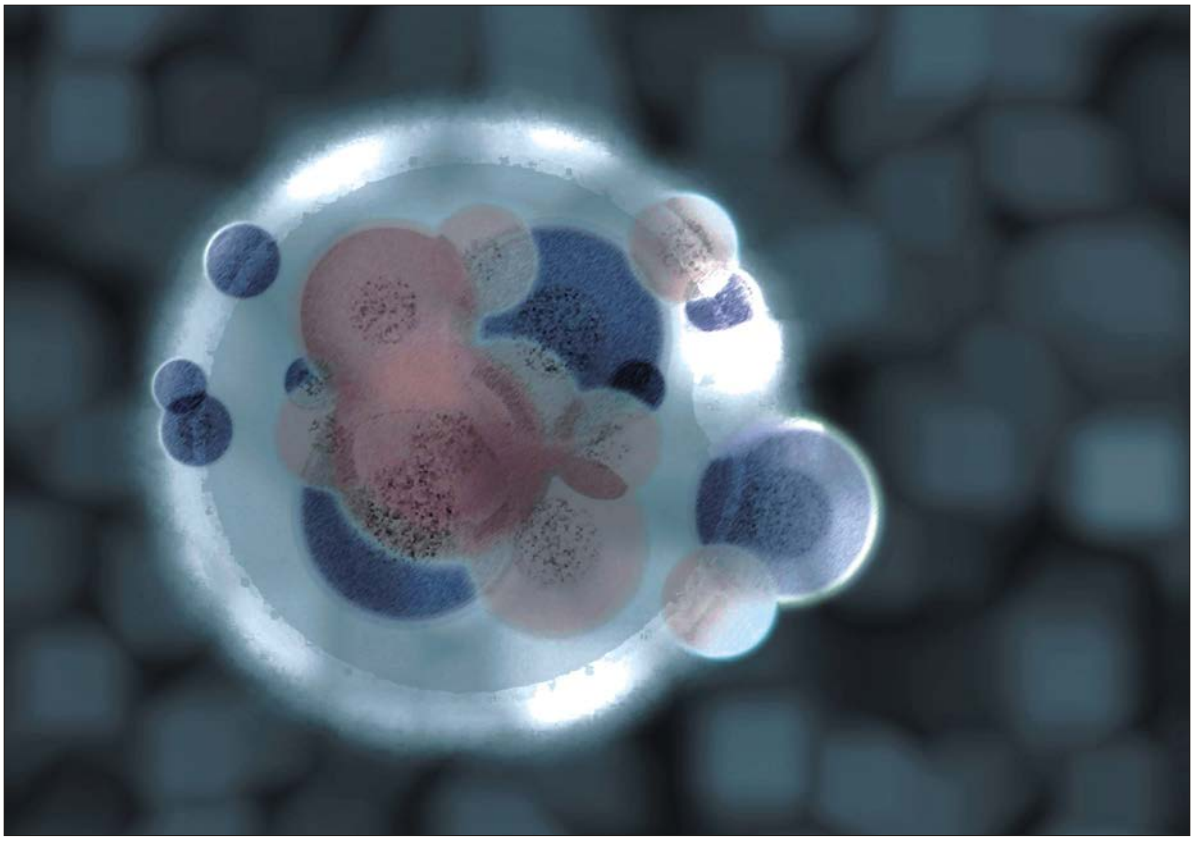

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Childhood Obesity and Asthma Severity: Is There a Link?

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Abstract: The aim of this study was to prove the relation between childhood obesity and asthma severity and that weight reduction improves asthma outcome. The study included 40 children with age range of 6-12 years divided into two groups; group I included 20 overweight moderate persistent asthmatics who will follow a weight reduction diet for 6 months and group II including 20 non obese moderate persistent asthmatics. All patients were assessed initially and after 6 months clinically and by Spirometric examination. Comparing both groups I and II at the beginning of the study as regards their spirometric results; group II had higher values in all parameters (FVC, FEV1, PEF and FEF 25-75) with p values of 0.001, 0.004, 0.001 and 0.001, respectively. There was also a marked statistically significant difference between all parameters of spirometry in group I before and after weight loss with a p-value of 0.001 in all parameters. Obesity is a cause of poor asthma control and weight reduction can be used as an adjunctive to decrease the need for medications and improve quality of life in obese children with persistent asthma.

