Study to Identify Infants at High Risk for Developing Obesity: Metabolic Programming and the Effects of Maternal Obesity on Neonatal Body Composition

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As the prevalence of obesity in children increases, it has been recognized that prevention of this epidemic must occur with interventions aimed at very young children, even infants who are deemed high-risk. How do we identify infants at high risk for developing childhood-onset obesity?

Multiple early-life factors potentially increase the risk: maternal pre-pregnancy body mass index (BMI), maternal weight gain during pregnancy, maternal glucose tolerance, breast-feeding duration and feeding practices, infant birth weight, and the rate of weight gain during infancy and early childhood.

Increased proportion of body fat at birth may convey increased risk for childhood-onset obesity.

The link between high birth weight and later obesity is well recognized. However, most children who become obese had a normal birth weight. Hence, it is crucial to study other parameters beyond birth weight to identify infants at risk.

Increased proportion of body fat at birth is one parameter that may convey increased risk for childhood-onset obesity. Newborn body fat also may be a more sensitive and specific predictor of childhood-obesity risk than birth weight alone. It is my hypothesis that obesity in non-diabetic pregnant women is associated with increased newborn body fat.

New technology helps measure body fat in newborns

Few studies have reported quantitative measures of body fat in the newborn because of the challenge in obtaining accurate data. This clinical research study is evaluating body fat in full term infants of obese and non-obese mothers using the Pea Pod® Infant Body Composition System, a fast, non-invasive mechanism to measure newborn body fat.

The Pea Pod system is located at Prentice Women's Hospital and uses air displacement to assess fat mass. Newborn measurements are performed within the first 48 hours following birth. First, an accurate length is measured using an infant measuring board. The neonate is weighed on the calibrated Pea Pod scale. Finally, body volume is measured by the air displacement plethysmograph technique. From these measurements, body composition of the neonate is calculated by the Pea Pod system.

Correlation of other risk factors to newborn body fat

The technological advance of the Pea Pod system has made it feasible to study neonatal body fat as a risk factor for childhood obesity. Additionally, the study is examining metabolic biomarkers, including glucose, the appetite regulator hormone leptin, and adiposity marker adiponectin, to identify a pattern reflective of altered maternal metabolism in obese women. Other factors, such as pregnancy weight gain and gestational age of the newborn, also are being evaluated to determine the relative contribution of each factor to newborn body fat percentage.

In the photo: Researcher Jami Josefson, MD, uses the Pea Pod system to measure body fat of newborn study participant Serena Liffgens.

Study population

The study currently is recruiting pregnant women, both healthy weight (pre-pregnancy BMI 18-25 kg/m^2) and obese (pre-pregnancy BMI > 30 kg/m^2). Women must have had a normal glucose challenge test. Diabetic women are excluded because gestational diabetes is known to be associated with increased risk of offspring obesity. The recruitment goal is 80 mother-infant pairs, half from each maternal weight category.

Planning ahead

This research study will characterize the anthropometric and metabolic status of offspring of obese mothers. Research that focuses on the long-term effects of the perinatal environment on the developing fetus, termed metabolic programming, may provide further understanding of the obese intrauterine environment and its relative contribution to offspring obesity. The current study will provide the preliminary data and the foundation for a larger cohort study to determine if adiposity and/or other biomarkers at birth predict adiposity in childhood.

If adiposity at birth indeed identifies infants at risk of developing obesity, interventions initiated from birth forward may prevent or reduce this risk. Ultimately, developing cost-effective interventions to reduce the prevalence of childhood obesity is necessary to curtail this epidemic.

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