CHILDHOOD OBESITY: The Global Epidemic

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Obesity
Definition

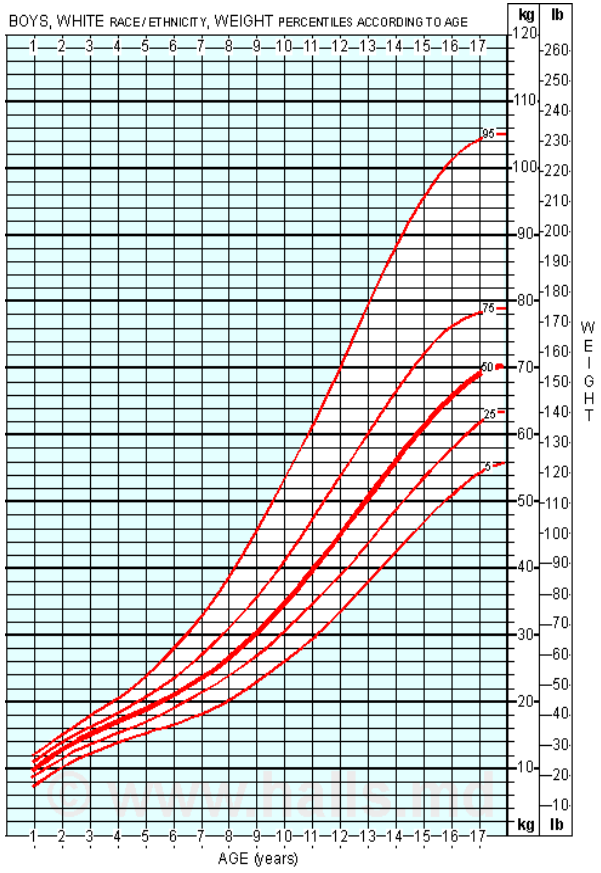
"Excessive storage of
energy as FAT relative to
lean body mass"

