# OBESITY IN CHILDHOOD

## Background

1. Definition:
    - Weight status based on age- and sex-specific %ile for BMI rather than by BMI categories used for adults.
    - For children and adolescents (aged 2–19 years), BMI value is plotted on Centers for Disease Control and Prevention (CDC) growth charts to determine the corresponding %ile
    - Overweight: BMI at or above the 85th %ile and lower than the 95th %ile.
    - Obesity: BMI at or above the 95th %ile

## Pathophysiology

1. Pathology of Disease
    - Childhood obesity is the result of an imbalance in calories consumed and calories burned
    - Genetic factors may play a role in specific cases of obesity (ie. Prader Willi syndrome).
2. Incidence and prevalence
    - 16% of children 6-19 years old are overweight or obese
    - Another 15% of children are at risk of becoming overweight[1]
    - Over the past three decades the childhood obesity rate has more than doubled for preschool children aged 2-5 years and adolescents aged 12-19 years
    - Obesity has more than tripled for children aged 6-11 years in the last 30 years[1]. Mexican-American children ages 6-11 are more likely to be overweight (22%) than non-Hispanic black children (20%) and non-Hispanic white children (14%).
    - Non-Hispanic black (21 %) and Mexican-American adolescents (23 %) ages 12-19 are more likely to be overweight than non-Hispanic white adolescents (14 %).
    - Among boys, the highest prevalence of obesity is observed in Hispanics
    - Among girls, the highest prevalence is observed in African Americans[2]
3. Risk Factors
    - Risk factors for overweight include low or high birth weight, low income, minority, television or computer screen time >2 hours per day, decreased physical activity, poor eating habits (ie. unhealthy snacks, fatty meals), depression, and pattern of weight change (ie. rapid weight gain within small interval of time)[3]
    - Nearly one-third of U.S. children ages 4 to 19 eat fast food every day, resulting in approximately six extra pounds per year, per child[4]
    - Fast food consumption has increased five-fold among children since 1970[4]

- Overweight adolescents have a 70 % chance of becoming overweight or obese adults. This increases to 80 % if one or more parent is overweight or obese. Adolescents with no insurance or public insurance are more likely than those covered by private insurance to be overweight[5]
- Among white teen girls, the prevalence of overweight decreases with increasing socioeconomic status[6]
- Among black teen girls, the prevalence of overweight increases with increasing socioeconomic status[6]

4. Morbidity/Mortality[2,7]
    - Neonatal history: Risk factors for overweight (i.e., low or high birth weight, low income, minority, maternal depression) including pattern of weight change
    - Psychological: Poor self-esteem, body image disorder, social isolation and stigmatization, depression
    - Neurological: Pseudotumor cerebri, idiopathic intracranial hypertension
    - Pulmonary: Exercise intolerance, obstructive sleep apnea, asthma
    - Cardiovascular: coagulopathy, chronic inflammation, endothelial dysfunction
        - In a population-based sample, approximately 60 % of obese children 5 to 10 years old had at least one cardiovascular disease risk factor, 25 % had two or more risk factors:
            - Elevated total cholesterol, triglycerides, insulin resistance or elevated blood pressure
    - Gastrointestinal: Gallstones, gastroesophageal reflux, non-alcoholic fatty liver disorder
    - Renal: glomerulosclerosis
    - Musculoskeletal: Ankle sprains, flat feet, tibia vera, slipped capital femoral epiphysis, forearm fracture
    - Endocrine: Insulin resistance, impaired fasting glucose or glucose intolerance, Type 2 Diabetes Mellius, precocious puberty, menstrual irregularities, polycystic ovary syndrome (females)
    - For obese children born in the US in 2000, lifetime risk of Type 2 diabetes is estimated to be 30 % for boys and 40 % for girls

**Diagnostics**[8]

1. History
    - onset of overweight, obese child and family's eating patterns, exercise habits
    - Distinguish overfeeding from genetic causes
    - Family history- comorbidities

