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Research Article

**ASSOCIATION BETWEEN BRONCHIAL ASTHMA CONTROL WITH  
BMI IN CHILDREN IN SAUDI ARABIA**

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**Abstract:**

**Background:** Most Saudi asthmatic children/adolescents visiting the ED had poor control of symptoms; indeed, none achieved complete control, which is related to deficient medication compliance and improper medication inhaler device use; deficient knowledge about asthma was also another factor hindering control. The objective from this study to analyze the relationship between obesity (measured by body mass index) and asthma control in the children known to have bronchial asthma.

**Method:** A cross-sectional study was carried out in ten primary and intermediate schools in Saudi Arabia. A self-administered questionnaire for parents with asthmatic children was sent with each school pupil, to be filled by one of his parents at home and then to be returned on the next day. The questionnaire responses were analyzed using the Statistical Package for the Social Science (SPSS Inc. Chicago, IL, USA) version 20.

**Result:** 68% of the parent's education level was intermediate and secondary school. Obese children with uncontrolled asthma were higher than obese children with controlled asthma (33.3%) ( $P < 0.05$ ). 23.1% of children with uneducated parents have uncontrolled bronchial asthma, compared to other children with primary, intermediate, secondary, and graduated parents. ( $P < 0.05$ ). Dust triggers bronchial asthma in 80% of the patients either alone or coexisted with other triggering factors. Only (11%) of asthmatic children use peak flow meter while the majority of them, which is about (61%), did not use it. Furthermore, about (28%) of parents with asthmatic children did not know this meter.

**Conclusion:** Abnormal BMI associated with poor control of bronchial asthma among children, the higher the BMI, the poorer control of bronchial asthma, at the same time, underweight BMI children will suffer of poor control of bronchial asthma. Parental education proportionally associated with bronchial asthma control. We need more efforts among pediatricians and physicians to increase awareness of importance and use of Peak Flow Meter.

**Key words:** Bronchial Asthma, Control, Body Mass Index, Childhood.

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**INTRODUCTION:**

Bronchial asthma is a heterogeneous disorder of the conducting airways involving chronic airway inflammation, declining airway function and tissue remodeling [1]. Asthma is a condition whereby one's airways can narrow and produce extra mucus causing symptoms of coughing, wheezing and shortness of breath [2]. The prevalence of asthma has rapidly increased over the last few decades to epidemic proportions and there are now an estimated 300 million individuals of all ages, ethnic groups and countries suffering from bronchial asthma, a total that is expected to rise dramatically over the next 15-20 year [1]. It is one of the most common chronic diseases in Saudi Arabia, affecting more than 2 million Saudis [3-5]. Its impact is manifested in patients, their families, and the community as a whole in terms of lost work and school days, poor quality of life, frequent emergency department (ED) visits, hospitalizations, and deaths. Asthma is associated with enormous healthcare expenditures and, despite the advances in effective therapy, the consequential economic burden associated with disease control and morbidity continues to escalate [6]. It is estimated that around 250,000 people die prematurely each year as a result of asthma. Concepts of asthma severity and control are important in evaluating patients and their response to treatment [1]. There is increasing and convincing epidemiological evidence of an association between obesity and asthma. Cross-sectional studies almost uniformly show an increased prevalence of asthma in obese subjects as compared with their leaner counterparts, both in adults and in children [7]. An even more important question is why asthma symptoms in obese patients are often so difficult to control [8]. Obese patients with asthma are indeed less responsive to standard asthma therapy and remain uncontrolled even when prescribed high doses of inhaled corticosteroids [9]. Weight gain and obesity have been associated with many chronic conditions like diabetes, hypertension and sleep apnea. Asthma can now be added to this list of chronic conditions affected by obesity. An increase in asthma has been seen in both children and adults with obesity, particularly among women. Obesity itself is now listed as a risk factor for the development of asthma. A person who is affected by obesity has a higher chance of developing asthma that responds less well to medications. A clear-cut relationship has also been described whereby the higher one's weight, the higher one's chances of developing asthma. Obesity has specifically been associated with an increase in daily asthma symptoms, missed workdays, an increased use of bronchodilator medications and an increased risk of hospitalization

