Dietary Factors and Weight Management, Behavioral Modification in Asthma

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Conflicts of Interest

- Speaker’s Bureau: AstraZeneca, Sanofi-Aventis, Merck, GSK, Alcon, Teva, Sunovium, Nycomed, Alcon, ISTA
- Consultant: AstraZeneca, Sanofi-Aventis, Merck, Alcon, Teva, Sunovium, Proctor & Gamble, Nycomed, Vectura, ISTA, Lupin
Learning Objectives

- Understand the effect of obesity on asthma
- To present information regarding what dietary and/or behavioral interventions are most successful in achieving appropriate weight control
Factors in Asthma—Some are Under Our Control

WE HAVE MET THE ENEMY AND HE IS US.
Obesity and Asthma
Obesity Trends Among U.S. Adults between 1985 and 2008

**Definitions:**

- **Obesity:** Body Mass Index (BMI) of 30 or higher.

- **Body Mass Index (BMI):** A measure of an adult’s weight in relation to his or her height, specifically the adult’s weight in kilograms divided by the square of his or her height in meters.
Obesity Trends Among U.S. Adults between 1985 and 2008

Source of the data:

- The data shown in these maps were collected through CDC’s Behavioral Risk Factor Surveillance System (BRFSS). Each year, state health departments use standard procedures to collect data through a series of telephone interviews with U.S. adults.

- Prevalence estimates generated for the maps may vary slightly from those generated for the states by BRFSS (http://aps.nccd.cdc.gov/brfss) as slightly different analytic methods are used.
Obesity Trends* Among U.S. Adults

(*BMI ≥30, or about 30 lbs. overweight for 5’4” person)
Association between asthma and obesity

- As a group, subjects with asthma are heavier than subjects without asthma.
- Among adults, prospective studies have shown that both greater initial weight and greater weight change among adults increases the risk of development of asthma in later life.
- Among children, prospective studies have shown as effect of overweight and obesity on the risk of development of asthma.
- Studies show obesity may worsen asthma control.

Lintonjua and Gold JACI 2008
Factors associated to lifestyle and risk of adult onset asthma


- A population of 10,597 adult twins, initially free of asthma was followed for 9 years. The main outcome measure was questionnaire-based report of physician diagnosed asthma.
- Logistic regression was used to estimate the risk of asthma predicted by lifestyle factors, with adjustment for atopy and respiratory symptoms.
- RESULTS: Obesity at baseline increased asthma risk (multivariable adjusted OR = 3.00, 95% CI: 1.64–5.50 for those with BMI ≥ 30 compared to those with normal weight BMI: 20–24.99).
- Leisure time physical activity had a slightly protective effect on asthma risk among men (P for trend = 0.037)
Body mass index and asthma severity in the National Asthma Survey

- Determined the association of body mass index (BMI) and asthma severity in the National Asthma Survey.
- A total of 3095 patients were divided into the following BMI categories: 1080 (35%) non-overweight (BMI < 25), 993 (32%) overweight (BMI ≥ 25 and < 30) and 1022 (33%) obese (BMI ≥ 30).
- Asthma severity measures included respiratory symptoms, healthcare utilization, medication use, missed work days and the Global Initiative for Asthma (GINA) severity classification.
- Models were adjusted for: gender, race, age, education, income, employment status, smoking status, family history of asthma, state of residence and residence in a metropolitan statistical area.
Body mass index and asthma severity in the National Asthma Survey

- Compared with non-overweight subjects, obese subjects with asthma were more likely to report
  - continuous symptoms (OR 1.66, 95% CI 1.09 to 2.54),
  - miss more work days (OR 1.35, 95% CI 1.01 to 1.81),
  - use short acting beta agonists (OR 1.36, 95% CI 1.06 to 1.75)
  - use inhaled corticosteroids (OR 1.34, 95% CI 1.01 to 1.79)
  - use any controller medication according to GINA guidelines (OR 1.37, 95% CI 1.01 to 1.85).

- Also, obese respondents were less likely to be in asthma remission (OR 0.56, 95% CI 0.38 to 0.82) and were more likely to have severe persistent asthma (GINA IV) (OR 1.42, 95% CI 1.05 to 1.90).
Asthma and obesity in children are common chronic conditions and both disorders have been increasing in the last 2 to 3 decades. The changes of dietary habits and a sedentary life style could have played a role in increasing the prevalence of both conditions. The aim of this report is to analyze the relation between some respiratory conditions (current wheezing, asthma and chronic cough) with dietary habits, body mass index (BMI), the physical activity and the habit to watch television.
A total of 19,995 children (10,294 males and 9701 females) were investigated.