Key words: Asthma, overweight children, pulmonary function

INTRODUCTION

Asthma is a chronic inflammatory disorder of the air ways and it is prevalent world wide, especially in developed countries where its prevalence is increasing to epidemic properties in some areas. (Busse *et al*., 2001).

Obesity is the most prevalent nutritional disorder among children in western countries; it affects 40% of children in the United States (Stenius-Aarniala *et al*., 2000).

Obesity is a major cause of mortality accounting for approximately 300,000 deaths each year. The parallel time trend with increasing prevalence of asthma has induced a debate about potential link between both conditions (Shore and Fredbary, 2005).

The prevalence of both obesity and asthma has clearly increased in recent decades, giving rise to speculation that they may be related, studies have found that obesity precedes and predicts the onset of asthma (time effect), that increased obesity leads to more severe asthma (dose-response effect) and that weigh reduction improves asthmatic symptoms (Guerra *et al*., 2004).

In explanation for the parallel increase of asthma and obesity, it might be based on genetic factors. Several overlapping linkage peaks for obesity and asthma have been identified in genome wide linkage studies (CA *et al*., 1999; Mai *et al*., 2005; Litonjua and Gold, 2008).

Recent investigations towards elucidating a shared genetic basis for these two disorders have identified polymorphism in specific regions of chromosomes 5q 6p11q 12q, each of which containing one or more genes encoding receptors that are relevant to asthma (Vollmer *et al*., 1999; Calfee *et al*., 2006; Cope *et al*., 2008).

Mechanical properties of the respiratory system associated with obesity such as diminished tidal lung expansion may partially account for this association with asthma (Seo *et al*., 2005; Mc-Vey *et al*., 2007; De Santis-Moniaci and Altshuler, 2007).

Several studies revealed a reduction in functional residual capacity and diffusion impairment in obese children and there were reduction in static lung volume correlated with the degree of obesity, also several studies proved that weight reduction can results in prevalent of lung function and symptoms among asthmatic adults. (Fuhlbrigge *et al*., 2006; Juniper *et al*., 2004; Chong *et al*., 2006).

The prevalence of asthma and obesity made us search for a link between both in children and whether weight reduction can ameliorate asthma and help improving the pulmonary functions and control asthma symptoms.

MATERIALS AND METHODS

The study was conducted at the Out Patient Clinic of the Pulmonology Department of Pediatric Hospital Cairo University during the period of January and June 2008; it included 40 children with moderate persistent asthma (according to the GINA, 2007 classification) with age range 6-12 years and was divided into two groups:

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Group I: Included 20 over weight moderate persistent asthmatics and they underwent a 6 month protocol of proper diet control for weight reduction.

Group II: Also included 20 but non obese age and sex matched moderate persistent asthmatic.

Exclusion criteria

- Children with history of acute asthmatic attacks within the past 6 months
- Children receiving systemic steroids within past year
- Children with any systemic diseases

*All patients were evaluated at the beginning and after 6 months from the onset of the study and for each patient the followings were done:

- Detailed history taking including family history of asthma and or obesity (for the obese group)
- Full Clinical Examination
- Anthropometric Measurements

***Height:** Measured by the same examiner using a wall-mounted harperder 5 stadiometer (Hattain Limited, Crymchy, Dyfeed, United Kingdom).

***Weight:** using a calibrated electronic scale (Seca, Homburg, Germany).

- Pulmonary function tests using Med Graphics Spirometry and the following parameters were measured:
  - Forced Vital Capacity (FVC)
  - Forced expiratory volume in the first second (FEV_1)
  - Forced Mid Expiratory Flow (FEF 25-75%)
  - Peak Expiratory Flow (PEF)
- Results of spirometry are being expressed as a percentage of predicted value adjusted for gender, age and height
- FVC, FEV and FEF 25-75% are considered abnormal if they were less than 80% of the normal predicted value

Statistical analysis: Statistical package of social science (SPSS) program was used for data analysis. Data was summarized as Mean±SD and percentage.

Mc Nemer test was used for analysis of 2 qualitative data in follow up. Independent and dependant t-test is used for data analysis.

Pearson Correlation was done to detect relation between two variables. r is considered weak if <0.25, mild between 0.25 and 0.5, moderate if more than or equal 0.5. <0.75 and strong if more than or equal 0.75, p-value is considered significant if <0.05.

RESULTS

Demographic data of the studies group is shown in Table 1.

There was a great improvement in all parameters after the 6 months diet control regimen in group I with a statistically significant difference with p-value 0.001 in all parameters. While in group II the improvement was not significant (Table 2).

