

Association between Asthma Severity and Body Mass Index in Pediatric Allergy Clinic in Mashhad

Fatemeh Behmanesh, Mohammad Khaje Daluee, Mina Sadat Mohajerzadeh

Mashad University of Medical Science, Paediatric Department, House No. 2-25 Azadi Street-Sajjad Blv, Mashad 91879-75859, Khorasan, Iran

Abstract

Citation: Behmanesh F, Daluee MK, Sadat Mohajerzadeh MS. Association between Asthma Severity and Body Mass Index in Pediatric Allergy Clinic in Mashhad. *Maced J Med Sci.* 2010;3(2):XXX-XXX. doi:10.3889/MJMS.1957-5773.2010.0097.

Key words: Body Mass Index; children; severity of asthma.

Correspondence: Fatemeh Behmanesh, MD, Mashad University of Medical Science, Paediatric Department, House No. 2-25 Azadi Street-Sajjad Blv, Mashad 91879-75859, Khorasan, Iran. E-mail: behmaneshf@mums.ac.ir

Received: 05-Jan-2010; Revised: 28-Mar-2010; Accepted: 28-Mar-2010; Online first: 07-Apr-2010

Copyright: © 2010 Behmanesh F. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Competing Interests: The authors have declared that no competing interests exist.

Introduction: Increase in the prevalence of obesity and asthma over recent decades has been reported in the literature. Various studies have shown a correlation between increased body mass index (BMI) and asthma prevalence.

Objective: The aim of this study was to determine whether there is a correlation between BMI and the severity of childhood asthma, which had been reported by limited studies before.

Methods: We undertook a cross-sectional study in outpatient Allergy Clinic at a University Hospital in Mashhad. BMI was calculated from recorded values of height and weight by the equation $BMI = \text{weight (kg)} / [\text{height (m)}]^2$. Asthma severity was defined by using the 2009 guidelines for asthma management and prevention, according to patient's clinical parameters.

Results: A total of 242 patients, with a mean age of 55.91 ± 38.10 months were included. Forty point seven percent of the patients were females and the remaining 59.3% were males. Patients were presented with intermittent asthma, mild persistent asthma, moderate persistent asthma, and severe persistent asthma in 6.4%, 47.3%, 43.8%, and 2.5% respectively. We divided our patients to 3 groups according to age (group I <5 years old, group II, 5-10 years old, group III > 10 years old). In group I, severity of asthma and BMI were inversely related. In group II, correlation between BMI and severity of asthma was statistically insignificant. In group III, we found statistically significant relationship between values of BMI percentiles and severity of asthma.

Conclusion: Our findings suggest that the association between severity of asthma and BMI differ between adolescent and children.

Introduction

Obesity and asthma have emerged as chronic health problems among the pediatric population [1]. The rise of obesity parallels the rise of asthma and hypothesis has been proposed that obesity could be a risk factor for asthma [2]. Asthma seems to be more prevalent in subjects with an increased body mass index (BMI), whereas weight reduction in obese patients markedly improves asthma and reduces medication needs [3]. Various studies have shown a correlation between increases

in body mass index and asthma prevalence in adults [4-6] but only a few studies have addressed obesity and asthma in children [7].

In a cross sectional study von Mutius and colleagues found a positive association between BMI and asthma risk [8]. In the Tucson study, girls becoming overweight or obese between ages 6 and 11 years were at a sevenfold increased risk for asthma [9]. Mechanical effects, higher frequency of gastric esophageal reflux, and immunological and inflammatory events correlates in

addition to a shared genetic basis [3,10].

The aim of this study was to determine whether there is a correlation between BMI and the severity of asthma.

Patients and Methods

Patients

This was a cross-sectional study and patients were examined by the pediatric allergist at the Allergy Clinic in Mashhad (North East of Iran). The study was conducted between November 2008 and June 2009. Two hundred forty two pediatric asthmatic patients aged 5 months to 17 years were included.

We diagnosed asthma by patient history, and details of history related to current asthma exacerbation, nocturnal and diurnal clinical signs and symptoms as well as parental asthma or history of parental atopy. Patients with chronic obstructive lung diseases; mainly cystic fibrosis, were excluded.

Asthma severity was defined by using the guide for asthma management and prevention 2009 guidelines, according to patients' clinical parameters. Patients were considered as either being mild intermittent, mild persistent, moderate persistent, or severe persistent asthmatics.

Mean BMI was calculated for each group. BMI was calculated by dividing weight in kg, by the square of the height in meters {weight in kg/ (height m)² }.