Current wheezing is associated with
- increased BMI (V quintile OR=1.65)
- TV watching (more than 5 h/day OR=1.53)
- adding salt to the foods (OR=2.45)
- fizzy drink (5 times or more per week OR=1.31).

Children who often eat tomatoes, fruits, cooked vegetables and citrus fruits have a lower risk of current wheeze.

The pattern of association is similar for asthma.
Possible mechanisms explaining the relationship between obesity and asthma

- Effects of obesity on lung mechanics
  - Decreased FRC
  - Decreased Tidal Volume
  - Airway Closure

- Systemic inflammation
  - Cytokines (TNF-alpha, IL-6)
  - Chemokines (eotaxin)
  - Reactive oxygen species
  - Acute phase reactions
  - VEGF

- Energy regulating hormones
  - Leptin
  - Adiponectin
  - Visfatin

- Co-morbidities
  - Dyslipidemia
  - GERD
  - Sleep Disordered Breathing
  - Type 2 Diabetes
  - Hypertension and its sequelae

- Common etiologies
  - Genetics
  - Dietary factors (antioxidants)

Shore S. J Allergy Clin Immunol 2008;121:1087-93
Weight Loss and Asthma Trials

Surgical Intervention

- Asthma was assessed preoperatively and at least 12 months after laparoscopic adjustable gastric banding surgery using a scaled asthma score based on severity, daily impact, medications needed, hospitalization, sleep and exercise.
- Patients were categorized into mild, moderate or severe asthma based on the National Asthma Campaign criteria.
- Although 10 had a history of severe asthma at baseline, none had severe asthma at the 12 month follow-up.
Dixon et al

- The impact of asthma on daily living activities improved by 50%.
- There was a 57% decline in the number of patients that needed daily medications from 14 to six after weight loss.
- The mean preoperative scaled asthma score of 44.5 decreased to 14.3 at follow-up (p<0.001). The investigators reported a correlation coefficient of 0.21 between percent weight loss and improvement in asthma scores.
Weight loss and asthma control in severely obese asthmatic females

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Respiratory Medicine (2008) 102, 102–108
Introduction

- Authors looked at the effect of weight reduction induced by bariatric surgery on asthma control in severely obese asthmatic patients.
- Patients and methods: A consecutive series of 12 asthmatic obese females who had laparoscopic adjustable gastric banding and 10 non-operated asthmatic obese females as control group.
  - All patients were non-smoker or had stopped smoking for 2 years or more. The diagnosis of asthma was conformed to the criteria of the GINA. Atopy was determined on the basis of positive wheal responses to 12 common airborne allergen extracts, using a standardized skin prick test kit.
- Body mass index (BMI), Asthma Control Test (ACT), pulmonary function test (PFT), exhaled nitric oxide (NO) were evaluated at baseline and after 1 year.
<table>
<thead>
<tr>
<th></th>
<th>OB group</th>
<th>Control group</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Follow-up</td>
<td>Baseline</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>115.3 ± 15.3</td>
<td>89.0 ± 8.5</td>
<td>113.0 ± 13.0</td>
</tr>
<tr>
<td>ΔWeight (%)</td>
<td>−22</td>
<td></td>
<td>+4.4</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>45.2 ± 4.7</td>
<td>34.8 ± 4.2</td>
<td>44.0 ± 2.5</td>
</tr>
<tr>
<td>ΔBMI (%)</td>
<td>−23</td>
<td></td>
<td>+2.9</td>
</tr>
<tr>
<td>ACT score</td>
<td>18.7 ± 2.6</td>
<td>22.2 ± 2.2</td>
<td>18.8 ± 1.6</td>
</tr>
<tr>
<td>ΔACT score (%)</td>
<td>+19</td>
<td></td>
<td>−1.1</td>
</tr>
<tr>
<td>eNO (ppb)</td>
<td>35.7 ± 6.3</td>
<td>36.4 ± 6.0</td>
<td>32.9 ± 6.4</td>
</tr>
<tr>
<td>ΔeNO (%)</td>
<td>+2.0</td>
<td></td>
<td>+6.4</td>
</tr>
<tr>
<td>FEV₁ (L)</td>
<td>83.0 ± 14.4</td>
<td>87.2 ± 14.9</td>
<td>82.3 ± 7.5</td>
</tr>
<tr>
<td>ΔFEV₁ (%)</td>
<td>+5.1</td>
<td></td>
<td>+2.6</td>
</tr>
<tr>
<td>FVC (L)</td>
<td>87.8 ± 13.5</td>
<td>95.2 ± 10.7</td>
<td>87.1 ± 10.3</td>
</tr>
<tr>
<td>ΔFVC (%)</td>
<td>+8.4</td>
<td></td>
<td>−1.2</td>
</tr>
</tbody>
</table>
Figure 1  Asthma Control Test (ACT) score in (a) 12 obese subjects affected by asthma before and 1 year after weight loss induced by bariatric surgery, *p<0.005; (b) 10 not-operated obese subjects affected by asthma at baseline and after 1 year, NS: not significant.
Other Results

