

Obesity in Children

JC Opperman

Definition

- The child too heavy for height or length
 - Obvious on inspection
 - 10 to 20% over desirable weight = overweight
 - More than 20% = obese
 - Use percentile charts for the calculation
 - Body mass index (BMI) above 95th percentile or more for age

$$\text{BMI} = \text{weight in kg} / (\text{height in m})^2$$

BMI differs according to age

- Skin fold

$$\frac{35}{23} \times 100 = 152\% \quad (52\% \text{ over desirable weight})$$

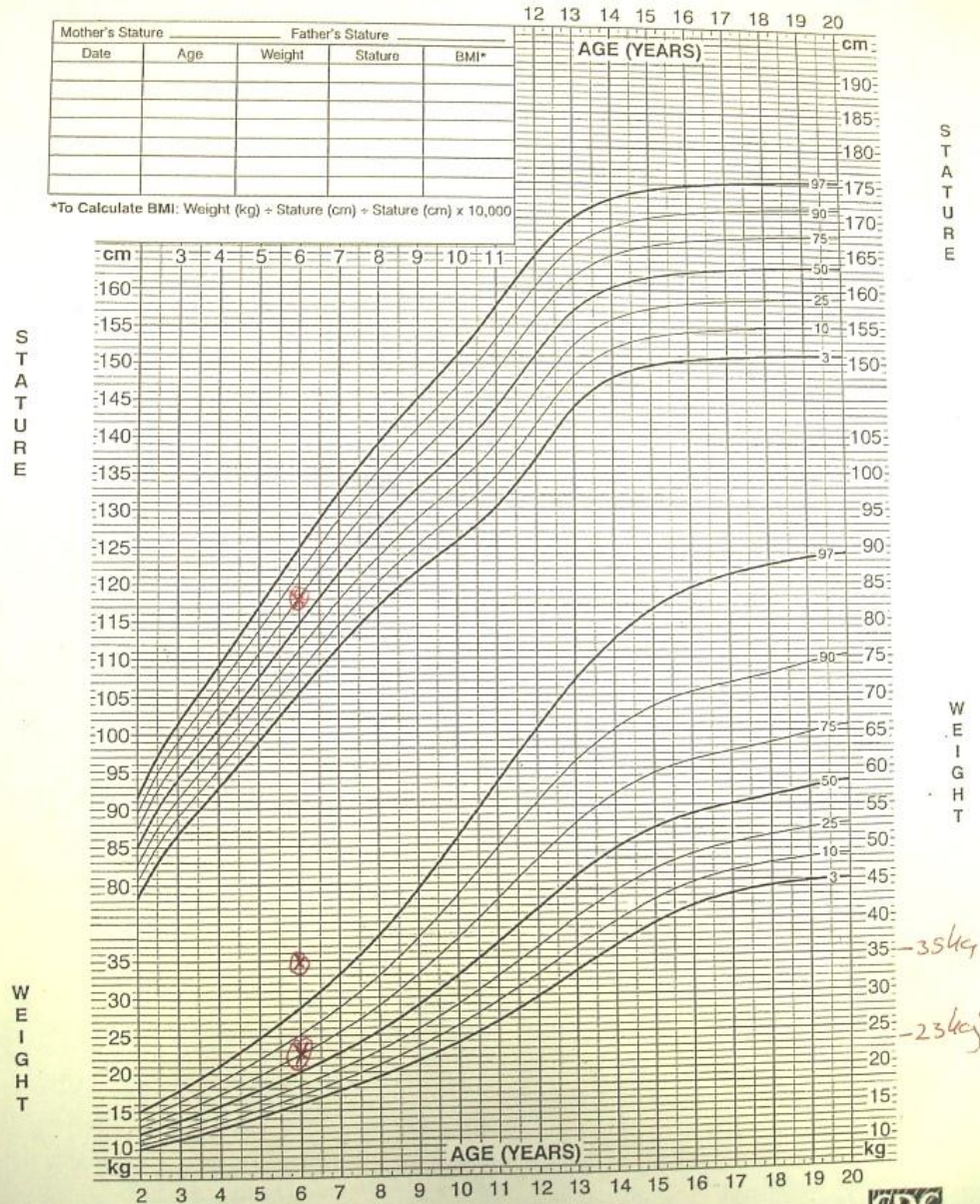
2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