The BMI percentile for age was used for classification of patients. Underweight is defined by BMI <5th percentile. Normal weight by a BMI 5th-84th percentile, at risk overweight by a BMI 85th – 94th percentile and overweight by a BMI³ 95th percentile.

Statistical analysis

The study of the association as well as correlation between asthma severity and BMI were conducted using the ANOVA and Spearman correlation tests. Ninety five percent confidence intervals for BMI means in patients categorized as having mild intermittent, mild persistent, moderate persistent and severe persistent were also calculated. Quantitative variables were expressed as mean \pm SD. All analyses were performed by SPSS software version 16. P value <0.05 was considered as significant.

Results

The study enrolled two hundred forty two pediatric patients with a mean age of 55.9 ± 38.1 months (range 5-204 months). Forty point seven percent of the subjects were females and 59.3 percent were males (Table 1).

Table1: Demographic characteristics of the study population.

Characteristics		p- value
Sex		
Girl (%)	(40.7)	0.001
Boy (%)	(59.3)	
Age (mean \pm SD) month		
Girl	59.67 ± 38.02	0.06
Boy	53.33 ± 38.06	
<5 y (%)	(57.6)	
5-10 y (%)	(36.3)	
> 10 y (%)	(6.1)	
Weight (mean \pm SD) kg		
Girl	19.45 ± 10.98	0.98
Boy	19.41 ± 10.09	
Height (mean \pm SD) m		
Girl	109.61 ± 22.05	0.56
Boy	107.98 ± 21.59	
BMI (mean \pm SD) kg/m ²		
Girl	15.91 ± 3.19	0.02
Boy	16.72 ± 2.44	
Asthma severity		
1	(6.4)	<0.001
2	(47.3)	
3	(43.8)	
4	(2.5)	

BMI mean was higher in males compared to females which was statistically significant ($p=0.003$) (Table 2).

Table 2: Association between BMI and gender.

Gender	BMI
Female	15.90 ± 3.19
Male	16.72 ± 2.44
Total	16.38 ± 2.80

Asthma severity frequency among the patients was as follows: 6.4% patients had mild intermittent asthma, 47.3% had mild persistent asthma, 43.8% had moderate persistent asthma and 2.5% had severe persistent asthma.

We divided our patients to 3 groups according to age (group I <5 year age) group II, 4-10 years age; group III > 10 years age. (Table 3, 4, 5). There was an inverse correlation between asthma severity and BMI in patients

Table3: Association between BMI and severity of asthma in children under 5 years.

Asthma severity	Weight (kg) mean \pm SD	Height (m) mean \pm SD	BMI (kg/m ²) mean \pm SD
1	13.2 \pm 3.54	88.10 \pm 12.81	17.11 \pm 1.93
2	13.0 \pm 5.7	90.63 \pm 12.22	16.01 \pm 1.65
3	14.87 \pm 4.38	97.97 \pm 11.86	15.40 \pm 1.94
4	17.00	104.00	15.71
p-value	0.18	0.007	0.04

as a whole but it was not statistically significant ($r=-0.06$, $P=0.39$).

Table4: Association between BMI and severity of asthma in children between 5-10 years old.

Asthma severity	Weight (kg) mean \pm SD	Height (m) mean \pm SD	BMI (kg/m ²) mean \pm SD
1	24.50 \pm 3.41	120.0 \pm 7.83	16.95 \pm 0.21
2	24.65 \pm 9.77	123.93 \pm 17.49	16.24 \pm 3.95
3	23.90 \pm 7.10	119.59 \pm 10.92	16.48 \pm 3.05
4	25.9 \pm 5.64	126.4 \pm 12.66	16.05 \pm 1.06
p-value	0.94	0.41	0.95

In group I, we found statistically significant inverse correlation between BMI and severity of asthma ($r=-0.21$, $P=0.04$). In group II, we found inverse correlation between BMI and severity of asthma but it was not statistically significant ($r=-0.07$, $P=0.95$). In group III, we found statistically significant direct correlation between BMI and asthma severity ($r=0.59$, $P=0.01$).

Table5: Association between BMI and severity of asthma in children >10 years old.

Asthma severity	Weight (kg) mean \pm SD	Height (m) mean \pm SD	BMI (kg/m ²) mean \pm SD
1	29.5 \pm 4.94	139.0 \pm 9.89	15.20 \pm 0.39
3	41.29 \pm 8.67	149.25 \pm 6.38	14.44 \pm 3.17
4	69.50	155.0	28.22
p-value	0.01	0.12	0.01

Discussion

Despite the recent findings suggesting that obesity by itself might be considered as an inflammatory condition, and generally approved fact that asthma is an inflammatory process, association between the two conditions is not well understood [11-13].