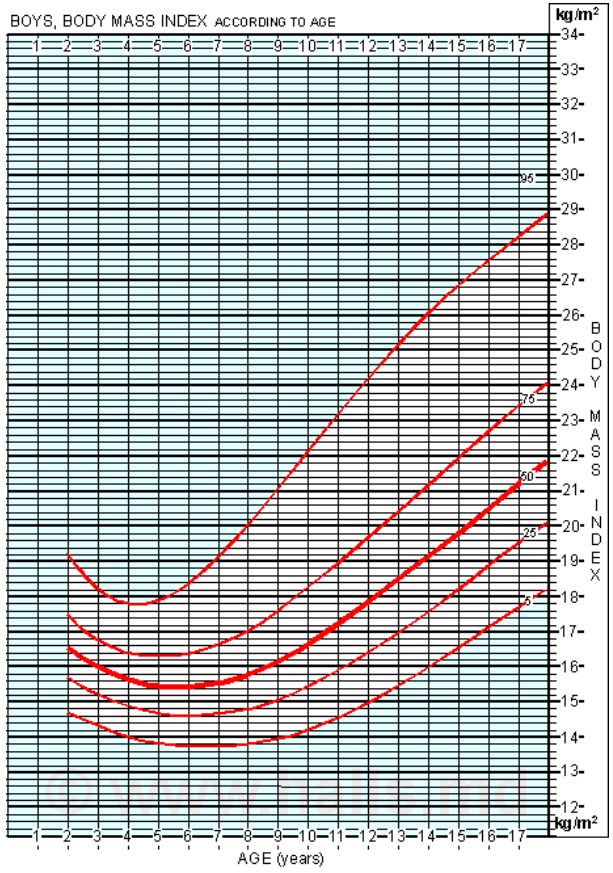
- Energy intake exceeds
expenditure

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

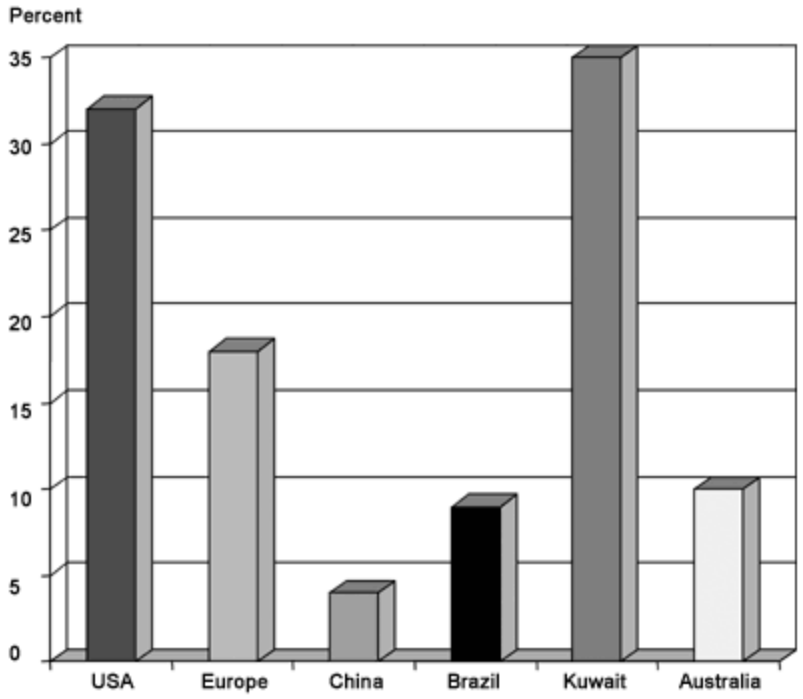
Obesity
Worldwide Epidemic

- 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

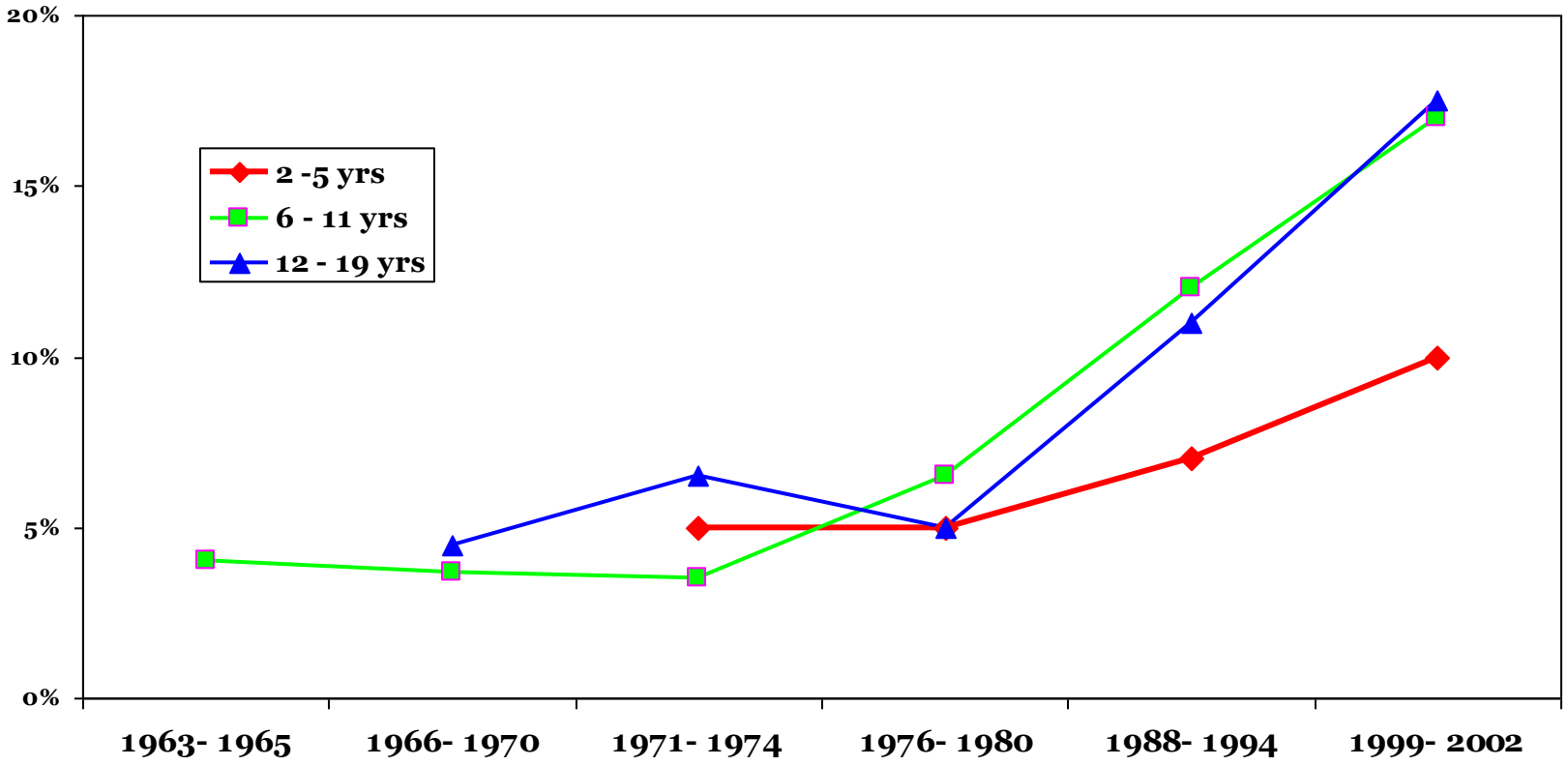
