Medical and Nutritional Assessment and Management of Pediatric Overweight

Marc S Jacobson MD FAAP
Professor of Pediatrics and Epidemiology (Nutrition),
Director, Pediatric Metabolic Medicine
ProHealthCare Associates
2 ProHEALTH PLZ
Lake Success, NY 11042

Medical and Nutritional Assessment and Management of Pediatric Overweight

Nancy Copperman, MS, RD, CDN
ncopper@northwell.edu
Assistant Vice President, Public Health and Community Partnerships
Northwell Health Solutions
Northwell Health

Selected Major Medical Complications of Obesity in Childhood
- Cholesterol and other lipids
- Hypertension
- Diabetes
- Sleep Apnea
- Non-Alcoholic Fatty Liver (NAFLD and NASH)
- Pseudotumor Cerebri
- Blount Disease
- Slipped Capital Femoral Epiphysis

Cardiovascular Complications of Obesity
- Hyperlipidemia
- Hypertension

Health related quality of life in pediatric chronic disease

Simplified Lipid Metabolism

Relation of Obesity (BMI > 95th %tile) to Adverse Risk Factors in 5-10 yo Children

<table>
<thead>
<tr>
<th>Factor</th>
<th>Prevalence</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol &gt;200 mg/dl</td>
<td>21.0%</td>
<td>2.1</td>
</tr>
<tr>
<td>Triglycerides &gt;130 mg/dl</td>
<td>17.3%</td>
<td>7.3</td>
</tr>
<tr>
<td>LDL-C &gt;130 mg/dl</td>
<td>19.3%</td>
<td>2.1</td>
</tr>
<tr>
<td>HDL-C &lt; 35 mg/dl</td>
<td>14.3%</td>
<td>4.7</td>
</tr>
<tr>
<td>Elevated insulin</td>
<td>21.3%</td>
<td>15.6</td>
</tr>
<tr>
<td>Elevated SBP</td>
<td>18.7%</td>
<td>11.0</td>
</tr>
<tr>
<td>Elevated DBP</td>
<td>12.3%</td>
<td>4.6</td>
</tr>
</tbody>
</table>

*Freedman et al, Pediatrics 1999

Criteria for Pharmacotherapy of Hyperlipidemias

1. Age > 8
2. LDL cholesterol > 190 mg/dl Or LDL cholesterol > 160 mg/dl, w/complications
3. Strong family history of severe premature atherosclerosis
4. Failure to respond to supervised dietary management in a reasonable time period OR Xanthomas

Hypertension

Unlike adults, where the definition and severity of hypertension is based on a single set of criteria, diagnosis of hypertension in children is based on percentiles (90th, 95th, 99th) adjusted for age, gender, and height.

Appropriate cuff size is critical. It should have a bladder width that is approximately 40% of the arm circumference midway between the olecranon and the acromion processes of the humerus.

Assessing Blood Pressure:

1. Gender, 2. Systolic/Diastolic, 3. Age, 4. Ht%ile, 5. BP as mmHg

Blood Pressure Measurements and Evaluation: Definitions

- Normal- systolic and diastolic <90th %ile

- Prehypertension = systolic BP or diastolic BP between the 90th and 95th %ile

- Hypertension:
  - Stage 1 - >95 - 99th %ile plus 5mm Hg
  - Stage 2 - >99th %ile plus 5mm Hg

(* or if BP >120/80 even if <90th up to 95th %)

Childhood Obesity:  
Associated Endocrine Disorders and Syndromes

- Hypothyroidism
- Cushing Syndrome (pituitary/adrenal axis)
- Prader-Willi Syndrome and other Dysmorphic Syndromes
- Short Stature Usually But Not Always Seen With Above
- Gynecomastia
- Type 2 Diabetes

Insulin Resistance Syndromes

A spectrum of increasing severity:

- 1. Obesity
- 2. Insulin resistance:
  - Metabolic Syndrome
  - Ovarian Hyper-androgenism or Polycystic Ovarian Syndrome (PCOS)
- 3. Prediabetes
- 4. Type 2 Diabetes Mellitus