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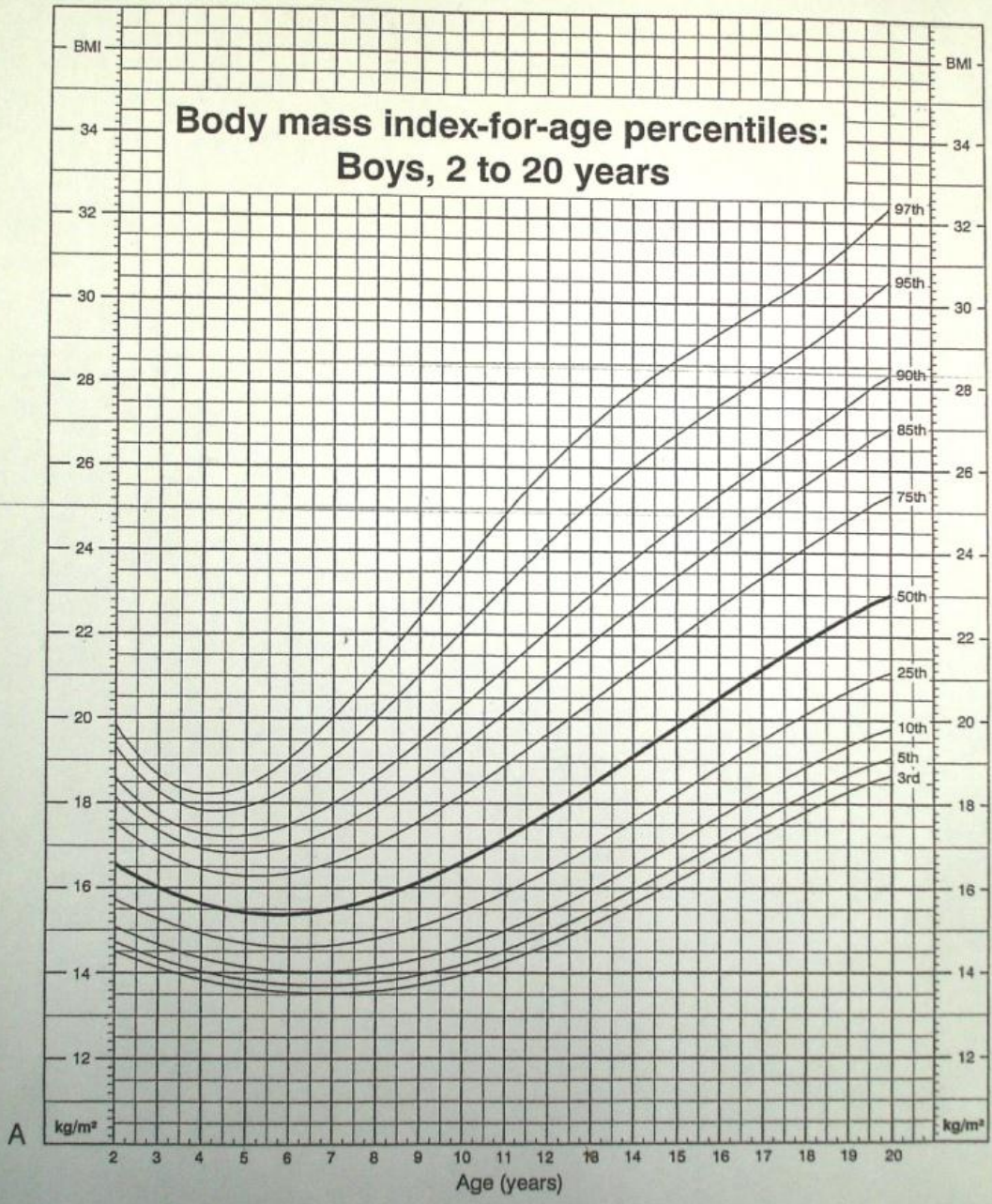
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Mother's Stature		Father's Stature			AGE (YEARS)	cm
Date	Age	Weight	Stature	BMI*		