Table 1: Demographic data of the studied groups

	Group I obese asthmatics		Group II non obese asthmatics	
Parameters	Girl	Boy	Girl	Boy
Sex distribution	♀	♂	♀	♂
	51%	49%	50%	50%
Height (cm)	145±2.3	144±3.3	146±2.3	148±3.4
Weight at beginning of study	56±4.3	59±5.3	36±4.3	40±5.3
Weight at end of study	45±3.2	42±4.3	38±4.3	41±4.1
Age	Mean	SD	Mean	SD
	10.72	±1.36	9.23	±1.60
Mediations used	Inhaled steroids+Montelukast		Inhaled steroids+Montelukast	

Data are expressed as Mean±SD

Table 2: Comparison between PFT parameter in group I and II before and after 6 months of a weigh reduction diet (in group I)

	Group I			Group II		
	Before	After		Before	After	
Parameters	Mean±SD		p-value	Mean±SD		p-value
FVC	75.67±3.5	97.22±7.22	0.001	87.90±9.17	95.25±11.8	0.07
FEV_1	75.94±9.9	94.40±10.03	0.001	87.16±12.13	92.52±12.1	0.03
PEF	61.29±13.06	78.12±12.46	0.001	75.60±7.56	78.40±9.16	0.05
FEF 25.75%	55.30±10.5	77.06±10.4	0.001	67.93±12.4	69.37±10.15	0.61

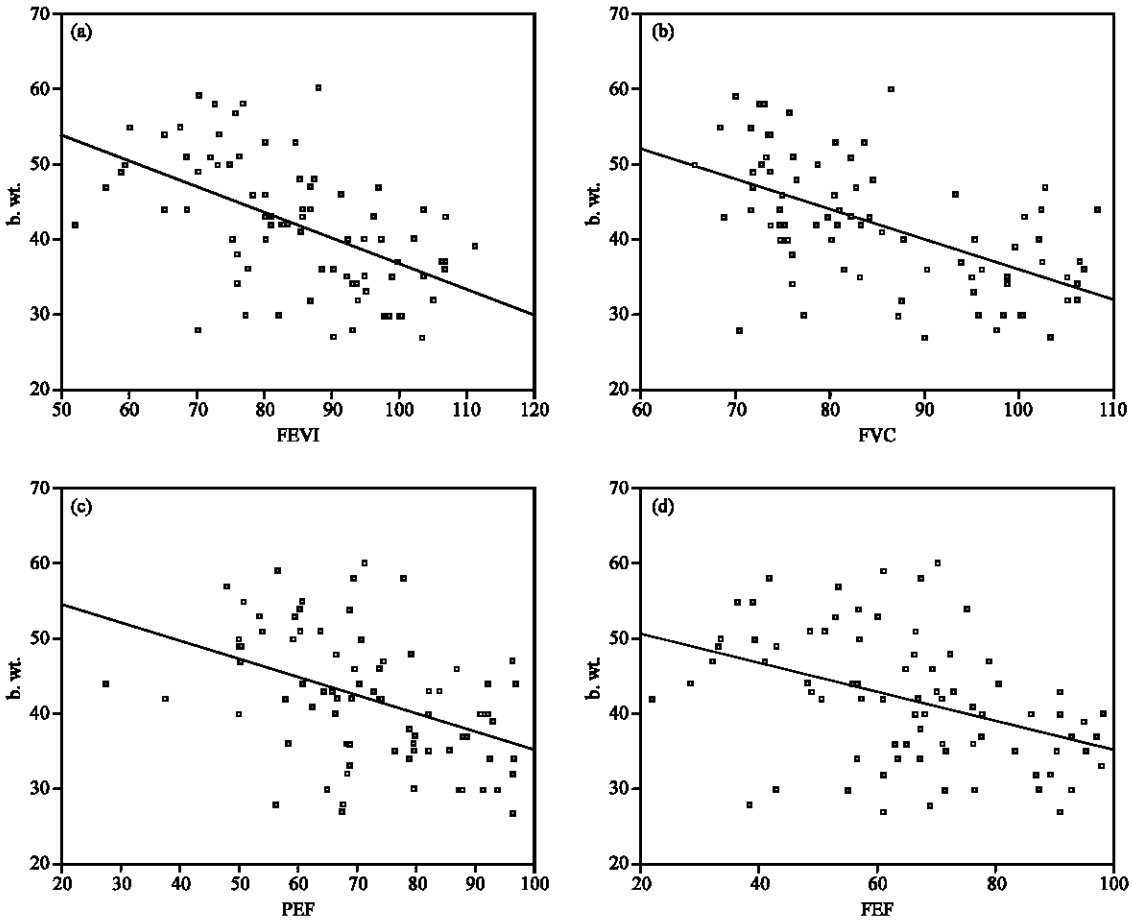

Fig. 1: The correlation graphs represented in a scattered dot graph with the vertical column presenting the body weight and the horizontal column presenting the (a) FEV1, (b) FVC, (c) PEF and (d) FEF, respectively

