CHILDHOOD OBESITY: The Global Epidemic

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Obesity
Definition

“Excessive storage of energy as FAT relative to lean body mass”

▪ Energy intake exceeds expenditure
Obesity Measurement

- Weight
- Weight:Height
- BMI
  - kg÷m²
- Skin Thickness
- Waist:Hip Ratio
Obesity
Growth Charts
Obesity - Measurement Research Tools

- Body Density
- Air Displacement Plethysmography
- Ultrasonography of the Skin
- Dual Energy XRay Absorptometry (DEXA)
- CT and MRI
- Bioelectrical Impedence Analysis
Obesity
Definition based on BMI

• Pediatrics
  – Obese - BMI> 95% for gender and age
  – At risk/overweight - BMI=85-95%

• Adults
  – Obese – BMI> 30
  – Overweight – BMI=25-30
Obesity
US Epidemic

• Prevalence doubled in past 25 years
• 50% increase obese children last decade
• Affects 20% of US children
Obesity
Worldwide Epidemic

- Variable definitions
- Increasing childhood obesity in developed and developing nations
- Similar prevalence to US: Latin America, Caribbean, Middle East, Northern Africa, Central-Eastern Europe
- Areas of Asia and Africa without increasing prevalence
Childhood Obesity Worldwide

- BBC reports China has 8% per year increase
Obesity Worldwide

Bar chart showing obesity rates for USA, Europe, China, Brazil, Kuwait, and Australia.
Obesity
Trends in children and adolescents

![Graph showing trends in obesity from 1963-2002 for different age groups. The graph indicates an increase in obesity over time across all age groups.](image-url)
Obesity
US Ethnic Groups

• Highest prevalence: African Americans, Hispanics, Native Americans ~ 24%

• Disproportionately increasing prevalence
  (1986-98)
    – 120% increase for AA and Hispanics
    – 50% increase non-Hispanic whites
Obesity
Socioeconomic status

• Inverse relationship
• Less consistent in non-white ethnic groups
Obesity Classification

• Idiopathic
• Endocrine: short
  – Hypothyroidism
  – Hypercortisolism
  – Growth hormone deficiency
• Genetic
  – Prader-Willi
  – Turner
Obesity Classification

• CNS conditions: hypothalamic damage
• Medications
  – Glucocorticoids
  – Phenothiazines
  – Lithium
  – Amytryptiline
  – Estrogen/progesterone
Obesity

Etiology

- Heterogeneous and Multifactorial
  - Environmental
  - Psychosocial
  - Genetic
Obesity
Genetics vs. Environment

• Weights of adopted children correlate better with biological parents
• BMIs of identical twins reared apart = together
• Monozygotic twins more similar in fat deposition and weight than dizygotic twins
Obesity
Metabolic factors

• Basic metabolic rate
  – Determined by fat free mass

• Energy expenditure
  – Determined by physical activity
Obesity

Environmental Factors: Increased Energy Input

- High caloric-density food
- Supersized portions
- Eating out
- Working parents
- Advertising
Obesity
Environmental Factors:
Decreased Energy Expenditure

- TV
- Computers
- Transportation
- Inadequate safe areas for physical activity
- Sedentary Lifestyle
Childhood Obesity
Environmental Factors
TV

- 25 hours/week
- Half the ads are for food
- Prevalence increases 2%/hour of viewing
- Strongest predictor of subsequent obesity
Obesity
Predictors of Adult Obesity

- 20% obese infants become obese children
- 40% obese children become obese teens
- 80% obese teens become obese adults
# Childhood Obesity

## Predictors of Adult Obesity

<table>
<thead>
<tr>
<th>AGE</th>
<th>OBESITY STATUS</th>
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<tbody>
<tr>
<td>&lt;3</td>
<td>parents</td>
</tr>
<tr>
<td>3-9</td>
<td>child=parent</td>
</tr>
<tr>
<td>&gt;9</td>
<td>child</td>
</tr>
</tbody>
</table>
Obesity
Sex Difference

• Males – Increased visceral fat
• Females – Increased hip fat
• At all ages females have more adipose tissue than males
Obesity Pathogenesis

- Stability of body weight over time
- LEPTIN - Adipostatic signal 1994
- Ob/Ob deficient in Leptin
- Db/Db insensitive to Leptin
Obesity
Leptin

• Hormone produced by adipose tissue
• Circulates in proportion to body fat stores
• Acts on Hypothalamus
• Decreases food intake
• Increases energy expenditure
Obesity
Leptin

• Low – neuropeptide Y – stimulates appetite
• High – MSH – inhibits appetite
• Fasting – decreases Leptin
• Eating – increases Leptin
Obesity

• Common obesity due to multiple allelic variations in hundreds of genes
• Monogenic obesity
  – Leptin deficiency
  – Leptin insensitivity
  – RARE
Obesity

Hypothalamus

• Central role of energy intake
• Lesions cause hyperphagia and obesity
Obesity
Health Risks

• Diabetes (Type 2)
• Hypertension and Heart Disease
• Neurologic Complications
• Respiratory Disease
• Orthopedic Condition
• Psychosocial Disorders
• Hyperlipidemia
• GI Manifestations
• Menstrual Disorders
Obesity
Metabolic Syndrome

• Clustering of CV risk factors related to insulin resistance

• Not well defined in Pediatrics
  – Insulin resistance
  – Dyslipidemia
  – Hypertension
  – Obesity
Obesity
Metabolic Syndrome- Prevalence

• US Population- 22%
• Adolescents – 4.2%
• Adolescents, normal – 0.1%
• Adolescents, overweight – 6.8%
• Adolescents, obese – 28.7%
Obesity
Type 2 DM