The design of this study enables a comparison between children with a "visible" chronic condition and children with no "visible" chronic condition [1]. Moreover, both cross-sectional and longitudinal studies have attempted to document a link between these two chronic disorders [14-16].

Although previous studies have attempted to show a relation between asthma prevalence and obesity,

and evaluated the correlation between obesity and asthma without considering the severity of the underlying disease, our study suggests a relationship between the degree of asthma severity and body mass index, which had been reported by limited studies before.

In this study, BMI was modeled as our primary surrogate of total body fat. The usefulness of this measure in children has been criticized.

The results of this study showed that in group III of asthmatic patients (>10 years) with increasing of asthma severity the BMI increased too.

Akerman et al undertook a retrospective medical record review of 143 adult patients at an inner-city academic asthma center. They found that the prevalence of obesity was significantly increased with increasing asthma severity ($P<0.0002$) [17]. This study confirmed the findings of previous studies that higher BMI is associated with an increased severity of asthma in adolescents.

A previous study on adults showed a linear relationship between asthma severity and BMI [18] and another study on adolescents in Brazil showed that there is a positive association between obesity and asthma severity [19].

Thus the relation between BMI and asthma may reflect the predisposition of an asthmatic adolescent to gain weight because of reduced exercise tolerance rather than a causal association between a high BMI and severity of asthma. Finally, interventions that aim to prevent excessive weight gain in the adolescents are especially important for healthy development and may also help to reduce asthma and overweight or obesity-related morbidity in adolescents.

The results of this study showed that in some groups of asthmatic patients (5-10 years) there is no association between the increased BMI and severity of asthma same as previous study that showed the BMI was not associated with asthma severity in pediatric patients [20].

The results of this study also showed that in group I of asthmatic patients (<5 years) there was inverse correlation between BMI and severity of asthma which was statistically significant ($P<0.05$). Our analysis also revealed that an association between being underweight and asthma appears to occur early in the life course.

It is possible that among some of the children in our sample, nutritional and growth restriction occurring during these periods could have contributed to abnormal

lung growth and asthma. The association we observed between being underweight and severity of asthma among patients under 5 years old needs to be further explored with a larger study, which should utilize both continuous and categorical measures of BMI and include assessments of gestational age and weight at birth.

Our study also suggests that the association between severity of asthma and BMI differs between adolescent and children and also suggests that asthma in children especially under 5 year age is more frequent in underweight subjects.

A previous study showed indirect relationship between asthma severity and BMI which was statistically significant ($P < 0.005$). The authors observed negative association between BMI and asthma severity in adults [21] and previous investigation has found association between being underweight and asthma in adults and adolescents [22, 23].

In summary, we found that increase of BMI is related to worsening of asthma severity in adolescent asthmatic patients. On the other hand, in patients less than 5 years decrease of BMI is related to increased asthma severity.

Conclusion

Our study showed that obesity is a risk factor for severity of asthma in adolescent but not in patients under 5 year of age. We found statistically significant correlation between BMI and gender. Further studies are needed in order to improve understanding of the correlation between these two conditions.

Acknowledgement

This project was supported by a grant from the Vice Chancellor Of Research, Mashhad University Of Medical Sciences. We would like to thank Dr. Ramin Sadeghi for editing the paper.