Table 3: Comparison between PFT of both group I and II at the end of the study

Parameters	Group I ---------- Mean±SD	Group II ----------	p-value
FVC	97.20±7.2	95.25±11.8	0.18
FEV_1	94.40±10.03	95.52±12.1	0.32
PEF	78.12±12.4	78.40±9.16	0.45
FEF 25.75%	77.06±10.4	69.37±10.15	0.0006

Table 4: Correlation between b.wt. and PFT in group I

Parameters	r	Significant
Weight	1.000	0.000
FVC	-0.568*	0.000
FEV1	-0.540*	0.000
PEF	-0.429*	0.000
FEF	-0.417*	0.000

*Correlation is significant at the 0.01 level (2-tailed)

Seeing the results of PFT of both groups after 6 months of a proper weight reduction diet, there's no statistical significant difference in all parameters except in the FEF 25-75 (Table 3).

There was a negative correlation between the body weight and the PFT levels in all parameters in Group I before loosing weight with a p-value of 0.0001 in all parameters (Table 4, Fig. 1a-d).

DISCUSSION

Asthma is the most prevalent chromic illness of childhood and has a major impact on lifestyle (Ostrom *et al*., 2005). Also obesity is a major cause of morbidity in children and a number of prospective studies have shown that weight gain can precede the development of asthma, (Gidding *et al*., 1995; Rajeshwari *et al*., 2005; Nicklas *et al*., 2004). There is evidence of a positive association between asthma and obesity in adults and children (Hammerman *et al*., 2002; Hong and Mahamitra, 2005; Locke and Marks, 2007).

Comparing both groups I and II at the beginning of the study regarding their PFT, we found that Group II had higher values than Group I in all parameters (FVC, FEV, PEF and FEF 25-75) with p-values (0.001, 0.004, 0.001 and

0.001, respectively) and this proves that non obese patients had better Spirometric values than obese patients of the same class (moderate persistent asthma).

These results agree with studies which found that increased obesity leads to move severe asthma (Hammerman *et al*., 2002; Hong *et al*., 2005; Laforest *et al*., 2006).

Also there was a marked statistically significant difference between all parameters of PFI in Group I before and after loosing weight with a p-value of FVC, FEV, PEF and FEF25-75 being 0.001, these results proved that PFT results were much better after losing weight.

These results agree with studies that found that increased obesity leads to more severe asthma and that weight reduction improves asthmatic symptoms (Belessis *et al*., 2004; Damore *et al*., 2008).

Also results partially agree with Laforest *et al*. (2006), who said that there is no association between obesity and asthma in young children, however there is a relation between obesity and asthma in girls who were over weight at the age of 6-11 being more at risk of developing asthma at the age of 11-13 (Lyell *et al*., 2005).

Now comparing the PFT results of both group I and II at the end of the study, after Group I patients lost weight, regarding FVC, FEV, PEF and FEF 25-75%, there were insignificant difference with a p-value being, (respectively) this proves that when the obese patients lost weight and become in the normal range they had nearly similar results as the non obese.

This is supported by studies which conclude that therapies targeting weight loss may provide an approach to asthma treatment (Shore and Fredberg, 2005; Vollmer *et al*., 1999).

Correlation between body weight with PFT (FVC, EEV, PEF and PEF 25-27%) at the beginning of the study in Group I showed a negative correlation in all parameters with a p-value of 0.0001, proving that the more the body weight the less the PFT levels.

CONCLUSION AND RECOMMENDATION

In the light of evidences found, we conclude the nature of the relationship; obesity is a cause of poor asthma control and asthmatics are more liable to sedentary life (due to their recurrent asthmatic attacks which limits their exercise ability) and thus to obesity.

Also weight reduction programs can be used as an adjunctive to decrease the need for medications and to improve the quality of life in obese patients with persistent asthma.

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