Long Term Impact of Maternal Obesity

Esther G. Schuster, MS,RD,CDE

Women of Reproductive Age

- Percentage of women at reproductive age who are overweight or obese has ⬆ dramatically over the past 20 years
- Data from national surveys conducted since 1960's show a wt.⬆ of 25 lbs, but ht.1 in. [9]
- Approximately 47% of women in US women currently overweight [1]
- There is an ethnic disparity, with > numbers among low socioeconomic & minorities

Pre-pregnancy BMI for 301 Current Pasadena Pprenatal Clinic Clients

1.	Underweight	12 pts.	.o4%
1.	Normal weight	140 pts.	.46%
2.	Overweight	72 pts.	. 24%
3.	Obese	78 pts.	.26%

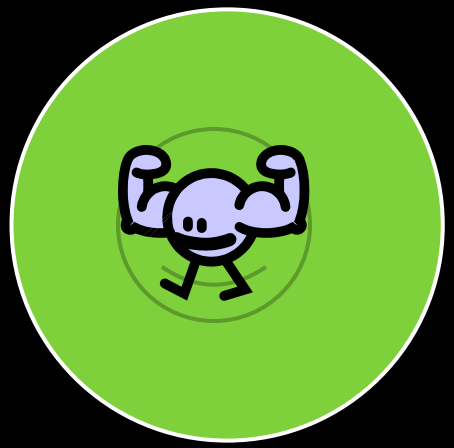
50% were overweight or obese

The Disconnect Between Present Environment and Past

- Photo from Smithsonian

Behavior & Biochemistry

- Diet & exercise: the PH message for wt. loss
- Recent HBO special, Weight of the Nation message: “to win you have to lose & the 1St step starts with you.”
- True, but it’s much more complex than that.
- Scientists are just beginning to understand how people’s body change when they gain/lose wt, altering metabolism, hunger, satiety.



Adipose Tissue

- Leptin Adiponectin favor wt. suppression
- Resistin, favors wt. increase

Gut

- PYY, GLP-1 favor wt. suppression
- Ghrelin favor wt. increase

Brain

- Neuropeptide Y favors wt. increase
- Serotonin/dopamine affect appetite

Role of Placenta & Maternal Obesity

Normal Placenta Functions

- exchanges nutrients, gasses, waste products between fetus & mother
- protects fetus from maternal immune responses
- secretes hormones & cytokines, modulates fetal environment

Placenta Subject to Maternal Obesity

1. ↑ TG's & glucose transfer to placenta in obese women
2. ↑ inflammatory cytokines leptin-6, TNF-alpha in obese women
3. altered fetal adipose tissue accretion

Sylvie Hauguel-de Mouzon, PhD

Case Western Reserve University

Role of Obesity in a Diabetic Pregnancy

- 60% women are overweight or obese at conception

- Prevalence of GDM ↑ 2-fold from 1990-2004

- In a normal pregnancy there is a 50-60% ↓ in insulin sensitivity

- Maternal cellular lipid accumulation triggers pro-inflammatory proteins like Interleukin-6
- Maternal proinflammatory cytokines impair insulin signaling pathways, ↑ insulin resistance
- Maternal hyperglycemia causes fetal hyperinsulinism causes LGA infant
- Fetal hyperinsulism may possibly program hypothalamic centers that control appetite, satiety, energy balance

- Both maternal GDM and obesity are independently associated with adverse pregnancy outcomes
- Their combination has a greater impact than either one alone

Patrick Catalano, MD

Professor of Obstetrics Case Western University

Effects of Maternal Obesity on Pregnancy Outcome

- ↑ risk for: preeclampsia
- GDM, HTN
- Macrosomia
- C/S delivery
- NTD [7]
- Fetal heart defects, showed marked ↑ with BMI >30
- Miscarriage
- Fetal & infant death
- Postoperative complications such as infection, deep vein thrombosis, hemorrhage [2, 7]

  Childbirth lacerations[9]
- Longer hospital stays[8]

Caesarean Delivery Doubles Risk for Childhood Obesity?

