Dietary Factors, Obesity and Pediatric Asthma

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Dietary Factors and Weight Management

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- Disclosures
  - Mylan (Dey) advisory committee
  - AAAAI past president
  - Misc Legal (APBA, immunology, drug allergy)
Objectives

- To review how to differentiate between lack of conditioning in obese children from loss of asthma control
- To consider when weight gain in childhood is most likely to contribute to asthma expression
- To present information regarding what dietary factors may be productive in reducing asthma induction and severity
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To review how to differentiate between lack of conditioning in obese children from loss of asthma control

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  \[ \text{___________________} \quad \text{and} \quad \text{___________________} \]

NAEPP, NHLBI 2007
To review how to differentiate between lack of conditioning in obese children from loss of asthma control

- Control consists of 2 domains...**Impairment** and **Risk**
Asthma Severity/Control

- **CURRENT IMPAIRMENT**
  - FREQUENCY/INTENSITY OF SYMPTOMS
    - “BREATHELESSNESS DURING THE DAY/NIGHT OR AFTER EXERCISE”
  - SABA ≤ 2 X/WEEK
  - FUNCTIONAL LIMITATIONS
Asthma Severity/Control

- Future Risk
  - Likelihood of Exacerbations
  - Loss of Lung Function/Lack of Lung Growth
  - Minimal or No Adverse Effects of Meds
Despite Recommendations....

- More than 10% of children and adolescents are over their recommended weight ......
- Cough, Breathlessness with Exercise, and Wheezing in obese children and adolescents may lead to OVERDIAGNOSIS of asthma by physicians
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Conditioning is a Function of

- **Increase in ventilation** during exercise (respiratory rate and flow rate)
- **Increase in cardiac output** (V/Q homogeneous or low and high areas of V/Q from acute asthma)
- **Neuroendocrine adaptation** (peak plasma concentration of epinephrine)
- **Metabolic adaptation** (aerobic and anaerobic capacity) (both can be decreased in asthma if FEV$_1$ is reduced)
- **Respiratory function** (airways obstruction)
Regarding Asthma, does the child have:

- Lack of ventilatory reserve (bronchoconstriction, chest wall deformity)
- Muscle deconditioning
- Cardiac limitation
- Uncontrolled Allergic Rhinitis or Rhinosinusitis?
- Concomitant chronic disease (CF?)
- Poor self esteem
- Lack of confidence in asthma therapy
- Asthma
12 year old with persistent mild-moderate asthma since age 2 years; Allergic Rhinitis; Overweight

Response to Therapy for Exacerbations

- Responds quickly
- Responds to combination ICS/LABA; occasional prednisone
- Slow to respond
12 year old with persistent mild-moderate asthma since age 2 years; overweight

Response to Therapy for Exacerbations

- Responds quickly
- Responds to combination ICS/LABA; occasional prednisone
- Slow to respond
Slow or Sub-Optimal Responses

- Non-adherence
- Overweight reduces responses to medications (doubtful impairment in persistent mild, moderate asthma (JACI 2009;123:1328-34)
- Un-recognized concurrent VCD
- Hyper-vigilant re symptom recognition
- Co-morbidities relevant
- De-conditioned
- Exercise induced hypocarbia
Co-Morbidities/Issues

- GERD, NERD, LPR (atypical reflux)
- Sleep Apnea
- Allergens at home (pets, dust mites, fungi, pests)
- Allergic rhinitis and/or CRS
- Adherence, self-efficacy (recognition of symptoms or change in PEF early)
- Expectations (patient and/or family)
- Social (overweight friends, family)
- Smoking
- Low/insufficient Vitamin D ≤ 30 ng/mL
Exercise Induced Syndromes..

- Asthma
- Bronchoconstriction (no underlying persistent asthma)
- Rhinitis
Exercise Induced Bronchospasm
### Which Therapies Modify (reduce) the Extent of EIB/EIA

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Which Therapies Modify (reduce) the Extent of EIB/EIA

- Albuterol, terbutaline
- LABA (rapid onset)
- Cromolyn
- Nedocromil
- Leukotriene Receptor Antagonist
- Leukotriene Synthesis Modifier

- Inhaled corticosteroids (not immediately effective)
- Theophylline
- Ca Channel Blockers
- *Nasal breathing*
- *Warm, moist air*
Is There Real Disease Here in an Obese Child/Adolescent with Shortness of Breath and Wheezing?

- **Coughing with deep inspiration** (in non-asthma patients, at total lung capacity, resistance decreases; in asthma, it can go up and cause coughing)

- **Abnormal expiratory flow rates and reversibility** or truncated inspiratory loop on a flow-volume loop

- What has been the response to medications?... *worsening if taken off* of or undertreated with medications?

- Poor effort on spirometry?
Exercise Induced Hyperventilation (Ann Allergy Asthma Immunol 1999;82:574-78)
Exercise Induced Hyperventilation (Hypocapnia)

- Reassurance of child or adolescent
- Try to suppress hyperventilation
- Avoid excessive pharmacotherapy
What About Excluding Asthma?