Childhood Obesity Worldwide

- BBC reports China has 8% per year increase

Obesity Worldwide



Obesity
Trends in children and adolescents



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

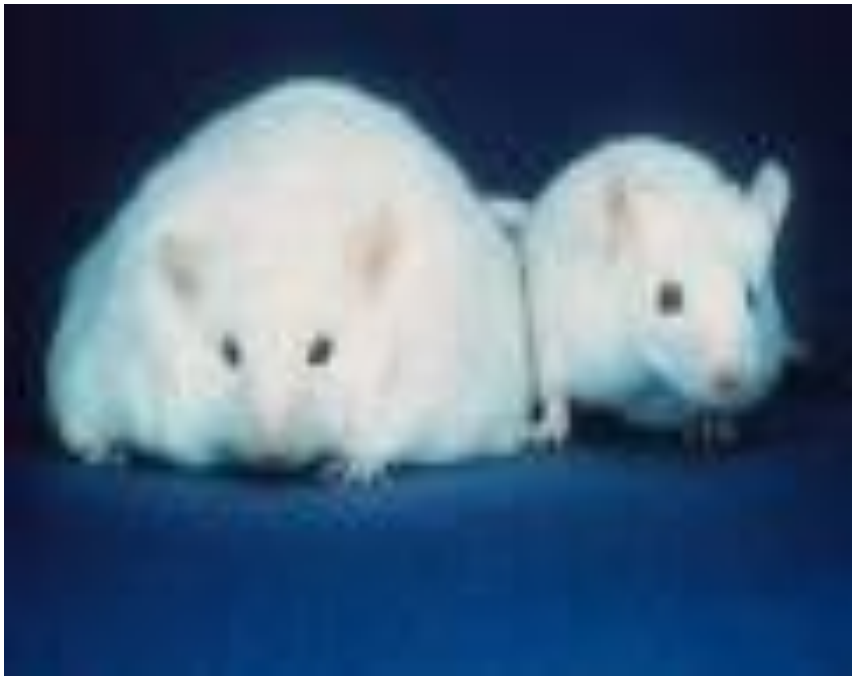
Childhood Obesity
Predictors of Adult Obesity