- In surgical group the parameters of shortness of breath and rescue medication use were significantly improved respectively after surgery (always $p<0.05$).
- Accordingly, none of the controls who did not experience any weight loss was able to obtain a full asthma control.
- No significant difference in exhaled NO was found both in surgery group after surgery as compared to before surgery.
  - Severe uncomplicated obese subjects demonstrate low exhaled NO levels which normalize after consistent weight loss.
Respiratory medication prescriptions before and after bariatric surgery

- A retrospective cohort of 320 patients continuously enrolled in a large, southeast Michigan health maintenance organization were studied for 1 year before and 1 year after bariatric surgery.
- The health maintenance organization claims database was used to compare respiratory prescriptions filled before and after surgery.
- Respiratory medications included bronchodilator inhalers, inhaled corticosteroids, oral corticosteroids, theophylline, and leukotriene antagonists.

Figure 1. Percentage of 320 bariatric surgery patients filling respiratory medication prescriptions. *P values are for the McNemar test of symmetry comparing the before surgery proportion with the after surgery proportion.
Weight Loss and Asthma Trials

Medical Intervention

- Open study, two randomized parallel groups from private clinics in Helsinki
- Obese patients with BMI between 30 to 42 with asthma
- Supervised weight reduction program including 8 weeks very low energy diet
- Outcomes: Body weight, PFTs, asthma symptoms, acute episodes, steroid bursts, and QOL
Fig 1 Mean morning premedication values for PEF, FEV₁, and FVC (% of predicted) at different stages during study. Vertical bars show standard errors of the mean. *Change from baseline shows significant (P<0.05) difference between groups (see table for P values)
Fig 2  Mean values for cough and dyspnoea (mm on visual analogue scale) and mean number of daily rescue medication doses at different stages during study. *Change from baseline shows significant (P<0.05) difference between groups (see text for P values)
Fig 3 Health status: mean scores for symptoms, impact, and activity, and mean total scores, according to St George’s respiratory questionnaire. *Change from baseline shows significant (P<0.05) difference between groups (see text for P values).
Effect of weight change on asthma-related health outcomes in patients with severe or difficult-to-treat asthma

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f Channing Laboratory, Harvard Medical School, Boston, MA, USA
Introduction

- A population of adult patients with severe or difficult-to-treat asthma who participated in The Epidemiology and Natural History of Asthma: Outcomes and Treatment Regimens (TENOR) study