Metabolic Syndrome

≥ 3 of the following:

1. Waist circumferencex ≥ 102 cm (40") in men and 88 cm (35") in women
2. Triglyceride concentration ≥ 150 mg/dL (1.69 mmol/L)
3. HDL-C ≤ 40 mg/dL (1.04 mmol/L) in men and ≤ 50 mg/dL (1.29 mmol/L) in women
4. Blood pressure ≥ 130/85 mm Hg
5. Blood glucose ≥ 100 mg/dL (6.1 mmol/L)

Peripheral Obesity, lower risk

Central Obesity, Higher risk

http://www.cdc.gov/nchs/data/nhanes/nhanes_03_04/bm.pdf

Section 3.3.1.7 pg 29-30.
Criteria For The Diagnosis Of Diabetes, Impaired Glucose Tolerance And Impaired Fasting Glucose.

Diabetes Care 2003;26(11):3161

<table>
<thead>
<tr>
<th>Diabetes</th>
<th>Pre-Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impaired Fasting Glucose (IFG)</td>
<td>Impaired Glucose Tolerance (IGT)</td>
</tr>
<tr>
<td>Fasting Glucose Or High HbA1C</td>
<td>100 - 125 mg/dl</td>
</tr>
<tr>
<td>≥126 mg/dl</td>
<td>140 - 199 mg/dl</td>
</tr>
<tr>
<td>&gt;6.5%**</td>
<td></td>
</tr>
<tr>
<td>2-Hour Glucose during OGGT Random</td>
<td>≥ 200 mg/dl</td>
</tr>
<tr>
<td>≥ 200 mg/dl plus Symptoms*</td>
<td></td>
</tr>
</tbody>
</table>

*Symptoms of diabetes include polyuria, polydipsia, unexplained weight loss. **OGTT using a glucose load containing 1.75 g/kg of glucose, up to a maximum of 75 g. **Styne D et al J Clin Endocrinol Metab, March 2017, 102(3):1–49.

Non alcoholic fatty liver disease (NAFL and NAFLD)

- Usually asymptomatic, found on routine blood tests of liver enzymes.
- Ultrasound evidence shows a greater prevalence than serum enzymes: 40-50% vs 23% among the obese.
- ALT, AST may be double normal values.
- Weight loss seems to be the only effective treatment.
- May lead to NASH which can lead to chronic liver disease (including cirrhosis and liver failure requiring transplant).
- Treatment: lifestyle modification is the cornerstone.
- Metformin is not effective and Vitamin E needs more study.

Pulmonary Complications of Obesity

- Asthma
- Sleep Apnea

Asthma and Obesity

- Why is this important?
  - Two most common childhood chronic diseases
  - Both occur more in underserved populations
  - Both have inflammatory components: adipokines
  - Synergy: Each has the potential to make the other more severe
    - Mechanical factors in obesity reduce lung volumes
    - Presence of asthma affects physical capacity and frequency of activity


Obstructive Sleep Apnea

- OSA has a significant prevalence among obese children. Witnessed apneas (cessation of airflow) and loud snoring
  - Caused by anatomic and physiologic derangements that result in upper airway obstruction and poor gas exchange
  - Symptoms:
    - Apnea, characterized by snoring with periods of silence followed by a gasp or coughing fits.
    - Daytime somnolence or agitation
    - Oral breathing
    - Enuresis
    - Learning disabilities
  - The diagnosis of OSA should be confirmed by polysomnography (sleep study with AHI score of 5 or more /hr). AHI is the sum of apnea and hypopnea episodes/hr.

Obstructive Sleep Apnea

- Complications:
  - Severe OSA can lead to hypoventilation, carbon dioxide retention, hypoxia, polycythemia, right ventricular hypertrophy and failure, and possibly pulmonary embolism.
  - These episodes produce brief arousals that may number in the hundreds per night
  - Cor pulmonale
  - Pulmonary hypertension.
  - Vicious cycle: OSA causes somnolence and fatigue that further impairs physical activity and predisposes to worsening obesity.
  - Conversely, in adults a 10% wt loss has been shown to decrease OSA by 26%.