AGE	OBESITY STATUS
<3	parents
3-9	child=parent
>9	child

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

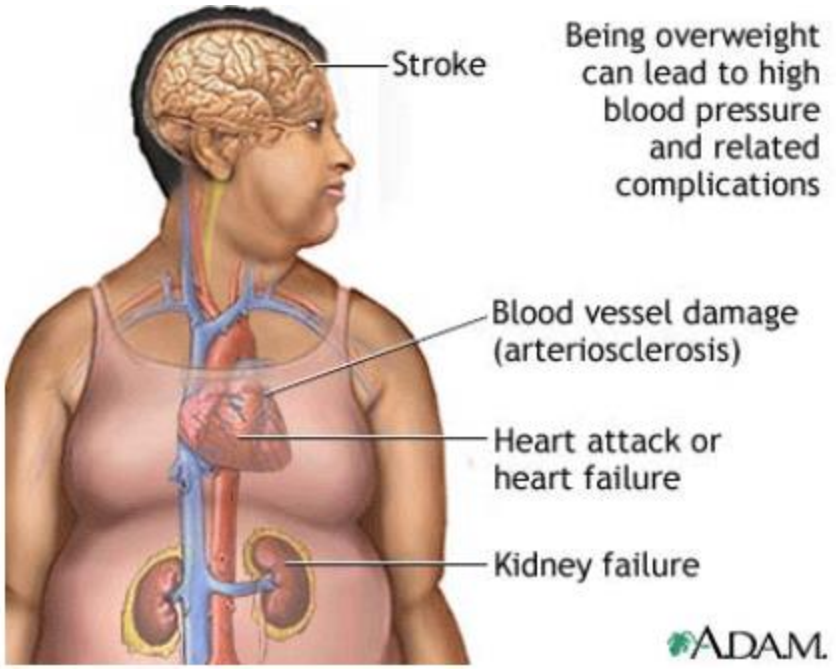
- Common obesity due to multiple allelic variations in hundreds of genes
- Monogenic obesity
  - Leptin deficiency
  - Leptin insensitivity
  - RARE

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

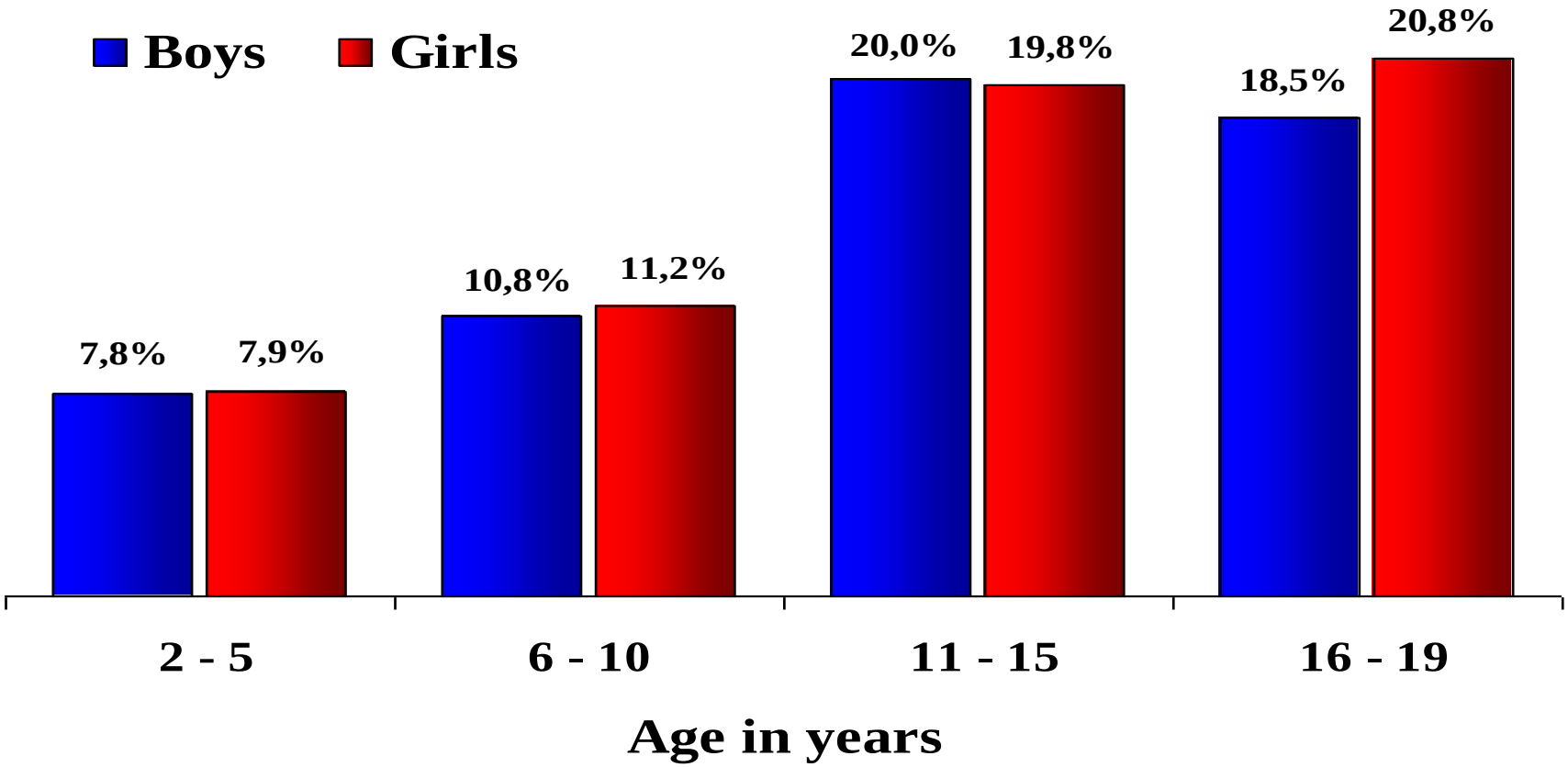
- Measures of obesity correlate + with
  - LDL
  - VLDL
  - Triglycerides
- Correlate - with
  - HDL
- Weight reduction lowers triglycerides and increases HDL

