Childhood Asthma and Obesity: What do we know?
What can we do – prevention and management?

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Overview

• What do we know?
  – allergy, asthma and obesity

• What can we do?
  – Prevention
  – Management
  – Barriers
Cardiovascular, metabolic, chronic lung diseases and allergic diseases are all collectively known as non-communicable diseases (NCDs). We have seen an increase in all of these NCDs over the past few decades. Early life nutrition play a significant role in the future prevention or development of non-communicable diseases (NCDs).

Prescott et al. 2013
The stats...

• In parallel to the rise in allergic diseases, we have seen a rise in obesity.

• Obesity and overweight affect more than 1.5 billion adults and account for 0.7 – 2.8% of health care costs. Claessen et al. 2011

• There is also an increase seen in the incidence of childhood and adolescence obesity, an important predictor of adulthood obesity, morbidity and mortality

Adair LS 2008; Park MH, Falconer C 2012
The definitions
When is a child obese?

• Body mass index (BMI) is a measure used to determine childhood overweight and obesity. It is calculated using a child's weight and height. BMI does not measure body fat directly, but it is a reasonable indicator of body fatness for most children and teens.

• A child's weight status is determined using an age- and sex-specific percentile for BMI rather than the BMI categories used for adults because children's body composition varies as they age and varies between boys and girls.
Definitions

• **Overweight** is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex.

• **Obesity** is defined as a BMI at or above the 95th percentile for children of the same age and sex.

http://www.cdc.gov/growthcharts/
Jade
4 years 3 months
1.05 m
22 kg
BMI: kg/m²
Plotting on the chart
The links
Obesity and allergy

• Review: 34 studies from 2002 – 2012
• Obesity is a risk factor for developing bronchial asthma.
• Association between obesity and asthma is independent of subject’s atopic status.
• Gender difference in BA prevalence, with being overweight a much stronger risk factor for BA in girls than in boys.
• Obesity increases the prevalence of wheezing and respiratory symptoms in subjects with a higher BMI compared to normal-weight subjects.
• Especially in infants, obesity increases the risk for late-onset and persistent wheezing, particularly in girls.

Baumann and Lorentz 2013
In Europe

- Data from 12,050 subjects of eight European birth cohorts on asthma and allergies showed:
  - children with a rapid BMI gain in the first two years of life had a higher risk for developing asthma up to the age of six years than children with less pronounced weight gain in early childhood

Rhezak P 2013
In the US

• Children (6-17 years) with physician-diagnosed asthma (NHLBI Severe Asthma Research Program, Georgia)
• Completed questionnaires, plethysmography, exhaled NO and Th1/Th2 cytokines.
• Asthma control was defined: National Asthma Education and Prevention Panel Expert Panel Report-3 (EPR-3).
• N=269: 58 (22%) overweight and 67 (25%) obese.
• No associations between obesity and outcome of asthma control.
• Obese children
  – more likely to report non-specific asthma symptoms: dyspnea and nocturnal awakenings.
  – impaired quality of life, greater healthcare utilization and an increased frequency of glucocorticoid use.
  – decreased expression of IL-5, IL-10 and IL-13 but distinct patterns of Th1 versus Th2 polarization were not observed.

Sah et al. 2013
Obesity and Allergic disease

- Children with an increased body weight have an increased prevalence for AD.
- The earlier a child becomes obese and the longer this state persists, the more the risk increases.
- No clear association between obesity and the prevalence of allergic rhinitis or allergic conjunctivitis or increased sensitisation to food allergens.

Baumann and Lorentz 2013
# Obesity and Food Allergy

<table>
<thead>
<tr>
<th></th>
<th>≤ 2 Foods Excluded</th>
<th>≥ 3 Foods Excluded</th>
<th>All the children</th>
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<tbody>
<tr>
<td></td>
<td>N = 66</td>
<td>N = 33</td>
<td>N = 97</td>
</tr>
<tr>
<td><strong>WA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ - 2 z-score</td>
<td>7.8%</td>
<td>10%*</td>
<td>8.5%</td>
</tr>
<tr>
<td>≥ 2 z-score</td>
<td>10.9%</td>
<td>3.3%</td>
<td>8.5%</td>
</tr>
<tr>
<td><strong>HA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ - 2 z-score</td>
<td>10%</td>
<td>14.2%</td>
<td>11.5%</td>
</tr>
<tr>
<td>≥ 2 z-score</td>
<td>6.6%</td>
<td>3.5%</td>
<td>5.5%</td>
</tr>
<tr>
<td><strong>WH</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ - 2 z-score</td>
<td>4%</td>
<td>3.5%</td>
<td>3.7%</td>
</tr>
<tr>
<td>≥ 2 z-score</td>
<td>6%</td>
<td>12%</td>
<td>7.5%</td>
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Meyer et al. 2014
Prevention is better than cure..
Pregnancy

• Maternal overweight has shown association with subsequent obesity in their offspring.

