



***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](mailto:msothe@lsuhsc.edu)**



**LSUHealthNewOrleans**

# Objectives:

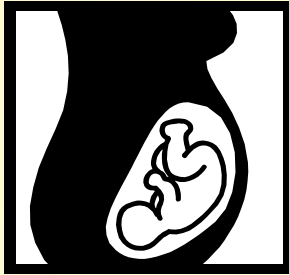
- 1. Describe the physiopathological evidence that supports multi-level, interdisciplinary approaches to prevention and management of pediatric obesity.**
- 2. Identify potential targets for developing high-quality multi-level, interdisciplinary, obesity prevention and management programs.**
- 3. Describe evidenced-based strategies for improving nutrition and physical activity in the family home.**

# Objectives:

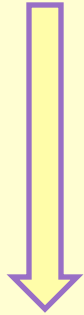
- **Describe the physiopathological evidence that supports multi-level, interdisciplinary approaches to prevention and management of pediatric obesity.**

# Prenatal

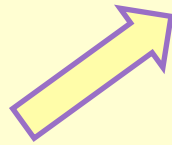
## Maternal Nutrition



Mother's  
Pregnancy  
Weight



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



# Postnatal/Infancy

## Breastfeeding



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



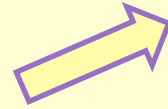
Glucose Tolerance  
Insulin Sensitivity  
↓  
Metabolic Syndrome  
Type 2 Diabetes

# Early Childhood

## Adiposity



## Physical Activity Nutrition



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).

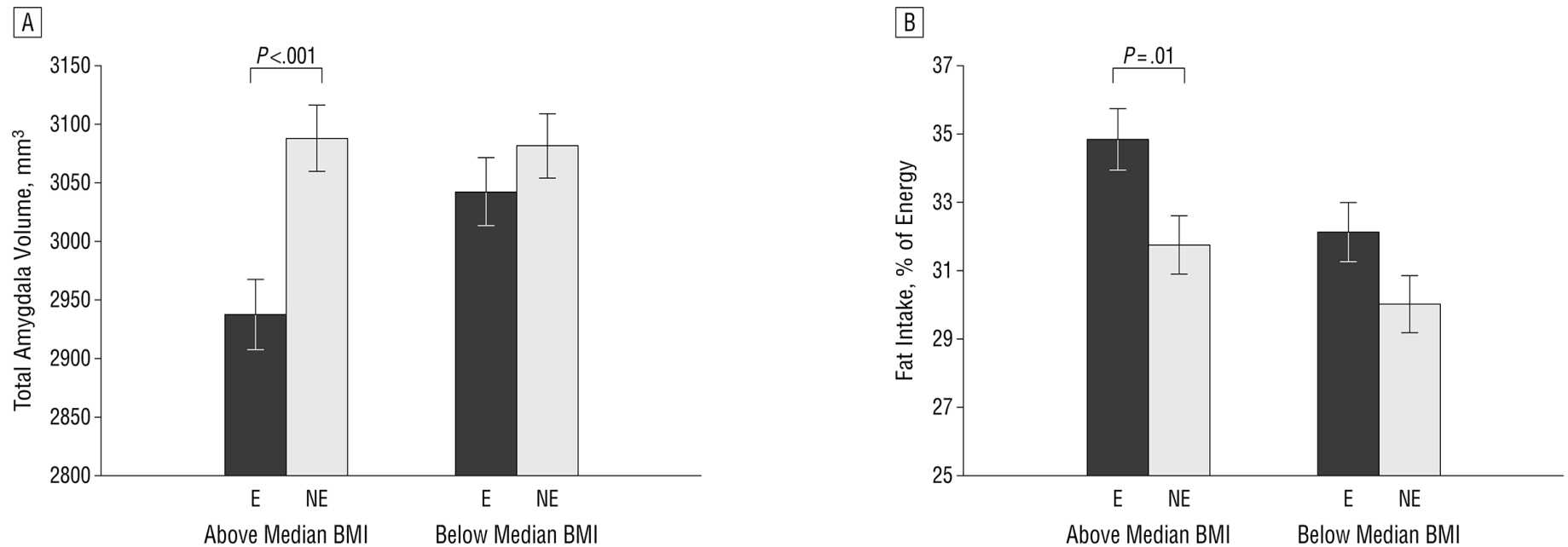
Maternal smoking during pregnancy is associated with shorter birth length and faster height growth in infancy and slower growth in later childhood (Howe, et al, Int'l J of Epidemiol, 2012)

K

Tappy, 2006; Hyponen, 2003

# ***Prenatal Exposure to Maternal Cigarette Smoking, Amygdala Volume, and Fat Intake in Adolescence.***

Arch Gen Psychiatry. 2012 Sep 3:1-8.