[2]. There is a relationship between the trend towards obesity and asthma. Moreover, it has been reported that asthma symptoms are associated with obesity [10]. Different hypothesis has been proposed regarding this relationship between obesity and asthma, one hypothesis relies on the facts that obesity leads to a decrease in lung volumes including the tidal volume which may increase airway obstruction, adipose tissue derived hormones and cytokines such as leptin, adiponectin, tumor necrosis factor and interleukins that play an inflammatory role [11]. Adipose tissue produces a number of mediators, termed adipokines, which have significant metabolic effects. One of these adipokines, adiponectin, is actually decreased in the obese. Primary metabolic effects of adiponectin are on glucose regulation and fatty acid metabolism; adiponectin is also anti-inflammatory [12,13]. The normocaloric dietary intervention was associated with improved Asthma Related Quality of Life and some asthma control. Dietary programs may serve as a complementary non-pharmacologic therapeutic strategy in obese adolescents who have asthma [14]. Dietary intervention can induce acute weight loss in obese asthmatic children, with improvements in static lung function, asthma control, and self-reported quality of life. Systemic and airway inflammation did not change after weight loss [14]. Obese children were more symptomatic than non-obese children were. Obese children reported more cough and wheezing than non-obese children. Asthma, as diagnosed by physician and inhaler use, was more common among obese children than non-obese children [15]. On the other hand, childhood obesity is one of the most serious public health challenges of the 21st century. The problem is global and is steadily affecting many low- and middle-income countries, particularly in urban settings. The prevalence has increased at an alarming rate [16]. Globally, in 2015 the number of overweight children under the age of five, is estimated to be over 42 million, at the same time, overweight and obese children are likely to stay obese into adulthood. Overweight and obesity, as well as their related diseases, are largely preventable. Prevention of childhood obesity therefore needs high priority [17]. Saudi Arabia the National Growth Study showed that the overall prevalence of obesity in children and adolescents from 5 to 18 years was 11.3% [18,19].

**METHODS:**

We have conducted a descriptive cross-sectional study in twelve primary and intermediate schools in Saudi Arabia. The study was conducted during the period from January to October 2018. The schools were selected by random sampling. Sampling was

stratified for the different geographical areas. Our study included children with bronchial asthma aged 5-16 years old.

We recruited 400 child with bronchial asthma, and a self-administered questionnaire, previously validated [20], require information about: (symptom of bronchial asthma regarding severity and control, and most common causes of exacerbations) was sent with each pupil to his parents, to be filled by one of them and then to be returned back on the next day. A letter that explains the objectives of the study and asks for parental consent was sent with the questionnaire. Each pupil's weight and height measured by medical professional and well trained students, then Body Mass Index (BMI) was calculated as  $\text{Weight} / \text{Height}^2$ . BMI classified to Underweight, Normal, Overweight and Obese according to Saudi growth charts of BMI.

The questionnaire responses were analyzed using the Statistical Package for the Social Science (SPSS Inc. Chicago, IL, USA) version 20. Categorical variables were described by frequencies and percentages. Descriptive analysis involving Chi-square test was used to test significance of association between categorical variables. The level of significance was set at  $P < 0.05$ . Official letters were sent to the selected primary and intermediate schools. Parents of the pupils were asked to give their written consents before participation in the study.

### RESULTS:

Table 1 shows general characteristics of the participants and their parents. Age of participants ranged from 5 to 14 year old, with a mean (SD) of 9.70 (2.81), the majorities were male (68.5%), and (68%) of the parents education level was intermediate and secondary school.

Table 2 shows significant relation between bronchial asthma control and BMI ( $P < 0.05$ ). Of total 400 participants, (37%) were under weight, (37%) were

normal, (14%) were overweight, (12%) were obese. within underweight participants, (43.2%) of them were controlled, (43.2%) were partially controlled, (13%) were uncontrolled. For normal BMI children, (51.4%) of them were good control, (43.2%) were partially controlled, (5.4%) and were uncontrolled. For overweight children, (57.1%) of them were good control, (21.45%) were partially controlled, (21.45%) were uncontrolled. For obese children (50%) of them were control, (16.7%) were partially controlled, (33.3%) and were uncontrolled.

Obese children with uncontrolled bronchial asthma were higher than obese children with controlled bronchial asthma. While normal BMI children with controlled bronchial asthma higher than normal BMI children with uncontrolled bronchial asthma. overweight children with uncontrolled asthma higher than overweight children with controlled asthma. Under weight children with controlled and uncontrolled bronchial asthma were nearly equal. Table 3 shows significant relation between bronchial asthma control and level of parent's education ( $p < 0.05$ ). (23.1%) of children with uneducated parents have uncontrolled bronchial asthma, compared to other children with primary, intermediate, secondary, and graduated parents (00.0%), (10%), (15.8%), and (14.3) respectively. No significant relation between bronchial asthma control in child and gender.

Table 4 shows the prevalence of triggering factors in the study population. Dust triggers bronchial asthma in 80% of the patients either alone or coexisted with other triggering factors. As same as for common cold (49%) cigarette smoking (46%) and cold weather (43%). Table 5 shows the use and knowledge of Peak Flow Meter. Asthmatic children who use peak flow meter were (11%), children who do not use it were (61%), and children who did not know about it were (28%).