Pseudotumor Cerebri

Benign Intracranial Hypertension

- Symptoms include:
  - Headache, Dizziness, Diplopia, Mild unsteadiness
  - Gradual onset
  - Focal neurological signs are absent
  - Diagnosis is made with physical exam confirmed by MRI, LP.
  - Weight loss may be best treatment.
  - Benign outcome

Bowing of the legs

- Tibia varum
- Blount Disease: Abnormality in the growth of the medial portion of the proximal tibia due to increased mechanical load on growing bones.
  - Presents with out bowed lower leg and leg pain usually in an adolescent
  - X-rays show irregularity of the growth of the proximal medial tibial physis with beaking of the metaphysis
The epiphysis of the proximal femur slips off the metaphysis posteriorly and medially.

Classic patient is an overweight, hypogonadal 11-15 y.o. boy with delayed bone age.

Symptoms include, limp, hip and or knee pain, typical gate.

Incidence has risen 3 fold since 1981, while age at presentation has decreased.

Slipped Capital Femoral Epiphysis (SCFE)

Medication Assessment

- Review of past medications
- List of current medications
- Impact of medication on weight gain or loss
- Impact of medication on appetite
- Impact of medication on metabolic parameters

Antipsychotic Drugs and Metabolic Abnormalities

<table>
<thead>
<tr>
<th>Drug</th>
<th>Wt Gain</th>
<th>&gt; Diab Risk</th>
<th>Lipid Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clozapine (Clozaril)</td>
<td>+++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Olanzapine (Zyprexa)</td>
<td>+++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Risperidone (Risperdal)</td>
<td>++</td>
<td>DR</td>
<td>DR</td>
</tr>
<tr>
<td>Quetiapine (Seroquel)</td>
<td>++</td>
<td>DR</td>
<td>DR</td>
</tr>
<tr>
<td>Aripiprazole (Abilify)</td>
<td>+/-</td>
<td>NE</td>
<td>NE</td>
</tr>
<tr>
<td>Ziprasidone (Geodon)</td>
<td>+/-</td>
<td>NE</td>
<td>NE</td>
</tr>
</tbody>
</table>

Source: Diabetes Care 2004;27:597

+ increase - no effect  dr discrepant results  ne limited data
Expert Committee

Laboratory Assessment

BMI >85th – 94th – no risk factors
Fasting Lipid profile
BMI >85th – 94th – with risk factors in hx or physical examination
Fasting Lipid profile, AST and ALT, fasting glucose
BMI >95th with or without risk factors
Fasting lipid profile, AST and ALT, fasting glucose, additional lab assessments based on sub-specialist findings might include these:
- Insulin, OGTT, HgbA1C
- BUN, creatinine
- Cortisol
- Free Testosterone
- CBC
- Thyroid function studies

Case Study – HPI, Family History, Physical Exam and Labs

Pharmacotherapy

- Orlistat (Xenical): FDA approved age 12+ @ 120mg TID, and over the counter as Alli 60mg TID
- Metformin (Glucophage, and others)
  FDA Controlled substance with potential for abuse.
  - Phentermine (Adipex, Ionamin), Diethylpropion (Tenuate), Phendimetrazine (Bontril)
  - Newer Agents FDA Approved for Adults 18+ only:
    - Loracaserin (Belviq)
    - Phentermine/Topiramate (Qsymia)
    - Bupropion/Naltrexone (Contrave)

Questions about medical complications?