• Increased birth weight has been associated with childhood and adolescence obesity.
  Yu et al. 2011; Koletzko et al. 2009
Always a bit of a disappointment…

- 1376 mother-infant pairs:
  - Overall dietary pattern using Mediterranean diet score, Alternate Healthy Eating Index modified for pregnancy (AHEI-P), and principal components analysis to look at Western and
  - Prudent diets did not affect wheeze at 3 years of age.
  - Did not look at obesity in the infants/children or any allergy specific outcomes.  

Lange et al. 2010
Healthy Eating Index Asthma

• Unpublished data – will be presented
Breastfeeding – works!

• A systematic review showed that breast-feeding reduced the risk of obesity in childhood significantly with a dose dependent effect seen in breast-feeding duration and the prevalence of obesity. Arenz et al. 2004

• Infants predominantly fed formula for the first 6 months were about 2.5 times more likely to be obese at 24 months of age relative to infants predominantly fed breast milk. Gibbs et al. 2013
…or doesn’t it?

- Breastfeeding could protect against allergic disease, but the evidence is contradictory and controversial.
- The tolerogenic potential of breast milk will depend on the presence of nutritional/immunomodulatory factors in breast milk and of its impact on the neonatal gut and immune system.

Verhasselt 2013
Weaning: Weight trajectories

Unpublished data to be presented
A number of systematic reviews on introduction of solid foods

• Little evidence that weaning before or after 12 weeks influences health outcomes up to 18 months.
  
  Morgan J et al. 2004

• No clear association between the timing of introducing solid foods and obesity in infancy and childhood
  
  Moorcroft et al. 2012
Type of food and how much?

Systematic review

• Some association between high protein intakes at 2-12 months of age and higher body mass index (BMI) or body fatness in childhood.

• Higher energy intake during weaning was associated with higher BMI in childhood.

• Consuming specific foods or food groups made no difference. Pearce et al. 2013
RCT from Oz

Six fortnightly training sessions:

- Module 1 addressed introduction of solids - healthy infant growth and requirements, variability of intake within and between infants, type (variety, texture), amount and timing (snacks) and trust in hunger and satiety cues.
- Module 2 focused on managing toddler feeding behaviours - strategies to manage food refusal, neophobia, dawdling, fussing, developmental need for autonomy and testing limits and role modelling healthy food choice and availability.

Results

- The control group infants had higher BMI-for-age z-score and were more likely to show rapid weight gain from baseline to follow-up.

Daniels et al. 2013
Introduction of solid food and allergy?

- n= 3142 Finnish children
- By 3 and 4 months of age, food diversity was not associated with any of the allergic end points.
- By 6 months of age, less food diversity was associated with increased risk of allergic rhinitis but not with the other end points.
- By 12 months of age, less food diversity was associated with increased risk of any asthma, atopic asthma, wheeze, and allergic rhinitis.

Nwaru et al. 2014
But if we need to manage…
Strategies for weight loss

Cochrane review 2005

• Found only one trial of fair methodological quality with a total of 38 patients suffering from chronic asthma!

• Significant increases in FEV(1) and FVC in the active treatment group compared with control.

Cheng et al. 2005
More up to date

• EAACI systematic review 2013

• Found no childhood studies to include.

• Studies show weak evidence of benefits from weight reduction and asthma outcomes.

Moreira et al. 2013
Dutch study

- n = 20; 6 weeks dietary trial
- Weight, and body mass index (BMI) were significantly reduced.
- Significant improvement of the percentage exercise-induced fall in FEV1, asthma control and quality of life.
- Reduction in BMI z-score was significantly related to the reduction in the percentage exercise-induced fall in FEV1 in children that lost weight.
- No changes in FeNO and ACQ.

Leeuwen et al. 2013
Saudi Arabia

- N = 40 per group; intervention: diet and exercise for 2 months
- BMI reduced significantly

<table>
<thead>
<tr>
<th></th>
<th>Mean + SD</th>
<th>t-value</th>
<th>Significant</th>
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<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td></td>
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<tr>
<td>TNF-alpha (pg/mL)</td>
<td>4.32 ± 1.54</td>
<td>3.56 ± 1.12</td>
<td>3.80</td>
</tr>
<tr>
<td>IL-6 (pg/mL)</td>
<td>2.19 ± 0.81</td>
<td>1.85 ± 0.76</td>
<td>3.64</td>
</tr>
<tr>
<td>IL-8 (pg/mL)</td>
<td>15.66 ± 4.63</td>
<td>12.14 ± 3.72</td>
<td>4.52</td>
</tr>
<tr>
<td>Leptin Ng/ml</td>
<td>31.43 ± 5.47</td>
<td>26.98 ± 4.50</td>
<td>5.83</td>
</tr>
<tr>
<td>Adiponectin (µg/mL)</td>
<td>10.61 ± 3.45</td>
<td>14.72 ± 3.21</td>
<td>5.11</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>32.31 ± 2.46</td>
<td>27.15 ± 2.38</td>
<td>4.74</td>
</tr>
</tbody>
</table>