Obesity
Hypertension

- + correlation between BP and BMI
- Weight loss decreases BP

Childhood Obesity Hypertension

Percentage of Overweight Children
With BP in 95th Percentile



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

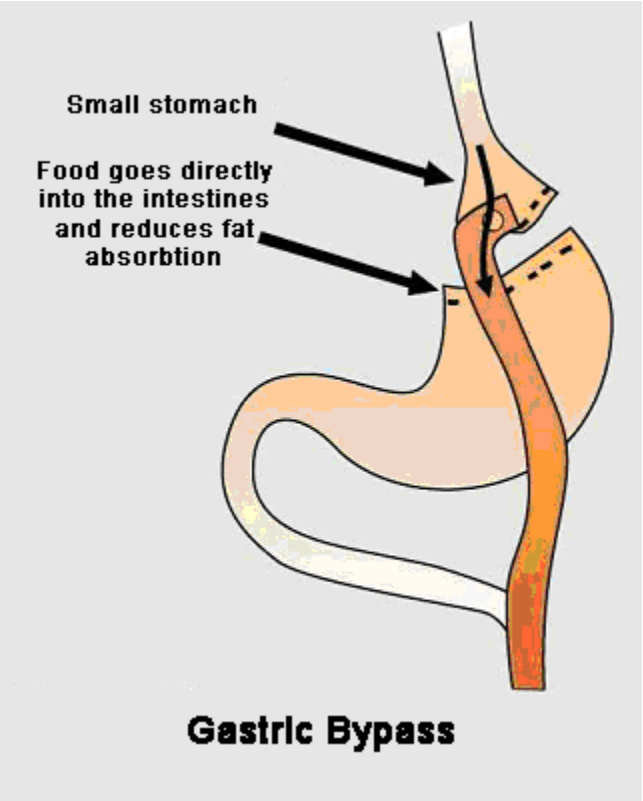
- Anti- obesity pills not approved for peds
- None of drugs tested for :
  - Long term use
  - Pediatric age groups
- Drug options
  - Appetite suppressants
  - Serotonin agonists
  - Inhibitors of fat absorption
  - Antihyperglycemic agents

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, flatulance, 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