2. Physical Examination
    - General appearance-dysmorphic features/distribution of fat
    - Vitals: Elevated blood pressure for >/= 3 occasions separated by one week for height, age and sex
    - Anthropometric measures: High BMI percentile, short stature
    - Head, eyes, throat-provide clues to the etiology or comorbidities (pseudotumor cerebri, obstructive sleep apnea)
    - Eyes: Papilledema, cranial nerve VI palsy
    - Neck: Goiter
    - Throat: Tonsillar hypertrophy
    - Chest: Wheezing
    - Skin: Acanthosis nigricans, excessive acne, hirsutism, violaceous striae, irritation, inflammation
    - Abdomen-hepatomegaly (Non-Alcoholic Fatty Liver) gallbladder disease
    - Musculoskeletal-nonpitting edema(hypothyroidism), small hands and feet (Prader Willi syndrome), Slipped Capital Femoral Epiphysis (limited Range of Motion/gait abnormal) or Blount disease(bowing of legs)
    - GU -genetic or endocrine delayed puberty (PWS, Cushing), undescended testicles, small penis, scrotal hypoplasia (PWS)
    - Development-syndromes
3. Diagnostic Criteria [B]
    - BMI value is plotted on the CDC growth charts to determine the corresponding BMI-for-age %ile
    - Weight (kg)/ Stature (cm)/Stature (cm) x10,000 or
    - Weight (lb)/Stature (in)/Stature (in)x 703

**Differential Diagnosis**

1. Endocrine
    - Insulin Resistance
    - Cushing's disease
    - Hypothyroidism
2. Syndromes
    - Prader Willi Syndrome
    - Polycystic Ovarian Syndrome
    - Turner's syndrome
3. Psychiatric
    - Eating disorder
    - Depression

**Therapeutics**

1. Acute Treatment
    - Primary care providers should universally assess children for obesity risk to improve early identification of elevated BMI, medical risks, and unhealthy eating and physical activity habits (SOR:C)[8]
    - Identification of medical risks (history and physical, child growth, parental obesity, and family history), behavior risks (sedentary time, eating, and physical activity), and attitudes (family and patient concern and motivation) (SOR:C)[8]
    - Labs include biannual aspartate transaminase (AST), alanine transaminase (ALT) fasting lipid panel if 10 years old or other risk factors present, blood urea nitrogen (BUN), and creatinine, and fasting glucose to evaluate other co-morbidities (SOR:C)[8]
2. Further Management[9,10]
    - In infancy: breastfeeding and delaying introduction of solid foods may help prevent obesity.
    - In early childhood: children should be given healthy, low-fat snacks and take part in vigorous physical activity daily.
    - Television viewing should be limited to no more than two hours/day including video games and Internet.
    - Children should eat with family at the dinner table every night.
    - Encourage children to participate in sports, chores, random and organized activities
    - Emphasize age appropriate physical activity (ie. household chores, yardwork, outdoor play) (SOR:C)[8]
    - Consider barriers (unsafe neighborhoods, no school-based physical education, no social support) (SOR:C)[8]
3. Long-Term Care
    - BMI should be calculated and plotted at least annually, and the classification should be integrated with other information such as growth pattern, familial obesity, and medical risks (ie. Diabetes Mellitis) to assess the child's obesity risk[8]
    - Parental lifestyle change:
        - Parental eating habits and physical activity patterns are significant predictors of children increasing fruit and vegetable intake.
        - Parents should use non-coercive feeding tactics to feed their children, decrease watching TV at dinnertime, decrease away-from-home food[7] [B].
    - Community/School intervention: walking schoolbus, organized physical activity, education classes to teach healthier food preparation to parents and children, early home visits by nursing staff to support new parents in

healthier lifestyles for their newborn (breastfeeding, waiting to introduce solid foods, and decrease unhealthy snacks) (SOR:C)[7]

**Follow-Up**

1. Return to Office
    - Time frame for return visit-approximately every 2-4 weeks to measure weight change maintenance, BMI reduction, and motivate compliance.
    - Recommendations for earlier follow-up for children with comorbidities (SOR:C)[11]
2. Refer to Specialist
    - Assess for risk factors (ie. extreme obesity, exam suggestive of genetic syndromes, eating fatty meals and little physical activity)
    - Consider referral to multidisciplinary pediatric obesity treatment center, pediatric endocrinologist or registered dietitian[13]