*To Calculate BMI: Weight (kg) ÷ Stature (cm) ÷ Stature (cm) x 10,000



Body mass index-for-age percentiles: Boys, 2 to 20 years



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Prevalence

- Many developed countries 10 -15% of school going children are obese
- More common in girls
- Epidemic of overweight and obesity started in mid to late 1980s (last 20 y)
- Epidemic is progressive:
 - Obese adults in USA 1995: 15.3%
 - Obese adults in USA 2005: 23.9%

Prevalence 2

- Overweight and obesity increase with age
England 1999 – overweight or obese:
 - 6y: 22%
 - 10y: 23%
 - 13y: 26%
- Increasing central (abdominal) adiposity
- What has changed?

Etiology

Positive energy balance

1. Genetics (40-70% of factors)

1.1 **Syndromic Obesity**
(pleiotrophic obesity syndromes) (± 30)

Def: Discrete genetic defects with complex pathophysiology. Obesity, mental retardation, dysmorphic features, organ specific developmental abnormalities. Link between protein product and disease not identified.

- Prader-Willi syndrome
- Bardet-Biedl syndrome (OD)
- Fragile X (X linked)

Genetics

1.2 Human monogenic obesity syndromes

Abnormalities of single genes which affect factors related to the leptin and melanocortin pathways

Suspect in severe early–onset obesity

- Leptin
- Leptin receptor on neuron in the hypothalamus
- MC4R (melanocortin 4-receptor gene) Most common monogenic obesity (2-3% of childhood and adult obesity)

Genetics

1.3 Polygenic obesity

- Over 244 genes described. 20 genes supported by 5 or more studies
- Large DNA banks of obese people
- These genes suggest a risk factor of a complex trait rather than a single cause

Examples of Genes Frequently Associated with Obesity in human – Wide Spectrum

- Uncoupling protein – energy metabolism
- Lipase hormone sensitivity – decreased adipocyte lipolysis
- Glucocorticoid receptor – differential response to glucocorticoids
- Insulin – functional genetic variant

Early Environment

- Early metabolic/ genetic imprinting
 - Gestational
 - Malnutrition of mother
 - Obesity of mother (appetite-regulating neural network)
 - DM type 1 & 2 of mother
 - Stressors of mother
 - Small for gestational age
 - High birth weight
 - Early infancy
 - Formula feeding (↑ protein)
 - Rapid infant weight gain
 - Diabetes in the lactating mother

Later Environment

- Inactivity
 - TV, computers & TV games
 - Unsafe outside
- High energy intake
 - High energy foods
 - Cheap food
 - Parental eating habits