References

1. Weiss ST, Shore S. Obesity and asthma: directions for research. *Am J Respir Crit Care Med.* 2004;169(8):963-8. [doi:10.1164/rccm.200303-403WS](https://doi.org/10.1164/rccm.200303-403WS) PMID:14742299.
2. Tantisira KG, Weiss ST. Complex interactions in complex traits: obesity and asthma. *Thorax.* 2001;56 Suppl 2:ii64-73. PMID:11514709.
3. Beuther DA, Weiss ST, Sutherland ER. Obesity and asthma. *Am J Respir Crit Care Med.* 2006;174(2):112-9. [doi:10.1164/rccm.200602-231PP](https://doi.org/10.1164/rccm.200602-231PP) PMID:16627866.
4. Schachter LM, Salome CM, Peat JK, Woolcock AJ. Obesity is a risk for asthma and wheeze but not airway hyperresponsiveness. *Thorax.* 2001;56(1):4-8. [doi:10.1136/thorax.56.1.4](https://doi.org/10.1136/thorax.56.1.4) PMID:11120896.
5. Akerman MJ, Calacamis CM, Madsen MK. Relationship between asthma severity and obesity. *J Asthma.* 2004;41(5):521-6. PMID:15360059.
6. Luder E, Melnik TA, Dimaio M. Association of being overweight with greater asthma symptoms in inner city black and Hispanic children. *J Pediatr.* 1998;132(4): 699-703. [doi:10.1016/S0022-3476\(98\)70363-4](https://doi.org/10.1016/S0022-3476(98)70363-4) PMID:9580773.
7. Adkinson NF, Bochner BS, Busse WW. Epidemiology of asthma and allergic disease. Tung EA, Matsui E, Wiesch DG. *Middleton's Allergy.* Mosby Elsevier, 2009:740.
8. von Mutius E, Schwartz J, Neas LM, Dockery D, Weiss ST. Relation of body mass index to asthma and atopy in children: the National Health and Nutrition Examination Study III. *Thorax.* 2001;56(11):835-8. [doi:10.1136/thorax.56.11.835](https://doi.org/10.1136/thorax.56.11.835) PMID:11641506.
9. Castro-Rodríguez JA, Holberg CJ, Morgan WJ, Wright AL, Martinez FD. Increased incidence of asthmalike symptoms in girls who become overweight or obese during the school years. *Am J Respir Crit Care Med.* 2001;163(6):1344-9. PMID:11371399.
10. Weiss ST. Obesity: insight into the origins of asthma. *Nat Immunol.* 2005;6(6):537-9. [doi:10.1038/ni0605-537](https://doi.org/10.1038/ni0605-537) PMID:15908930.
11. Kelly A, Marcus CL. Childhood obesity, inflammation, and apnea: what is the future for our children? *Am J Respir Crit Care Med.* 2005;171(3):202-3. [doi:10.1164/rccm.2412001](https://doi.org/10.1164/rccm.2412001) PMID:15668301.
12. Busse WW, Lemanske RF. Asthma. *N Engl J Med.* 2001;344(5):350-62. [doi:10.1056/NEJM200102013440507](https://doi.org/10.1056/NEJM200102013440507) PMID:11172168.
13. Tantisira KG, Litonjua AA, Weiss ST, Fuhlbrigge AL; Childhood Asthma Management Program Research Group. Association of body mass with pulmonary function in the Childhood Asthma Management Program (CAMP). *Thorax.* 2003;58(12):1036-41. [doi:10.1136/thorax.58.12.1036](https://doi.org/10.1136/thorax.58.12.1036) PMID:14645968.
14. Kasper DL, Braunwald E, Fauci AS, et al. *Harrison's principles of internal medicine* 16th ed. Philadelphia: MC Graw Hill 2005. Vol. 2:1508-1516.
15. World Health organization. Controlling the global obesity epidemic. 2001.
16. Gennuso J, Epstein LH, Paluch RA, Cerny F. The

- relationship between asthma and obesity in urban minority children and adolescents. *Arch Pediatr Adolesc Med*. 1998;152(12):1197-200. [PMID:9856429](#).
17. Akerman MJ, Calacanis CM, Madsen MK. Relationship between asthma severity and obesity. *J Asthma*. 2004;41(5):521-6. [doi:10.1081/JAS-120037651](#) [PMID:15360059](#).
18. Tavasoli S, Heidarnazhad H, Kazemnejad A, Miri S. Association between Asthma Severity and Obesity in Two Asthma Clinics in Tehran. *Iran J Allergy Asthma Immunol*. 2005;4(4):179-83. [PMID:17301443](#).
19. Cassol VE, Rizzato TM, Teche SP, Basso DF, Centenaro DF, Maldonado M, Moraes EZ, Hirakata VN, Solé D, Menna-Barreto SS. Obesity and its relationship with asthma prevalence and severity in adolescents from southern Brazil. *J Asthma*. 2006;43(1):57-60. [doi:10.1080/02770900500448597](#) [PMID:16448967](#).
20. Hom J, Morley EJ, Sasso P, Sinert R. Body mass index and pediatric asthma outcomes. *Pediatr Emerg Care*. 2009;25(9):569-71. [doi:10.1097/PEC.0b013e3181b4f639](#) [PMID:19755889](#).
21. Nadi E, Zeraati E, Ansari M, et al. Association of asthma severity with body mass index among adults. *Acta Medica Iranica*. 2007;45(5):383-388.
22. Schachter LM, Peat JK, Salome CM. Asthma and atopy in overweight children. *Thorax*. 2003;58(12):1031-5. [doi:10.1136/thorax.58.12.1031](#) [PMID:14645967](#).
23. Lusky A, Barell V, Lubin F, Kaplan G, Layani V, Shohat Z, Lev B, Wiener M. Relationship between morbidity and extreme values of body mass index in adolescents. *Int J Epidemiol*. 1996;25(4):829-34. [doi:10.1093/ije/25.4.829](#) [PMID:8921463](#).