complete data were available for 163 children. Rapid weight gain was defined as a growth rate that resulted in crossing the percentiles in an upward direction from birth to one year of life.

At follow-up, 14% of the children were at risk of or overweight, as defined Centers for Disease Control (CDC) growth reference. Among children with normal or low birth weight, rapid weight gain in the first year of life significantly increased the odds of overweight in childhood. Infants whose birth weight was at or above the 85<sup>th</sup> percentile were at higher risk of being overweight, regardless of their rate of weight gain during the first year.

*Conclusions and Implications These findings suggest that rapid weight gain during infancy has different implications for the odds of being overweight in childhood, depending on birth weight.*

**Source: Jones-Smith JC, Fernald CH, Neufield L. Birth size and accelerated growth during infancy are associated with increased odds of childhood overweight in Mexican children. J Am Diet Assoc 2007; 107: 2061-2069**

## **Is it important to give babies vegetables before starting fruit?**

Although many mothers have heard that babies should be introduced to vegetables first before introducing fruit, there are actually no data showing that offering fruit first hinders acceptance of vegetables. Some research suggests that early exposure to flavors may occur in the womb, supposedly from the mother's diet to amniotic fluid. Similarly, exposure to a variety of flavors from the mother's diet to her breast milk may explain why breastfed infants are more willing to try new foods, compared to formula-fed infants. The purpose of this study was to examine the effects of breastfeeding and dietary exposure to new foods on acceptance of a new fruit and a green vegetable in infants, ages 4 to 8 months.

The study involved a randomized eight-day trial in which 45 babies were assigned to be fed, in addition to their usual breast milk or formula, either green beans only or green beans followed by peaches. About half of the infants in each group were exclusively breastfed; the remaining babies were only given formula. Before and after the eight-day period of exposure, the researchers determined acceptance of the green beans and peaches by measuring amount consumed, rate of feeding, frequency of negative facial expression during the feeding (recorded by videotape), and the mother's rating of infant enjoyment. Fewer negative expressions, such as squinting, nose wrinkling, upper-lip raising, proved to be significantly related to acceptance, as shown by amount of food eaten and time spent eating.

Breastfeeding appears to have a positive effect on infant acceptance of new foods but only for those foods that the mother also consumes frequently. In this study, breastfeeding mothers ate more peaches and less green beans than formula-feeding mothers. At baseline, infants who were breastfed for the first few months showed greater acceptance of peaches than did the formula-fed infants. However, breastfed and formula-fed infants squinted and grimaced similarly when first offered green beans. Compared to infants only fed green beans, those who were fed peaches shortly after eating green beans showed greater acceptance of green beans (as measured by facial expressions) at the end of the 8-day trial ( $p < 0.001$ ). However, there were no differences in the actual amount of green beans eaten or how quickly the food was consumed. As in other studies, infants who tasted green beans every day for 8 days, regardless of whether they were offered with peaches, did eat more green beans at the end of the study.

*Conclusions and Implications: Contrary to what we often tell mothers, introducing green beans followed by peaches at the same feeding may actually led to greater infant acceptance of green beans compared to only offering green beans at a feeding. We do not know if the same effect would occur if peaches had been given first and then green beans. Regardless, this study also confirms previous findings that babies will learn to like a new food when consistently and frequently given an opportunity to taste that food.*

**Source: Forestell CA and Mennella JA. Early determinants of fruit and vegetable acceptance. *Pediatrics* 2007; 120: 1247-1254.**

## **Counting diapers as a measure of breastfeeding adequacy**

The question that often plagues a breastfeeding mother is whether or not her baby is getting enough to eat. Mothers are often sent home from the hospital with advice to count the number of wet and soiled diapers as one way to tell if the baby is nursing adequately. But, what is the science behind that recommendation? A recent study has examined diaper counting to determine whether it yields useful information on breastfeeding adequacy.

The data for the analysis were collected as part of another study that looked at risk factors for poor breastfeeding outcomes. The final sample included 242 mothers who lived in Davis CA; delivered healthy, single, term infants; and were willing to try exclusive breastfeeding for at least one month. The researchers interviewed the mothers within 24 hours of birth (day 1) and at days 4, 6, 8, and 14. They recorded infant birth weights and weight at day 4. The mothers recalled daily number of wet and soiled diapers from days 1-7 and provided information related to breast fullness. The definition of breastfeeding inadequacy was an infant weight at day 4 that was 10% or more below birth weight. The researchers looked at various combinations of indicators to see how well they help identify cases of breastfeeding inadequacy. In their approach, they tried to get a combination that is sensitive (able to detect problems) while also being reasonably specific (able to avoid misdiagnosis where no problem exists).

As might be expected, the number of wet and soiled diapers varies widely for newborn infants during the first week of life. The best set of indicators appears to be fewer than 4 soiled diapers on day 4, used in combination with delayed onset of lactation (72 or more hours postpartum). This set of indicators is more sensitive but less specific than guidelines recommended by the American Academy of Pediatrics (3-5 wet diapers and 3-4 stools by age 3-5 days). However, while this new combination of indicators is very sensitive, the downside is that still 41% of mothers, who are actually breastfeeding adequately, would be incorrectly identified as “inadequate”. Thus, these mothers might lose confidence unnecessarily and start supplementing too soon.

*Conclusions and Implications: This study is the first to examine the sensitivity and specificity of diaper counting, as a tool to be used at home to screen for breastfeeding inadequacy. Counting the numbers of wet and soiled diapers may be useful but not as the sole method for mothers to use at home to tell whether their babies are nursing adequately. As recommended by the American Academy of Pediatrics, a pediatrician or knowledgeable health professional should plan a follow-up visit with all breastfeeding infants at 3-5 days of age.*

**Source: Nommsen-Rivers LA, Heinig MJ, Cohen RJ, and Dewey KG. Newborn wet and soiled diaper counts and timing of onset of lactation as indicators of breastfeeding inadequacy. J Hum Lact 2008; 24(1): 27-33.**

**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/>. \The University of California, in commonplace with the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and the Rehabilitation Act of 1973, does not discriminate on the basis of race, creed, religion, color, national origin, sex, or mental or physical handicap in any of its programs or activities, or with respect to any of its employment policies, practices, or procedures. The University of California does not discriminate on the basis of age, ancestry, sexual orientation, marital status, citizenship, medical condition (as defined in section 12926 of the California Government Code), nor because individuals are disabled or Vietnam era veterans. Inquires regarding this policy maybe directed to the Director, Office of the Affirmative Action, Division of Agriculture and Natural Resources, 300 Lakeside Drive, Oakland, CA 94612-3550. (510) 987-0097.