Physical Assessment
Physical assessment
- General physical appearance (gynecomastia)
- Tanner Stage
- Anthropometrics

Tanner Sexual Maturation Staging
- Stage 1 (prepubertal) to stage 5 (Adult)
- Males are staged by growth and development of their genitals 1-5
- Females are staged by breast development
- Both Males and Females are staged by the degrees of growth of pubic hair, 1-5
  - Males G1-PH2, Females B3-PH4

Tanner Stages
- Stage 2-3: Peak height velocity occurs in girls
- Stage 4: Menarche often occurs (US 12.5 yrs)
- Stage 3-4: Peak height velocity occurs in boys
- Stage 3: Faint but noticeable mustache for boys

Anthropometrics
- Weight
- Height
- Skinfold measurements**
- Waist/Hip Circumferences**
- Bioimpedence
  - ** Not recommended for clinical practice assessment in overweight and obese pediatric population-Expert Committee

Weight Measurement Considerations
- Gowned vs clothes
- Weight in relation to menstrual cycle
- Weight in relation to BMI
- A time to chat

http://www.cdc.gov/nchs/data/nhanes/nhanes_03_04/bm.pdf Section 3.3.1.2 pg 20-23
Height Measurement Considerations

- Wall mounted stadiometer
- 3 point position
- Bar position parallel to floor
- Height in relation to BMI

---

Case Study - Anthropometrics

Expert Committee Weight Targets

Expert Committee Weight Targets

Expert Committee Weight Targets

* 85%-94% - until BMI<85th% or slowing of weight gain as indicated by a downward deflection in BMI curve
# 95%-98% - until BMI<85th% or gradual weight loss of lb/mo

* 85%-94% - until BMI<85th% or slowing of weight gain as indicated by a downward deflection in BMI curve
# 95%-98% - until BMI<85th% with no more than an average of lb/week
USING BMI TO ESTIMATE GOAL WEIGHT

Nutrition Assessment

Psychosocial Assessment
• readiness to change
• low self esteem, depression
• family discord, poor peer socialization
• eating disorders

Physical Activity Assessment
• sedentary activities
• activity preferences
• barriers to increasing physical activity

Environmental Assessment Community
• food purchasing options
• community feeding programs
• federal food programs
### Environmental Assessment

**Home**
- Family composition
- Single or dual family incomes
- Family schedules
- Child care arrangements
- Food availability

**School**
- Involvement in school feeding programs
- A la carte snack programs
- Dietary restrictions

### Case Study - Nutritional Assessment

#### Methods of Nutritional Assessment

- Global assessment
- 3 day food record
- Nutrition questionnaires
- Interviews

#### Energy Recommendations

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age(s)</th>
<th>Sedentary</th>
<th>Mod Active</th>
<th>Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>2-3</td>
<td>1000-1500</td>
<td>1200-1600</td>
<td>1400-1800</td>
</tr>
<tr>
<td>Female</td>
<td>4-8</td>
<td>1200-1400</td>
<td>1400-1600</td>
<td>1600-1800</td>
</tr>
<tr>
<td>Female</td>
<td>9-13</td>
<td>1200-1400</td>
<td>1400-1600</td>
<td>1600-1800</td>
</tr>
<tr>
<td>Male</td>
<td>4-8</td>
<td>1200-1400</td>
<td>1400-1600</td>
<td>1600-1800</td>
</tr>
<tr>
<td>Male</td>
<td>9-13</td>
<td>1200-1400</td>
<td>1400-1600</td>
<td>1600-1800</td>
</tr>
<tr>
<td>Male</td>
<td>14-18</td>
<td>1200-1400</td>
<td>1400-1600</td>
<td>1600-1800</td>
</tr>
</tbody>
</table>

Source: 2015 US Dietary Guidelines
**Previous and Currently Recommended Energy Intakes**

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Previous Avg Energy Intakes</th>
<th>2015 Estimated Energy Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-6 yrs</td>
<td>1600</td>
<td>4-9yr mod-active &amp; active MF</td>
</tr>
<tr>
<td>Older children &amp; teenage girls</td>
<td>2200</td>
<td>9-13yr mod-active &amp; active males</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9-13yr active females</td>
</tr>
<tr>
<td>Teenage Boys</td>
<td>2800</td>
<td>14-18yr mod-active &amp; active males</td>
</tr>
</tbody>
</table>

**Deviations from Predicted Energy Requirements**

- Chronic dieters/restrictive meal patterns
- 14yr male BMI 33.5 7 yrs hx of dieting
  Predicted REE: 3273 kcal
  Measured REE: 2125 kcal - 65%
  Intake: 1675 kcal (M-F) 2600 kcal (S-S)
  Exercise: 4-1hr. aerobic trainings/week
  RX: 2000 kcal and 2 training sessions

**EAL Pediatric Weight Management Guidelines**

A nutrition prescription should be formulated as part of the dietary intervention in a multicomponent pediatric weight management program. The exact specification of nutrients and energy is often translated into a specific eating plan. Nutrition interventions are selected based on the nutrition prescription.