- Demonstrate overdiagnosis or remission
- Negative bronchial provocation challenge with mannitol.. (recently available with high specificity— if no disease, test is negative)
- Examine if symptomatic
- Identify other explanations
- Keep an open mind
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Obesity as a Socially Infectious Disease?

- 17% of children, adolescents ages 2-19 years are obese in the U.S.

BMI > 30 kg/m²
Which Children?

- BMI ≥ 40 kg/m²
- *Overweight* if there is inadequate control of asthma or prevention of EIB
- *At risk* infants, toddlers, children, adolescents
To present information regarding what dietary factors may be productive in reducing asthma induction and severity

- Pre-Natal.....avoid excessive weight gain
- Pre-Natal.....pro and pre-biotics (modest-to keep weight down)
- Age up to 2 yrs.....avoid overfeeding and rapid growth (top 20th percentile)
- Mediterranean diet
- Sufficient sleep (when using diet)
- Vitamin C, apples, pears?
Associations of maternal and children adherence to a Mediterranean diet with wheeze and atopy in Menorcan children at age 6.5 years.

Is Having Asthma A Risk Factor for Obesity?

- Yes
- No
The Relationship Between Asthma and Obesity in Urban Minority Children and Adolescents

- Asthma is a risk factor for obesity in children ages 4-10.5 yrs and 11-16 yrs.
- The severity of asthma was not associated with obesity.
- Asthma (Symptoms and MD confirmed wheezing).
- Percent overweight was reported as a continuous variable so that overweight was >50th percentile for BMI.
The Relationship Between Asthma and Obesity in Urban Minority Children and Adolescents

Table 2. Percentage of Subjects Who Were Obese (≥85th BMI Percentile) and Very Obese (≥95th BMI Percentile) and Their Percent Overweight in Relationship to Asthma Status

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<tr>
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<th>Nonobese</th>
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<tr>
<td><strong>Obese (≥85th BMI Percentile)</strong></td>
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<tr>
<td>Asthmatic</td>
<td>46 (54.1)</td>
<td>39 (45.9)</td>
<td>2.7 ± 8.5</td>
<td>45.8 ± 25.6</td>
</tr>
<tr>
<td>Nonasthmatic</td>
<td>60 (69.8)</td>
<td>26 (30.2)</td>
<td>2.8 ± 10.6</td>
<td>33.4 ± 18.9</td>
</tr>
<tr>
<td><strong>Obese (≥95th BMI Percentile)</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Asthmatic</td>
<td>59 (69.4)</td>
<td>26 (30.6)</td>
<td>7.1 ± 11.6</td>
<td>57.4 ± 18.9</td>
</tr>
<tr>
<td>Nonasthmatic</td>
<td>76 (88.4)</td>
<td>10 (11.6)</td>
<td>6.8 ± 12.9</td>
<td>51.9 ± 15.6</td>
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*BMI indicates body mass index (weight in kilograms divided by the square of the height in meters). χ² Analyses for obese and very obese children are χ²₁ = 9.25, P = .002, and χ²₁ = 4.44, P = .04, respectively.
Can A Child or Adolescent with Asthma Be Fit (Conditioned) and Overweight?

- Yes
- No
Observations re Obesity

- With increasing bronchoconstriction, there is greater mechanical disadvantage eg higher FRC and lower Inspiratory Capacity which causes GREATER DYSPNEA.
- During bronchoconstriction, inspiratory muscles apply radial traction on the airways to support caliber (tidal volume and ventilation).
Observations re Obesity

- Severity of dyspnea is perceived to be greater in obese patients with asthma for the same level of bronchoconstriction.
Advice/Conclusions

- Overweight status is an *immediate alert* for attention to weight control or weight loss/physical conditioning and asthma control.
- Overweight status has modest negative effects on responses to monotherapy with ICS, not to montelukast or ICS/LABA but in studies is not a major contributor to lack of asthma control.
- Verify improvement with interventions.
Summary

“The mind can absorb only what the seat can endure”
35 y/o (BMI 42)-non-asthma
Preserved Flow Rates but Reduced TLC, FRC and VC
Loss of Protective Effect of Deep (Bronchodilating) Inspiration with Obesity during Methacholine Challenge (JACI 2005;115:1100-5)
Response to Bronchoprovocation

AJRCCM 2008;177:970-5

- Perception of dyspnea and influence of obesity
- 30 Female Adults with asthma
- Methacholine challenge
- Little change in TLC; increases in Residual Volume similar despite differences in BMI
- FEV$_1$ decreased 28% as expected
- Numerical but no significant differences in VAS for dyspnea; no relationship with BORG score......but.........
Do Obese Patients with Asthma Sense Airway Closure Differently Pre and Post Methacholine?

Changes in FRC

Percentage Predicted of FRC

BMI Tertile Group

- Tertile 1
- Tertile 2
- Tertile 3

BMI 20-24.9
BMI 25-30.9
BMI 31-45