A healthy start to life


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For 30 years, the number of overweight children has crept higher and higher. In 2008, the Centers for Disease Control and Prevention reported 10 percent of children ages 2 to 5 had an unhealthy body mass index. Those children have a 70 percent chance of being overweight or obese adults.

Establishing good health habits early can reverse this trend and help children have healthy lives. The UNC Gillings School of Global Public Health leads the fight against the obesity epidemic and promotes healthy behaviors locally, nationally and globally.

"Combating obesity is a key strategic area for the School," says Peggy Bentley, PhD, nutrition professor and the School's associate dean for global health. "UNC is playing a major role in obesity research. We have faculty and graduate student expertise from the molecular level through epidemiology, economics, interventions and policy."

You are what your mother eats

Society's advice to expectant mothers historically has been to "eat for two." However, contemporary research shows that eating unhealthy, high-calorie foods during pregnancy can put children at risk for weight struggles and health complications before they are born.

For 15 years, Anna Maria Siega-Riz, PhD, RD, nutrition and epidemiology professor and associate dean for academic affairs at the School, has analyzed prenatal nutrition data to determine which health habits give children the best start in life.

"Pregnancy is a happy moment in life, but it's also when women are most concerned about the health of their child," she says. "If they have bad health habits, many women are more likely to modify their behavior, at least in the short term."

Although most women know to limit weight gain during pregnancy, 60 percent still gain more weight than they should, based on Institute of Medicine recommendations. (Siega-Riz was a member of the prestigious IOM panel that developed those guidelines, available at *http://tinyurl.com/iom-guidelines*.) Fewer than 25 percent receive guidance from their doctors about physical activity. Making and maintaining behavioral changes is difficult unless women have positive, consistent support.

Siega-Riz's team uses the Internet, podcasts, chat rooms and cell phones to provide health information and online support for pregnant women. One podcast includes a skit in which four women, all at different parenthood stages, advise an expectant mom about choosing nutritious foods.

Women with healthy habits may avoid having a baby who is too large for gestational age (often leading to C-section births), prevent shoulder dystocia for the baby during birth, and limit the child's risk for developing diabetes and obesity.

"Women who aren't eating right or exercising need assistance," Siega-Riz says. "We must help them find balance and give them all the support they require."

Choosing healthful foods during pregnancy could reduce the burden of chronic diseases later in life, says Mihai Niculescu, MD, PhD, nutrition assistant professor. Whether the "fat gene" exists is debatable (see page 14), but Niculescu's epigenetic work – research that determines how outside

influences alter our DNA – shows that high-fat diets and maternal obesity in mice alter DNA, shutting down some genes and accelerating others. Developmental brain delays in offspring are the result.

When maternal obesity exists, the neurons in mouse fetal brains at 17 days of pregnancy appear less developed, according to Niculescu's observations. The implications are worrisome, he says, because the effects are evident after three or four generations.

"This may have profound consequences for an offspring's life, including his or her mental development and ability to learn," he says. "A high-fat, less nutritious diet can also create food preferences in unborn offspring that lead them to choose unhealthy foods later in life."

Open the hangar – *here comes the airplane!*

Parental influence over children's nutrition doesn't end at birth, but little research exists on what increases obesity risk in children under two. In 2002, Associate Dean Bentley became a pioneer in this area when she launched "Infant Care, Feeding and Risk of Obesity," a study of strategies used by first-time African-American mothers to feed their 3-month to 18-month-old children.

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Women who choose healthful foods during pregnancy may reduce their own risk of chronic diseases later in life and improve their children's ability to learn.

With National Institutes of Health funding, Bentley recruited 217 mother-child pairs in North Carolina through the Women, Infants and Children program and videotaped them at three-month intervals to identify feeding styles. She and her team identified five styles: controlling, laissez-faire, responsive, pressuring and restrictive. Responsive mothers, she says, are "perfect moms" who pay close attention to and correctly interpret child cues of hunger and satiety. They are very engaged during feeding and may provide verbal and physical encouragement and help, when needed. Other styles pressure or even force children to eat when they reject food or overly restrict the quality and quantity of what children eat, often because the mother is concerned about her child becoming fat.

"Many factors play a role in how we feed infants. However, we believe that it is not just what children are fed, but also *how* they are fed that makes a difference in the child's acceptance of food and perhaps in later food preferences and health outcomes," Bentley says. "Understanding the role these styles

play in growth and development outcomes is a big part of what drives our childhood obesity study."

Meghan Slining, PhD, nutrition assistant professor, analyzed data from Bentley's study while she was a UNC doctoral student. Overweight infants – those who measured greater than the 90th percentile for weight versus length – were nearly twice as likely as normal-weight infants to have delayed motor development, Slining found.

"While baby fat may be cute," Slining says, "it increases the chance that a child could become an overweight adult. We also have seen more immediate consequences to extra pudginess. These children have lower gross motor development." (See a video about Slining's research at *http://tinyurl.com/slining-baby_fat*.)

Add a mother with an eating disorder to the mix, and feeding a child becomes even more complex. Jordan Distinguished Professor of Eating Disorders Cynthia Bulik, PhD, used data from the Norwegian Mother and Child Cohort Study, which followed more than 100,000 Norwegian mothers, some of whom had anorexia or bulimia nervosa or binge eating disorder, to determine how they fed their children. Bulik followed the mothers from 17 weeks' gestation through their children's eighth birthdays.

Although some mothers with eating disorders experienced a reprieve from their conditions during pregnancy, this was not universally the case. In fact, a surprising number of women developed binge eating disorder during pregnancy. Eating disorders during pregnancy expose babies to erratic eating, Bulik says.

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Mothers with eating disorders also abandoned breastfeeding earlier than did healthy mothers, Bulik says. After giving birth, women with eating disorders often feel they no longer "have a reason to be overweight" and choose not to consume adequate calories to support breastfeeding.

Bulik's study also shows that, as these children grow, they are more likely to develop eating problems, such as having stomach aches, vomiting without cause or not enjoying food.

According to Miriam Labbok, MD, Professor of the Practice of maternal and child health and director of the School's Carolina Global Breastfeeding Institute, a breastfeeding baby will "stop when full," but bottle feeding can overpower a baby's ability to recognize satiety. When a parent insists that the baby empty the bottle, the child learns the habit of overeating, Labbok says. Additionally, breastfed babies are exposed to the tastes of foods eaten by their mothers. For a formula-fed child, food flavors are new and strange, which could cause the child to be a picky eater.

Employing research to instill good eating habits early is paramount to changing the course of human health, Bentley says.

"It's harder to intervene and prevent nutrition problems when a child is older. They have preferences and eating patterns that make changes more complicated and difficult," she says. "But, with the research ongoing at the School, we know we're leading a positive trajectory of implementing healthy habits early."

–Whitney L.J. Howell

Karina Agopian, research assistant at UNC's Nutrition Research Institute in Kannapolis, works with a toddler to determine what and how much the child has eaten. Research shows that early eating habits influence later food preferences and health outcomes.

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