- Harvard study of 1255 mothers/offspring, ¼ were C/S. Children weighed at birth, 6 months, 1 year, 3 years
- C/S women weighed more, babies were bigger and most didn't breastfeed
- Possible explanation for ↑ wt, microbiota
- Type of gut bacteria from C/S affects E extraction, insulin sensitivity, inflammation, fat deposits [5]

Maternal Obesity and Breastfeeding

- Associated with:

↓ intention to breastfeed

↓ initiation to breastfeed

↓ duration of breastfeeding [10]

Fetal Metabolic Programming

- A phenomenon where a nutritional stress/stimulus applied at critical periods of development alter an organism's physiology & metabolism.
- Recent studies have begun to examine the effects of overnutrition during fetal development and the offspring's risk of developing the same chronic disease as fetal undernutrition [3]

Fetal Exposure to Metabolic Syndrome and GDM

- Strong, convincing evidence linking adult metabolic syndrome to childhood obesity and in-utero fetal obesity
- In pregnancy, maternal hyperglycemia correlated with childhood, adulthood obesity & future DM
- Fetal insulin cord levels associated with risk for future metabolic syndrome
- GDM was the strongest factor associated with future metabolic syndrome for offspring

Avon Longitudinal Study of Parents & Children

- Analysis of 5154 mother/offspring pairs
- Offspring of mothers who exceeded IOM wt. recommendations followed until age 9:

1. elevated BMI
2. >waist circumference, > fat mass
3. ⬆ leptin levels, and BP
4. > CRP, > interleukin-6
5. lower HDL and apolipoprotein levels [3]

Overnutrition is Abnormal Nutrition for Offspring

- Excess prepregnancy wt. or excess wt. gain during gestation may lead to:

1. Excess maternal nutrient delivery
2. ⬆ neonatal adiposity, hyperinsulinemia & hyperleptinemia
3. Lasting mal-programming of endocrine systems
4. Legacy of CV and metabolic risk [3]

How is Maternal Obesity Defined?

BMI Classification

- <18.5 underweight
- 18.5-24.9 normal weight
- 25-29.9 overweight
- 30-34.9 Class 1
- 35-39.9 Class 11
- > 40 Class 111

Case Study

- 36 year old pt. with a pre-pregnancy wt. 245 lbs, Ht. 63”, BMI 43, BP 121/71
- GTT: 90/170/166/83 at 10 wks gestation
- Intervention: 2200-2300 Kcal, omit sweetened drinks, 30 min. walking/ day
- Repeat GTT at 28 wks: 89/165/152/120
- Total wt. gain, at 38 wks gestation= 6 lbs
- IBW 7 lbs, 6 oz

IOM Gestational Weight Gain Guidelines

If Prepregnancy BMI Is:

	(twins)	(singleton)
< 18.5	ask MD	28 to 40 lbs
18.5 to 24.9	37 -54 lbs	25 to 35 lbs
25 to 29.9	31-50 lbs	15 to 25 lbs
≥ 30	25-42 lbs	11 to 20 lbs

Excess Gestational Weight Gain in Normal Weight Women

- About 40% of normal wt. women have excess GWG [4]
- Linked to postpartum wt. retention
- May lead to long-term maternal obesity
- Associated with > infant adiposity and ⬆ obesity in offspring

Wt. Gain in Pregnancy: how much is too much, too little?

- 2009 IOM recommends 11-20 lbs. (BMI>30)
- Strong evidence links excess wt. gain with numerous adverse pregnancy outcomes
- Strong evidence links low gestational wt. gain with preterm delivery in women with a low BMI
- Several large observational studies support lower wt. gain among class II and class III obesity

- Normalize wt. prior to pregnancy
- Target wt. goal & track wt. during pregnancy
- Individualize counseling
- Assist postpartum pt. in returning to prior wt.

Naomi Scotland, MD
Associate Professor , UCSF

Addressing Weight at the Pasadena Prenatal Clinic

- Pt.'s pregnancy wt. and desired wt. is discussed & plotted on grid in chart
- Both underwt. & overwt. pts. are seen more often
- Attitudes towards wt. gain, nutrition, physical activity are discussed
- We identify factors for poor/excess weight
- We ask about depression
- We talk about breastfeeding

Cause for Optimism

Yes, strong data suggests maternal obesity creates a significant risk for future generations.

1. Moms want to be good parents
2. Ideal opportunity to counsel about healthy behaviors
3. We begin with small changes

Targeting High-Risk Population, is PH at Best

Small Steps

1. Encourage less sweetened beverages
2. Change your environment
3. Commit to eating more produce
4. Plan your activity, so it happens

Continue to look for effective strategies to improve maternal & fetal outcome