# Obesity and asthma

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Obesity and asthma are common problems in developed countries. Data from the World Health Organization suggested that over 340 million adolescents and children aged 5 to 19 were obese in 2016.[1] Although obesity had become a worldwide epidemic, it was not until the late 90s that we realised obesity affected patients with asthma. The first paper that drew widespread attention to this epidemic was published by Camargo et al. in 1999 that evaluated the relative risk of developing new asthma in eighty-five thousand women from the Nurses' Health Study in the United States.[2] A higher Body Mass Index (BMI) was found to have a significant, independent and positive association with the risk of adult-onset asthma.

In Hong Kong, there is an increasing trend of overweight and obesity of secondary school student from the school year recently.[3] Though we don't have local data regarding the causal role of obesity in asthma, many epidemiological studies have shown a modest association between obesity and asthma. Beuther DA and colleagues have published a meta-analysis of prospective epidemiologic studies that suggested an increased prevalence of asthma in obese adult of 11.1% compared to 7.1% in the control group.[4] The difference was even more marked in women of 14.6% compared to 7.9% in the control group. A higher BMI conferred increased odds of the incidence of asthma; the odds ratio (OR) for incident asthma for average weight versus overweight was 1.38 (95% confidence interval (CI), 1.17-1.62) and was further elevated for normal versus obese individuals at 1.92 (95% CI, 1.43-2.95).

Peter's-Golden et al. reviewed three thousand patients with moderate asthma treated with montelukast, beclomethasone or placebo.[5] The asthma control days were 34% of average weight versus 25% for overweight and 26% for obese. They demonstrated that the clinical response to beclomethasone declined with increasing BMI. Gibson postulated the underlying mechanisms linking obesity and asthma included mechanical chest wall restrictions in obese subjects, non-eosinophilic airway inflammation, diet-induced airway and systemic inflammation.[6] Obesity-related asthma have a reduced beta-2 agonist and corticosteroids response, and less atopy T-helper 2 inflammation.

Rodrigo published a prospective cohort study of 426 hospitalised patients with severe asthma exacerbations.[7] Overweight or obese subjects were more likely to have failed outpatient therapy and had a higher rate of use of inhaled steroid/theophylline in the past seven days. After adjusting for confounding factors, obese/overweight patients had an increased length of emergency department stay (2.3 hours versus 1.9 hours) and an increased hospitalisation rate (13.7% versus 6.8%).

Obese subjects have elevated inflammatory mediators. Baffi proposed that adipose tissue produced pro-inflammatory cytokines, i.e. adipokines, leptin, tumor necrosis factor alpha, interleukin 6, interleukin 8 and monocytes chemoattractant protein 1 with direct lung effects.[8] For example, leptin has roles in the immune system, being proinflammatory cytokines produced by adipocytes.[9,10] The increased level of leptin correlated with increasing body fat, i.e. BMI and skinfold thickness. Overall, these metabolic mediators in obesity can lead to an increase in airway hyperreactivity. These mediators such as serum leptin concentrations are also potential biomarkers predictive for asthma in children, especially boys, regardless of BMI.

Dias-Junior et al. assessed the impact of a medical weight loss program with low-calorie intake, sibutramine and orlistat use in 33 asthmatic subjects with BMI greater than 30.[11] Twelve out of twenty-two patients in the treatment group achieved a bodyweight reduction of greater than 10%, that resulted in a significant reduction in Asthma Control Questionnaire score suggesting better asthma control. A randomised case-control study evaluating the effect of exercise and a weight-loss program on asthma control, quality of life, lung function, aerobic capacity and inflammatory biomarkers was carried out by the Freitas group in 2017.[12] Fifty-five subjects was randomised to one of the 2 groups, including weight loss/sham exercise or weight loss/aerobic exercise group for three months. The result showed a significant weight loss and reduced airway/systemic inflammation in the weight loss/ aerobic exercise group.

Van Huisstede et al. carried out a longitudinal study in morbidly obese asthmatic subjects and morbidly obese without asthma subjects undergoing bariatric surgery and a group of obese subjects with asthma not undergoing bariatric surgery as control.[13] There was a significant weight loss in subjects with bariatric surgery at 12 months. With bariatric surgery shown to reduce systemic inflammation and the number of mast cells in the airway and improved small airway function.

In conclusion, obesity increases the risk of developing asthma in both children and adults. (Fig. 1) Previous studies demonstrated that obese asthmatic subjects have less responsive to bronchodilators and inhaled glucocorticoids. There was an increase in healthcare utilisations and hospitalisations for obese asthmatics.

The addition of exercise may improve weight loss efforts and asthma control. Finally, bariatric surgery may be an effective therapy to help obese asthmatics improve asthma outcomes.

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Fig. 1