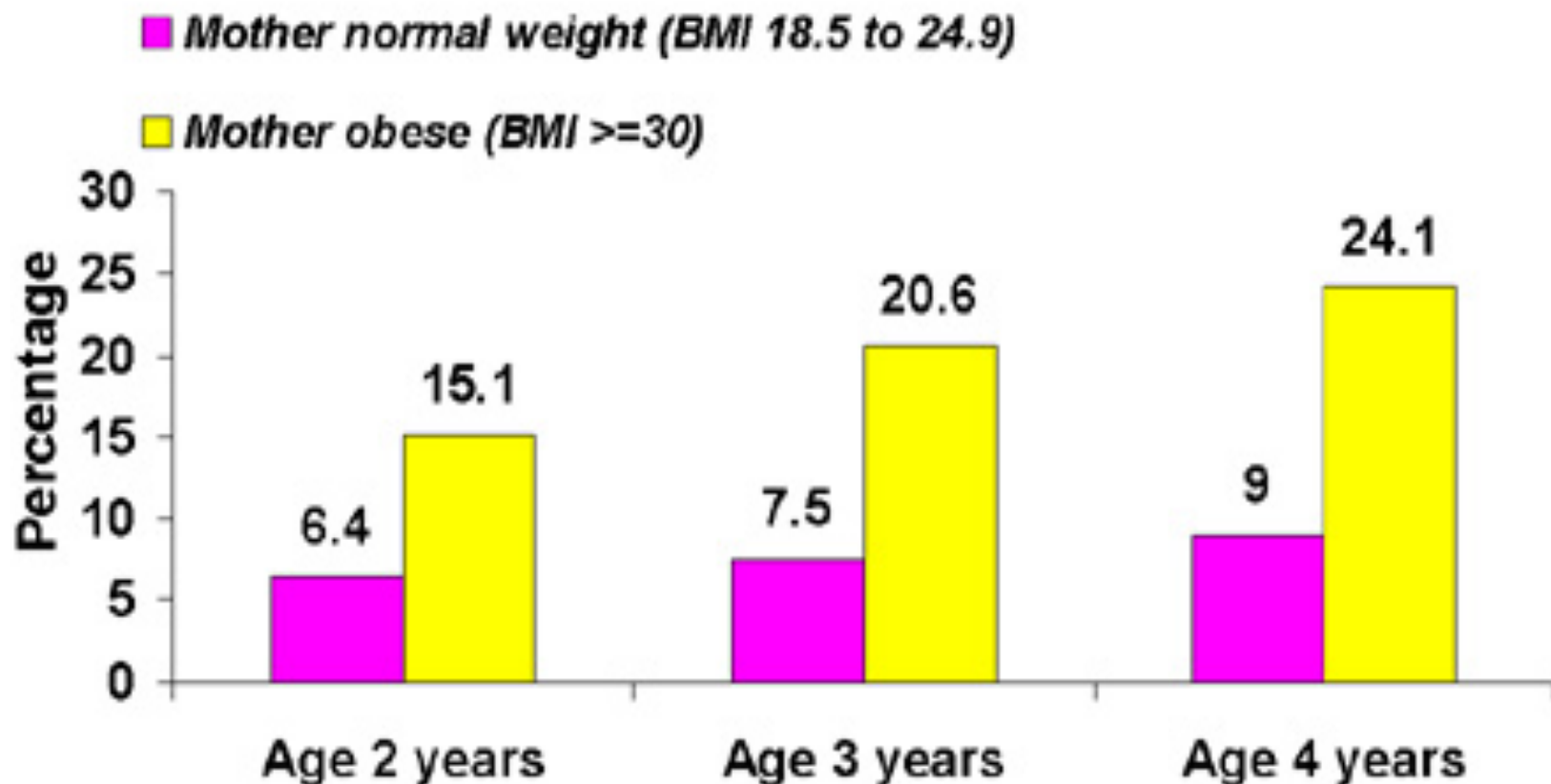


Association of prenatal exposure to maternal cigarette smoking with amygdala volume (A) and fat intake (B) in individuals with above median (obese) and below median (non-obese body mass index (BMI)). The median split was performed separately in exposed (E) and nonexposed (NE) individuals on age-adjusted and sex-adjusted BMI.



# Overweight Moms have Overweight Children

## Percentage of newborns obese as preschoolers by maternal weight in the 1<sup>st</sup> trimester of pregnancy



Whitaker. *Pediatrics*. July 2004

# 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