• Tenfold increase in prevalence of Type 2 DM
• OGTT given to 167 obese, asymptomatic multiethnic youth
  – Impaired Glucose Tolerance (IGT)
    • 25% ages 4 – 10
    • 21% ages 11 – 18
  – Type 2 DM in 4% obese adolescents
Obesity
Type 2 DM

- Effect of Lifestyle Changes
  - Can prevent or delay progression from IGT → DM
  - Can reverse early Type 2 DM
Childhood Obesity
Cardiovascular Disease

• Autopsy studies show correlation between atherosclerosis and CV risk factors
  – BMI
  – BP
  – LDL
  – Triglycerides
  – Smoking

• Multiple risk factors are synergistic
Childhood Obesity
Dyslipidemia

• Measures of obesity correlate + with
  – LDL
  – VLDL
  – Triglycerides

• Correlate - with
  – HDL

• Weight reduction lowers triglycerides and increases HDL
Obesity
Hypertension

• + correlation between BP and BMI
• Weight loss decreases BP
Childhood Obesity Hypertension

Percentage of Overweight Children With BP in 95th Percentile

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Boys</th>
<th>Girls</th>
</tr>
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<tbody>
<tr>
<td>2 - 5</td>
<td>7.8%</td>
<td>7.9%</td>
</tr>
<tr>
<td>6 - 10</td>
<td>10.8%</td>
<td>11.2%</td>
</tr>
<tr>
<td>11 - 15</td>
<td>20.0%</td>
<td>19.8%</td>
</tr>
<tr>
<td>16 - 19</td>
<td>18.5%</td>
<td>20.8%</td>
</tr>
</tbody>
</table>

Note: Based on a retrospective study of 18,618 patients.
Source: Dr. Rappaport
Obesity
Respiratory Diseases

• Causes both restrictive and obstructive disease
• Sleep apnea 7-33%
• Asthma ~30%
Obesity
GI manifestations

• Steatohepatitis
  – Fatty infiltration of the liver
  – Abnormal insulin metabolism
  – 10% obese teens increased LFTs
  – Can progress to fibrosis and cirrhosis

• Gall bladder disease
  – Increased cholesterol excretion
  – ~30% of gallstones in children
Obesity
Orthopedic Conditions

• Genu varum/valgus deformities
• Blount Disease
  – bowing of legs
  – tibial torsion
  – 50-80% obese
• Slipped Capital Femoral Epiphysis (SCFE)
  – Femoral epiphysis slips off of metaphysis
  – 60% obese
  – Associated with hypothyroidism, hypogonadism, & GH deficiency
Obesity
Neurologic Complications
Pseudotumor Cerebri

- Increased ICP
- HA, vomiting, diplopia, blurred vision
- 30-80% obese
Obesity
Menstrual Disorders
Polycystic Ovarian Syndrome

• Oligomenorrhea/Amenorrhea
• Acanthosis Nigricans
• Insulin Resistance
• Obesity
• Hirsutism
• Acne
• Hyperandrogenism
Obesity
Psychological Disorders

• Difficult to quantitate
• Stigmatization
• Low self esteem
• Depression
• Discrimination
Obesity
Healthcare Costs

• $98-129 Billion in 2004
• 9% of all US medical spending
• ½ cost paid by Medicare/Medicaid
• Outranks drinking and smoking combined costs
Childhood Obesity

Treatment

• Prevention easier than cure
• Lifelong weight control
• Decrease energy intake
• Increase energy expenditure
• Must maintain normal growth
Childhood Obesity

Education

• Need to educate family
• Parents impose their lifestyle
• + family support improves weight loss
Childhood Obesity
Dietary Therapy

• Cornerstone of treatment
• Weight loss determined by #calories consumed relative to expended
• Healthy diet
  – 55% carbs
  – 30% fat
  – 15% protein
• Avoid fad diets
Childhood Obesity
Dietary Therapy

• Fat vs Carbs
  – Carb converted to fat 30% of energy consumed
  – Little energy used in absorbing fats

• Glycemic Index
  – High carb diets
  – Leads to increased serum insulin
  – Promotes excessive food intake
Childhood Obesity
Physical Activity

• Physical activity essential for weight loss
• Energy costs greater for obese
• Physical activity decreases 50% during adolescence (girls>boys)
Childhood Obesity Treatment Programs

• Summary of 41 programs
  – Best: comprehensive with behavioral Rx, diet, and exercise
  – Behavioral modification works best

• Summary 12 school programs
  – Mean weight reduction 10%
  – Best: interventional components
Childhood Obesity Pharmacotherapy

- Anti-obesity pills not approved for peds
- None of drugs tested for:
  - Long term use
  - Pediatric age groups
- Drug options
  - Appetite suppressants
  - Serotonin agonists
  - Inhibitors of fat absorption
  - Antihyperglycemic agents
Childhood Obesity
Pharmacotherapy: Metformin

• Approved for Type 2 diabetes and hyperinsulinemia
• Decreases hepatic glucose production
• Enhances insulin sensitivity
• Results in modest weight loss
• Side effects: nausea, flatulence, bloating, diarrhea, lactic acidosis
Obesity
Treatment: Surgery

- Gastric bypass
- Gastic plication
- Gastric banding
- Jejuno-ileal bypass no longer performed
- Not routine for children
Childhood Obesity

Conclusion

- Heterogeneous disorder
- Multifactorial causes
- Global epidemic
  - Not driven by changing gene pool
  - Sedentary lifestyle
  - Too much in
  - Too little out