Endocrine disorders

- Hypothyroidism
- Cushing's disease (↑ cortisol)
- Growth hormone deficiency

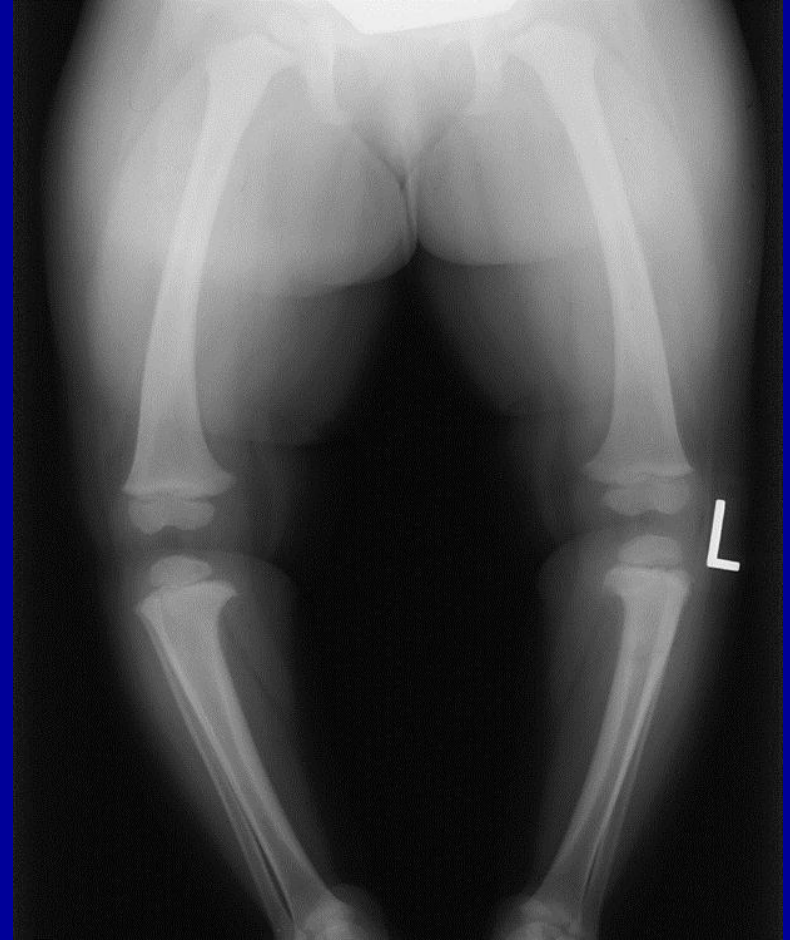
Simple obesity when no underlying pathology identified – largest proportion of patients

Complications

- Lung diseases
 - Repeated pneumonia
 - Obstructive sleep apnoea – vicious cycle (pulmonary hypertension)
 - Higher risk for asthma
- Cardiovascular
 - Hypertension
 - Dislipidemia
 - Left and right ventricular hypertrophy
- Diabetes mellitus type 2

Complications 2

- Psychological
 - Low self-esteem
 - Social isolation
 - Depression
 - Anorexia nervosa
- Skeletal complications
 - Slipped capital femoral epiphyses
 - Flat feet
 - Genu valgum
 - Tibia vara (Blount's disease)
- Nonalcoholic fatty liver disease
- Increased mortality and morbidity



The Hypothalamus in Energy Balance

- Central role in energy balance
- Receive and integrate information (neurotransmitters: melanocortin etc.)
 - Nutrient (circulating nutrients)
 - Hormonal (leptin, tumour necrosis factor α , Ghrelin, cholecystokinin, cortisol)
 - Cortex (taste, memory, stress)
 - Peripheral nerves (gut distension)
- Influences energy expenditure
 - Autonomic system
 - Pituitary hormones via releasing hormones (metabolism)
 - Cortex (meal size, food choice)

Clinical approach

- Make a diagnosis
 - Percentile charts - Height below 50th percentile in obese children are suspicious of specific syndromes and endocrine abnormalities.
 - Mental retardation increase the possibility of specific syndromes
 - Look for dysmorphic features
 - Exclude hormonal deficiencies if appropriate
 - Simple obesity if long, obese and normal intelligence
- Look for complications