Research shows that when individualized nutrition prescription is included, improvements in weight status in children and adolescents are consistent. When an individualized nutrition prescription is not included, results are less consistent.

**2015 EAL PWM Guidelines**

New Methodology

- Because of the extreme heterogeneity between multicomponent pediatric weight management intervention studies, classic meta-analysis was not possible.
- Studies were separated into arms and arms were categorized into types based on 30 different intervention characteristics using multiple correspondence analysis.
- Weighted means for each time point were estimated for separate arm types and compared. Qualitative Comparative Analysis procedures were used to evaluate context dependence.

**Assessment of Fast Food Meal Frequency in Children and Teens**

- The registered dietitian nutritionist (RDN) should assess the frequency of fast-food intake of overweight or obese children and teens. Limited evidence in populations eight years to 16 years of age at baseline suggests that higher frequency of fast-food consumption, particularly more than twice a week is associated with increased adiposity; BMI-Z-score; or risk of obesity during childhood, adolescence and during the transition from adolescence into adulthood.
- Rating: Weak
Fast Food Meal Frequency in Children and Teens

If the overweight or obese child or teen consumes fast-food meals, the RDN should encourage reduction in the frequency of fast-food intake to less than twice a week. Limited evidence in populations eight to 16 years of age at baseline, suggests that higher frequency of fast-food consumption, particularly more than twice a week is associated with increased adiposity; BMI Z-score; or risk of obesity during childhood, adolescence and during the transition from adolescence into adulthood.

Rating: Weak

RDN in Multi-component Pediatric Weight Management Intervention

The RDN should be an integral part of multi-component pediatric weight management interventions. A strong body of research indicates that short-term (6mos) and long-term (2 yr) decreases in BMI and BMI Z-scores for all age categories were more likely to be achieved when an RDN or psychologist/mental health provider were involved in multi-component weight management interventions that included diet and nutrition [including medical nutrition therapy (MNT), physical activity and behavioral components.]

Rating: Strong

Family Participation in Multicomponent Pediatric Weight Management Interventions

The RDN should encourage family participation as an integral part of a multi-component pediatric weight management intervention for children of all ages, including teens. A strong body of research indicates that family involvement as part of a multi-component pediatric weight management intervention is highly consistent with positive weight status outcomes at both six months and 12 months.

Rating: Strong

Length of Treatment in Multi-component Pediatric Weight Management Interventions

The RDN should ensure the multi-component pediatric weight management intervention is at least 6 mos in duration. Research indicates that shorter term (< 6 mos) interventions were not consistently associated with positive weight status at 12 months. At least 6 mos of treatment was associated with longer-term positive weight status outcomes, especially when group pediatric weight management sessions were included and it occurred in a clinic.

Rating: Fair

Treatment Setting in Multi-component Pediatric Weight Management Interventions

The RDN can provide multi-component pediatric weight management interventions either within the clinic or outside the clinic setting. Research indicates that positive weight status outcomes occur in either setting, especially when the interventions are multi-component, include group pediatric weight management sessions and have family involvement.

Rating: Fair

Group Sessions in Multicomponent Pediatric Weight Management Interventions

The RDN can include group sessions and family participation as part of the multi-component pediatric weight management interventions. Multi-component intensive interventions that included group pediatric weight management sessions and included family participation were consistently associated with shorter-term (6 mos) and longer-term (1 yr) positive weight status outcomes.

Rating: Fair
The RDN can include individual sessions as part of the multi-component pediatric weight management intervention. Treatment that relied exclusively on individual pediatric weight management sessions with or without family participation was associated with shorter-term positive weight status outcomes. Information about the longer-term impact on weight status are mixed.

Rating: Fair