TNF-alpha = tumor necrosis factor – alpha.   IL-6 = Interleukin-6
IL-8 = Interleukin-8.                      BMI = Body Mass Index
Australia

- N=28; intervention group: 10 week dietary trial
- Body mass index (BMI) z-score reduced significantly
- Expiratory reserve volume (ERV) increased significantly
- ACQ improved significantly

Jensen et al. 2013

<table>
<thead>
<tr>
<th>Lung function variables</th>
<th>Intervention group</th>
<th>Control group</th>
<th>Change (A) between groups: P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Change (A) vs. baseline</td>
<td>Baseline</td>
</tr>
<tr>
<td>FEV(_1) (L); median [IQR]</td>
<td>2.4 [2.0, 2.9]</td>
<td>0.0 [-0.2, 0.1]</td>
<td>2.6 [2.2, 2.9]</td>
</tr>
<tr>
<td>FVC (L); median [IQR]</td>
<td>3.4 [2.7, 3.5]</td>
<td>0.1 [0.2]</td>
<td>3.3 [2.9, 3.5]</td>
</tr>
<tr>
<td>FEV(_1)/TLC (%); mean (SD)</td>
<td>59.1 (9.0)</td>
<td>2.3 [-1.3, 14.1]</td>
<td>64.7 (8.9)</td>
</tr>
<tr>
<td>TLC (L); median [IQR]</td>
<td>4.4 [3.4, 4.8]</td>
<td>0.0 [-0.5, 0.0]</td>
<td>4.0 [3.6, 4.7]</td>
</tr>
<tr>
<td>FRC (L); median [IQR]</td>
<td>1.9 [1.7, 2.1]</td>
<td>0.2 [0.5]</td>
<td>1.6 [1.5, 2.1]</td>
</tr>
<tr>
<td>RV (L); median [IQR]</td>
<td>0.9 [0.8, 1.6]</td>
<td>-0.4 [0.5] *</td>
<td>0.9 [0.7, 1.1]</td>
</tr>
<tr>
<td>RV/TLC (%); mean (SD)</td>
<td>25.8 (9.3)</td>
<td>-6.9 [9.2] *</td>
<td>20.5 (9.0)</td>
</tr>
<tr>
<td>Dose–response slope (%fall/mL); median [IQR]</td>
<td>2.6 [1.4, 9.2]</td>
<td>0.4 [-0.4, 1.7]</td>
<td>1.8 [0.5, 14.3]</td>
</tr>
<tr>
<td>logPD(_{15}) (mL); mean (SD)</td>
<td>1.4 [0.4, 2.0]</td>
<td>-0.4 [-0.8, 0.3]</td>
<td>1.1 [-0.3, 2.4]</td>
</tr>
</tbody>
</table>

FEV\(_1\), forced expiratory volume in 1 second; FVC, forced vital capacity; TLC, total lung capacity; FRC, functional residual capacity; RV, residual volume; logPD\(_{15}\), log-transformed provocation dose.

*P < 0.05 vs. baseline value.
Barriers to weight loss

• Barriers are very individual
• Ideally you would want to be exploring the individual’s barriers using a motivational interviewing style approach to elicit person barriers in a non-judgmental, explorative way.
• This is really the only way to overcome barriers to change – to identify an individuals barriers and work on these in a person centred way.
Barriers to change (2)

- Lack of understanding about the change itself. Awareness and knowledge are essential first steps
- Only 50 to 60% of information given in health consultations is recalled
- Good literacy skills do not imply good health literacy skills (Weiss BD. 2007)
- Doctors interrupt patients after an average of 18 seconds of their opening statement
- Patients fail to disclose significant concerns in consultations
- 70% of patients want to ask more questions but do not
- Perceived lack of support – evidence suggests that support is needed to engage people in change and help with continuously moving forwards
- Basic lack of focus and motivation for change – Some people say they are happy with things how they are currently
- Lack of clear process/plan for change.
- Practical Issues – e.g. lack of child care/social support, time, financial difficulties…
- Emotional difficulties – untreated or unrecognised depression/anxiety/eating disorders, or just a struggle with emotions such as fear, guilt, shame. Low self esteem.
- Acceptance and beliefs - an individuals personal beliefs and attitudes impact on the way they behave.

Although, going back to the person centred approach, sometimes I am surprised at individuals own barriers, sometimes things you wouldn't expect. Laura Fowler 2014
Thanks

• Any questions?
Key references