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Innovative Approaches to Prevention and Management of Childhood Obesity: Physiopathological Basis and Successful Interventions

Melinda S. Sothern, PhD, Professor
Jim Finks Endowed Chair in Health Promotion
Behavioral and Community Health Sciences
School of Public Health
Department of Pediatrics
School of Medicine
Louisiana State University Health Sciences Center
Prevention of Childhood Obesity Laboratory
Pennington Biomedical Research Center
Email: msothe@lsuhsc.edu

LSU Health New Orleans
Objectives:

1. Describe the physiopathological evidence that supports multi-level, interdisciplinary approaches to prevention and management of pediatric obesity.

2. Identify potential targets for developing high-quality multi-level, interdisciplinary, obesity prevention and management programs.

3. Describe evidenced-based strategies for improving nutrition and physical activity in the family home.
Objectives:

- Describe the physiopathological evidence that supports multi-level, interdisciplinary approaches to prevention and management of pediatric obesity.
Physical Activity

Nutrition

Adiposity

Prenatal

Postnatal/Infancy

Early Childhood

Mother’s Pregnancy Weight

Tobacco Use, High/Low Birth Weight Offspring; Fetal Programming

Obesity, Metabolic Functioning (e.g. BP, Cholesterol, Visceral Adiposity, Ectopic Fat, Fat Oxidation)

Glucose Tolerance

Insulin Sensitivity

Metabolic Syndrome

Type 2 Diabetes

Inflammation?

Social Disadvantage?
Fetal Origins Hypothesis

- The local availability of nutrients, especially protein during pregnancy, has strong implications for future metabolic health.
- Undernourished infant establishes a “thrifty” way of handling food:
  - Adjustments to protect brain tissue preferentially over visceral and somatic growth result in an altered metabolic profile, obesity & type 2 diabetes
- High blood glucose concentrations negatively impact glucose transportation the muscles.
- Decreased muscle growth - sarcopenia

Keller, 2003; McGarry, 2002; Ong, 2000; Barker, 1995; Law, 1996; Neel, 1962; Tappy, 2006; Hyponen, 2003
Fetal Origins Hypothesis

Nutrition, particularly over-nutrition is likely the most important environmental factor that modulates the expression of genes involved in metabolic pathways and phenotypes associated with obesity and diabetes (Mathias, et al, Eur J Nurt. 2014).

Maternal and paternal smoking during pregnancy are associated with abdominal body fat and increased overall risk for overweight in offspring (Durmus, et al, Int’l J of Obesity, 2014).

Maternal smoking during pregnancy is associated with shorter birth length and faster height growth in infancy and slower growth in later childhood (Howe, et al, Int’l J of Epidemiol, 2012)

Keller, 2003; McGarry, 2002; Ong, 2000; Barker, 1995; Law, 1996; Neel, 1962; Tappy, 2006; Hyponen, 2003
Association of prenatal exposure to maternal cigarette smoking with amygdala volume (A) and fat intake (B) in individuals with above median (obese) and below median (non-obese body mass index (BMI)). The median split was performed separately in exposed (E) and nonexposed (NE) individuals on age-adjusted and sex-adjusted BMI.
Overweight Moms have Overweight Children

Percentage of newborns obese as preschoolers by maternal weight in the 1st trimester of pregnancy

- Mother normal weight (BMI 18.5 to 24.9)
- Mother obese (BMI >=30)

Overweight Moms have Overweight Children

Maternal BMI has a stronger influence on BMI growth than paternal BMI. Offspring of obese mothers had higher BMI at birth and between 1.4 and 3.5 years when compared to overweight and normal weight mothers (Linabery, et al, Pediatr Obes, 2013)

Both pre-pregnancy maternal and paternal body mass index are associated with fetal and post natal growth measures in children through age 4 years. Maternal body mass index had a significantly stronger effect than that of males (Durmus, et al, Pediatr Obes, 2013)
Obesity Starts in the Womb

• Mothers with higher levels of omega-6 fatty acid (unhealthy fat) intake were more likely to have obese children 3 years later.
  • Data from mother’s diet history and umbilical cord blood

• The increase in unhealthy fat consumption in the diet of American mothers promotes an altered genetic expression in the unborn child.

• May explain why each succeeding generation of Americans is getting more obese

• Children with altered genetic profiles must be managed throughout life to maintain a healthy weight