**Prognosis**

1. The mortality rate from endogenous causes in the highest quartile of childhood BMI was more than double that in the lowest quartile[13]
2. Obesity in children who do not have Diabetes Mellitus is associated with increased rate of death from endogenous causes during early adulthood (< age 55)[13]

**Prevention**

1. For prevention, the recommendation by American Academy of Pediatrics includes a four stage approach if the child has evidence of health risk; 1) Prevention in the primary care office, which may consist of brief counseling, 2) Structured weight management in the primary care office with support possibly from nutritionist, 3) Comprehensive multidisciplinary intervention involving community resources, healthcare and patient self management, 4) Tertiary care intervention at tertiary care center, for example obesity clinic (SOR:C)[8]
2. Target behaviors: limit consumption of sugar sweetened beverages, encouraged fruit and vegetables (9servings per day with the serving size depending upon the age), limit television (none before age 2 and no more than 2hrs per day for children more than 2 years old), no television in sleeping area,breakfast daily, limit fast food, family meals together, limit portion sizes, moderate or vigorous physical activity up to 60 minutes daily (SOR:C)[8]
3. Measure BMI and compare with %ile charts for BMI-for-age.
4. Encourage healthy eating and regular physical activity.
5. Assess for risk factors (obesity, abnormal physical exam, adverse eating and exercise behavior, family history and obesity-related diseases)

**Patient Education**

1. http://www.aafp.org/online/en/home/clinical/publichealth/aim/about.html
2. http://www.letsmove.gov/

3. www.nhlbi.nih.gov/health/public/heart/obesity/wecan/index.htm
4. http://www.aap.org/obesity/index.html

**References**


1. Hedley A, et al. Prevalence of Overweight and Obesity Among Children and Adolescents: United States, 1999-2002. JAMA. 2004; 291:2847-2850.
2. "Preventing Childhood Obesity: Health in the Balance, 2005," Institute of Medicine.
3. Pickering et al., 2005 [5]; National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, 2004.
4. "Effects of Fast-Food Consumption on Energy Intake and Diet Quality Among Children in a National Household Survey," Pediatrics, January 2004.
5. Treatment of Childhood Overweight and Obesity. http://www.guidelines.gov. Accessed website June 17, 2011
6. P. Gordon-Larsen et al. The relationship of ethnicity, socioeconomic factors, and overweight in U.S. adolescents. *Obesity Research*, 11, 121-129. 2003
7. Batch, Jennifer and Baur, Louise. Management and prevention of obesity and its complications in children and adolescent. *The Medical Journal of Australia*. MJA 2005; 182 (3):130-135
8. Barlow, Sarah E and the expert committee. Expert Committee Recommendations Regarding the Prevention, Assessment, and Treatment of Child and Adolescent Overweight and Obesity: Summary Report. *Pediatrics* 2007;120;S164
9. American Academy of Pediatrics. Breastfeeding and the use of human milk. American Academy of Pediatrics. Work Group on Breastfeeding. *Pediatrics* 1997 Dec; 100(6):1035-9
10. American Academy of Pediatrics: Children, adolescents, and television. *Pediatrics* 2001 Feb;107(2):423-6
11. Ayala Guadalupe X PhD MPH, Elder John P. PhD, MPH, Campbell Nadia R. MPH, et al. Longitudinal intervention effects on parenting of the Aventuras para Ninos Study. *Am J Prev Med* February 2010;38(2):154-162
12. National Guidelines. Michigan Quality Improvement Consortium. Treatment of childhood overweight and obesity. Southfield (MI): Michigan Quality Improvement Consortium; 2010 Jun. 1 p.
13. Franks, Paul W Ph.D. et al. Childhood obesity, other cardiovascular risk factors, and premature death. *The New England Journal of Medicine*. Feb 11,2010;362 (6):485-493



**Author: Aminah Jones, MD, MPH, & Michelle A. Roett, MD, MPH, FAAFP,** *Georgetown University-Providence Hospital, Washington DC*

**Editor: Christina Gillespie, MD, MPH, FAAFP,** *Georgetown University-Providence Hospital, Washington DC*