- We categorized 2396 TENOR patients >18 years into three groups (>5 lb loss, stable, >5 lb gain), based on a 5 lb (2.27 kg) difference between baseline and 12-month follow-up weight.
  - Asthma Therapy Assessment Questionnaire (ATAQ) and Asthma Quality of Life Questionnaire (AQLQ) scores, exacerbations, and steroid bursts at the 12-month follow-up.
Figure 2  Baseline measures of patient body weight (A) and BMI (C) and changes in body weight (B) and BMI (D) at the 12-month follow-up. BMI = body mass index.
Table 3  Outcome measures at 12-month follow-up.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Weight change at 12-month follow-up</th>
<th>p value</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>≥5 lb (≥2.27 kg) loss</td>
<td>Stable</td>
</tr>
<tr>
<td>Total patients, n (%)</td>
<td>557 (23.2)</td>
<td>1187 (49.5)</td>
</tr>
<tr>
<td>Mean post-bronchodilator % predicted FEV₁ ± SD</td>
<td>80.2 ± 21.7</td>
<td>78.7 ± 22.1</td>
</tr>
<tr>
<td>Mean post-bronchodilator actual FEV₁/FVC (%) ± SD</td>
<td>72.8 ± 12.0</td>
<td>71.2 ± 12.3</td>
</tr>
<tr>
<td>Mean race-adjusted % predicted FEV₁ ± SD</td>
<td>78.7 ± 21.3</td>
<td>76.2 ± 20.3</td>
</tr>
<tr>
<td>Overall MiniAQLQ score, mean ± SD</td>
<td>5.0 ± 1.4</td>
<td>5.1 ± 1.3</td>
</tr>
<tr>
<td>ATAQ control problems, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>180 (32.3)</td>
<td>399 (33.6)</td>
</tr>
<tr>
<td>1</td>
<td>125 (22.4)</td>
<td>295 (24.9)</td>
</tr>
<tr>
<td>2</td>
<td>146 (26.2)</td>
<td>304 (25.6)</td>
</tr>
<tr>
<td>3+</td>
<td>106 (19.0)</td>
<td>189 (15.9)</td>
</tr>
<tr>
<td>WPAI-Asthma % overall work impairment, mean ± SD</td>
<td>16.9 ± 23.7</td>
<td>13.1 ± 20.6</td>
</tr>
<tr>
<td>WPAI-Asthma % overall activity impairment, mean ± SD</td>
<td>26.1 ± 27.6</td>
<td>23.8 ± 26.7</td>
</tr>
<tr>
<td>Overnight hospitalization in previous 3 months, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>*18 (3.2)</td>
<td>*31 (2.6)</td>
</tr>
<tr>
<td>No</td>
<td>538 (96.8)</td>
<td>1150 (97.4)</td>
</tr>
<tr>
<td>ER visit in previous 3 months, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>*62 (11.2)</td>
<td>*73 (6.2)</td>
</tr>
<tr>
<td>No</td>
<td>494 (88.8)</td>
<td>1108 (93.8)</td>
</tr>
<tr>
<td>Unscheduled office visit in previous 3 months, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>*156 (28.1)</td>
<td>*326 (27.6)</td>
</tr>
<tr>
<td>No</td>
<td>400 (71.9)</td>
<td>855 (72.4)</td>
</tr>
<tr>
<td>Steroid burst in previous 3 months, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>*173 (31.2)</td>
<td>*354 (30.0)</td>
</tr>
<tr>
<td>No</td>
<td>382 (68.8)</td>
<td>827 (70.0)</td>
</tr>
</tbody>
</table>

*Some patient data missing. ATAQ = Asthma Therapy Assessment Questionnaire; ER = emergency room; FEV₁ = forced expiratory volume in 1 s; FVC = forced vital capacity; MiniAQLQ = Mini-Asthma Quality of Life Questionnaire; NS = not significant; WPAI-Asthma = Asthma-Specific Work Productivity and Activity Impairment.
Figure 3  Multivariable regression results assessing the risk of poor asthma control, exacerbations, steroid bursts, and overall quality of life in patients who gained ≥5 lb (≥2.27 kg) vs. those whose weight remained stable, and in patients who lost ≥5 lb (≥2.27 kg) vs. those whose weight remained stable.
In Summary

- Asthma patients who gained >5 lb (2.27 kg) during the 12-month interval between baseline and follow-up reported compared to patients who maintained their baseline weight or lost <5 lb (2.27 kg)
  - poorer asthma control (adjusted odds ratio [OR]: 1.22; 95% confidence interval [CI]: 1.01–1.49; p <0.04),
  - worse quality of life (least square means: -0.18; 95% CI: -0.30 to -0.06; p < 0.003)
  - a greater number of steroid bursts (OR: 1.31; CI: 1.04–1.66; p < 0.02)
Weight-Loss Practices and Asthma: Findings from the Behavioral Risk Factor Surveillance System

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Introduction

- The Behavioral Risk Factor Surveillance System (BRFSS), a large telephone-based survey of all states in the United States, provided a unique opportunity to examine weight-control practices and physician counseling behaviors among persons with asthma.
64.1% of overweight or obese patients with asthma and 72.9% of obese patients with asthma reported trying to lose weight suggest that the majority of these patients recognize the importance of maintaining a desirable weight regardless of whether they are having a difficult time in achieving one.

But only 16.2% of overweight patients with asthma and 44.9% of obese patients with asthma recalled receiving advice from their health-care providers to lose weight.
Conclusions

- Obesity has a relationship with asthma—either a direct cause and/or worsening of the condition.
- Weight loss appears beneficial in improving asthma control.
- Weight-loss in obese people with asthma may be advisable for general long-term health reasons outside of asthma control such as the prevention of coronary heart disease and diabetes.