2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

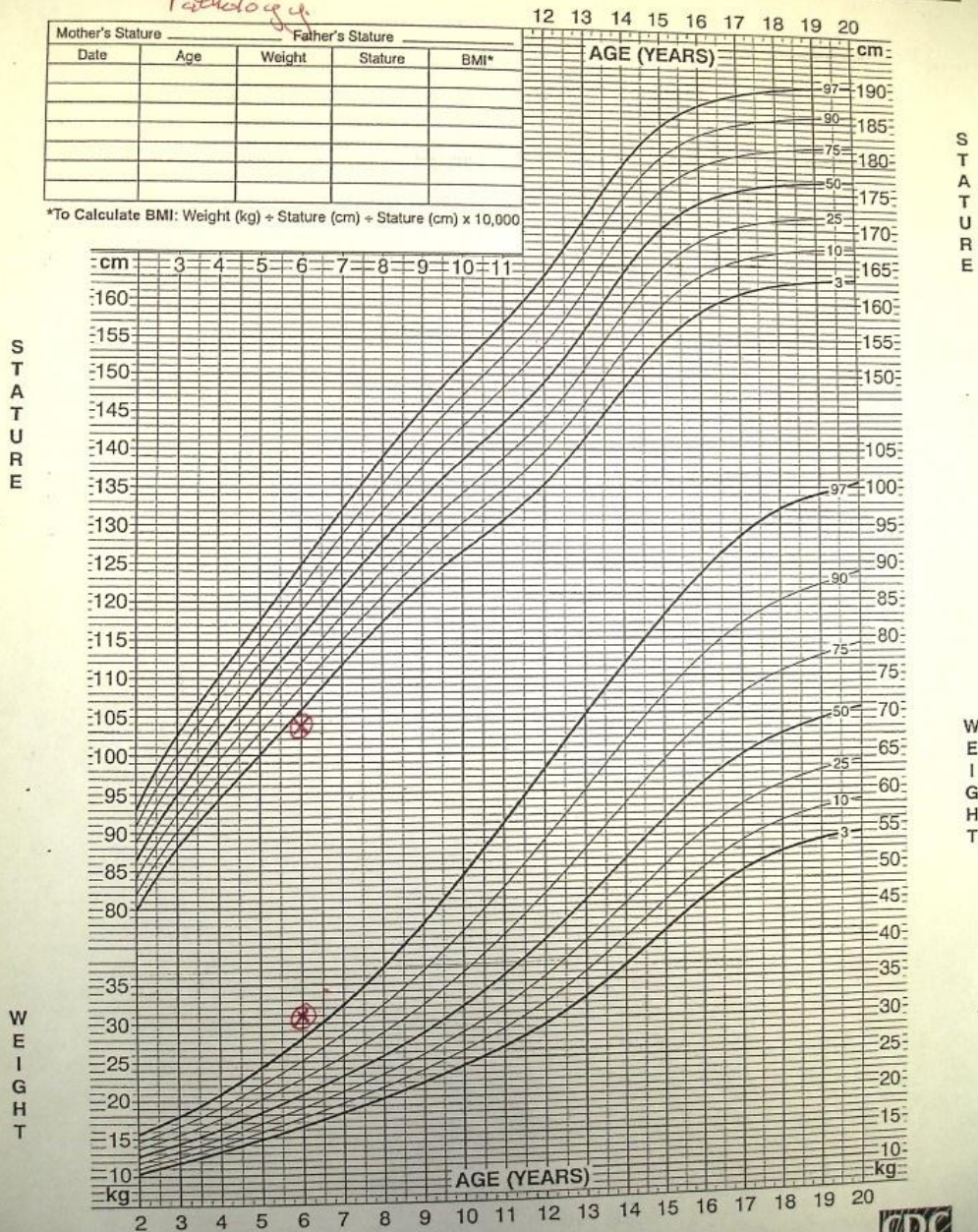
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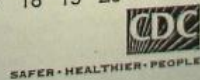
Pathology

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SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).



Treatment

- Diet
 - Main therapy
 - Keep weight static instead of weight loss
- Increase activity, less TV
- Drug management
 - Consensus not for children
 - Exceptions: Sibutramine (non-selective neuronal reuptake inhibitor) – **not** approved for adolescents
 - Orlistat (lipase inhibitor) – approved in USA and Europe

Treatment

- Surgical
 - Gastric banding – safest
 - Gastric bypass – high mortality (restrictive + malabsorption)

Surgery contra-indicated in children because of morbidity and mortality

- Motivational interviewing, cognitive behavioral therapy
- Emotional support for patient, family and health care workers (keep contact)

Conclusion

- Childhood obesity is common
- It is not a benign disease because of short and long term complications
- Difficult to manage