**Table 1: General characteristics of the participants (n= 400)**

Character		
Age	Mean (SD) (y)	9.70 (2.81)
	Range (y)	5 - 14
Gender	Male (n (%))	274 (68.5%)
	Female (n (%))	126 (31.5%)
Education	Not educated (n (%))	052 (13%)
	Primary/Intermediate/ Secondary (n (%))	292 (73%)
	Graduate (n (%))	056 (14%)
Income	Poor (n (%))	068 (17%)
	Average (n (%))	308 (77%)
	High (n (%))	024 (6%)

**Table 2: Bronchial asthma control in relation to BMI**

BMI	Control N (%)	Partial control N (%)	Uncontrolled N (%)	Total N (%)
Underweight	64(43.25%)	64(43.25%)	20(13.5%)	148(100%)
Normal	76(51.4%)	64(43.2%)	8(5.4%)	148(100%)
Overweight	32(57.1%)	12(21.4%)	12(21.4%)	56(100%)
Obese	24(50.0%)	8(16.7%)	16(33.3%)	48(100%)
Total N(%)	196(100%)	148(100%)	56(100%)	400(100%)

**Table 3: Bronchial asthma control in relation to education of parents**

Education	Controlled n (%)	Partially controlled n (%)	Uncontrolled n (%)	Total n (%)
Uneducated	24(46.1%)	16(30.8%)	12(23.1%)	52(100%)
Primary\ Intermediate\ Secondary School	152(52%)	104(35.6%)	36(12.4%)	292(100%)
Graduated	20(35.7%)	28(50%)	8(14.3%)	56(100%)
Total n(%)	196(100%)	148(100%)	56(100%)	400(100%)

**Table 4: Prevalence of triggering factors in the study population (n=400)**

Triggering Factors	(n)	%
Dust	320	80%
Common Cold	196	49%
Cigarette Smoking	184	46%
Cold Weather	172	43%
Physical Activity	88	22%
Pits	64	16%
Pollens	28	7%

**Table 5: Knowledge and use of Peak Flow Meter**

Is the asthmatic Px using Peak Flow Meter	n=400	%
Yes	44	11
No	244	61
I do not know it	112	28
Total	400	100

**DISCUSSION:**

Asthma in children is a leading cause of emergency department visits, hospitalizations and missed school days. Unfortunately, childhood asthma can't be cured, and symptoms may continue into adulthood. But with the right treatment, you and your child can keep symptoms under control and prevent damage to growing lungs [21]. In this study, uncontrolled bronchial asthma measured by GINA guide lines of bronchial asthma severity and control. Based on our finding, Obese children have the highest rate of uncontrolled bronchial asthma (33.3%) compared to overweight, and underweight children who have uncontrolled bronchial asthma were (21.4%), and (13.5%) respectively. Children with normal BMI with uncontrolled bronchial asthma were (5.4%). Similar finding were reported in other countries suggest that childhood obesity is associated with increased risk of worse bronchial asthma control and exacerbation [22]. Other similar finding that Results identify higher BMI and obesity as potential behavioral factors related to worse asthma control and quality of life, but not asthma severity, and suggest important avenues for asthma management and control initiatives [23]. This study showed that, obese, overweight, and underweight children associated with more uncontrolled bronchial asthma, in both genders, but more in female than in male. Another study showed that higher BMI was associated with more symptom days and exacerbations among females only [24]. Other study suggests that there is no statistically significant association between asthma control and BMI [25]. In this study, the majority of parents education level was intermediate and secondary school (68%), graduated parents and parents with basic education have less children with uncontrolled bronchial asthma compared to uneducated parents who have more children with uncontrolled bronchial asthma. A study done among children diagnosed with bronchial asthma, demonstrated that children from families with lower education used fewer controller medications than those whose parents were college graduates [26]. The prevalence of triggering factors also explored, the most common triggering factors were dust, common cold. A study done in Tabuk city showed that the most common triggering factors of bronchial asthma exacerbation were URTI, and dust [27]. It is important to be aware of the common triggering factors in our area to help to control asthma symptoms and decrease the hospitalization by advising patients about the needed techniques for reducing any allergen exposure. Given the increasing morbidity and mortality of asthma, it is clear that

therapeutic efforts should be focused on identifying relevant allergens and advising patients about techniques for reducing exposure [28]. Measuring peak flow rate in asthma episodes helps to determine the severity of exacerbations and assists in guiding therapeutic decisions in the home, school, practitioner's office, and emergency department [29]. Based on the findings in this study, only (11%) of asthmatic children use peak flow meter while the majority of them, which is about (61%), did not use it, and furthermore, about (28%) of parents with asthmatic children did not know this meter.

In conclusion, the majority of children with uncontrolled bronchial asthma were obese children. The most common triggering factors of bronchial asthma in Saudi Arabia were Dust followed by common cold. The majority of children whom parents were uneducated have uncontrolled bronchial asthma. As the majority of parents for children with bronchial asthma do not use PFM or do not know about it, we need more efforts to increase the awareness about PFM among parent for asthmatic children.

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