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Association Between Body Mass Index and Severity of Bronchial Asthma in Children

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ABSTRACT

Background

Bronchial asthma is a common chronic airway disease observed in children. This study was done to find the association of body mass index with bronchial asthma severity.

Methods

An analytical cross-sectional study was conducted at College of Medical Sciences-Teaching over a period of 1 years. This study evaluated 120 asthmatic children aged 5-15 years. All data obtained were entered to an Excel worksheet and were analyzed using SPSS software, version 16.0. Categorical variables were analyzed using Chi-square tests. ANOVA was used to study the mean BMI with the different categories of severity of asthma.

Results

Out of 120 patients, 67 (55.8%) were males and 53 (44.1%) were females. Among males, 10 (14.9%) had mild intermittent, 32 (47.7%) mild persistent, 22 (32.8%) moderate persistent, and 3 (4.4%) severe persistent asthma. Among females, 2 (3.7%) had mild intermittent, 24 (45.2%) mild persistent, 27 (50.9%) moderate persistent asthma(none severe).Overall , 102 (85%) were underweight, 18 (15%) normal weight; none were overweight/obese. Among underweight children, 11 (10.7%) had mild intermittent , 52 (50.9%) mild persistent , 36 (35.2%) moderate persistent while 3 (2.9%) had severe persistent asthma. Normal BMI children presented with: 1 (5.5%) mild intermittent, 4 (22.2%) mild persistent, 13 (72.2%) moderate persistent. Mean Body Mass Index in children with mild intermittent asthma, mild persistent asthma, moderate persistent asthma and severe asthma were 15.1 (SD 2.2), 14.8 (SD 2.8), 13.3 (SD 3.3) and 12.4 (SD 0.1) respectively and the relation was statistically significant (p=0.038).

Conclusions

The severity of bronchial asthma has a significant relation with the Body Mass Index, with the severity increasing as the index decreases.

Keywords: Asthma; Body Mass Index; Nepal; Child.

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INTRODUCTION

Bronchial asthma is chronic airway disease characterized by airway hyper responsiveness causing emergency hospitalization and missed school days in children.[1] Affecting over 300 million people globally, its prevalence continue to rise.[2-4] Symptoms like wheeze, shortness of breath and cough may be persistent or in many cases so intermittent posing a diagnostic challenge.[5] Diagnosis in such cases require Peak expiratory flow rate (PEFR) determination. Body mass index is a modifiable risk factor. Both the extremes of BMI negatively impact the respiratory system.[6-9] Underweight children have lower lung function and lower body fat, which were associated with higher occurrence of asthma symptoms. [6, 7] Conversely, obesity has been proposed to cause low grade systemic inflammation induced by leptin and adiponectin, which acts on lungs to exacerbate asthma.[10] This study aimed to study the association of body mass index and severity of bronchial asthma among children aged 5-15 years.

METHODS

Study Area

The study was conducted at College of Medical Sciences-Teaching Hospital, a tertiary care referral hospital situated in Central Nepal.

Study Design

A hospital-based analytical cross-sectional study was conducted over the period of 1 year.

Sample size and sampling

All eligible consecutive children of age group of 5-15 years who visited the hospital during the study period were included in the study. Bronchial asthma was diagnosed based on history, examination and Peak Expiratory Flow Rate (PEFR) based on the GINA guidelines during the first visit to the centre. Repeated PEFR measurements were done and only the newly diagnosed children not under medications were included in the study. Children with other causes of respiratory symptoms like pneumonia, foreign bodies, pleural effusion, tuberculosis, cardiac manifestation, congenital malformation or syndromic associations were excluded.

Data Collection

The study was conducted over a period of 1 years after ethical clearance was obtained from Institutional Review Committee, College of Medical Science-Teaching Hospital (Ref. No.: 2023-71). Anthropometric measurements, including weight and height of those patients was measured and body mass index was calculated using the ratio of weight (kg)/height(m2) and classified according to the age- and sex-specific percentiles defined by the US Centres for Disease Control and Prevention (CDC) according to which BMI less than 5th percentile is underweight, 5th to 85th Percentile is normal, 85th percentile to less than 95th percentile is overweight, and more than 95th percentile is obesity. Severity of asthma was categorized as per GINA on the basis of level of symptoms, airflow limitation, and lung function variability into different categories as intermittent, mild persistent, moderate persistent, and severe persistent (Table 1).[11]

Table 1: Severity of Asthma as per GINA.

Characteristics	Intermittent	Mild persistent	Moderate persistent	Severe persistent
Symptoms	Less than once a week	More than once a week but less than once a day	Daily	Daily
Exacerbations	Brief	May affect activity, sleep	May affect activity, sleep	Frequent
Nocturnal symptoms	Not more than twice a month	More than twice a month	More than once a week	Frequent
FEV1 or PEF	>=80%predicted	>=80%predicted	60-80%predicted	<=60%predicted
PEFR orFEV1 variability	<20%	20-30%	>30%	>30%

The PEFR was measured using miniature wright peak flow meter, a measure widely accepted in clinical practice.[12] The patients were asked to take maximum inspiration and then exhale forcibly into flowmeter with nose closed after satisfactory trial recordings were taken.

Data Analysis

All data obtained were entered to an Excel worksheet and were analyzed using SPSS software, version 16.0 (SPSS Inc., Chicago, IL). Categorical variables were expressed as numbers and percentage while numerical values were summarized with mean and standard deviation. Categorical variables were analyzed using Chi-square tests. ANOVA was used to study the mean BMI with the different categories of severity of asthma.

RESULTS

Out of 120 patients, 67 (55.8%) were males and 53 (44.1%) were females with the Male: Female ratio of 1.2:1. Age group was distributed such that 80 (66.7%) children were of age 5-8 yrs, 33 (27.5%) above 8 till 12 years, and 7 (5.8%) above 12 till 15 years age. Low birth weight was reported in 73 (60.8%) of the patients whereas 47 (39.2%) were reported to have normal birth weight. (Table 2)

Table 2: Demographics of the patients (n=120).

Characteristics	Frequency n (%)
Sex	
Male	67 (55.8)
Female	53 (44.1)
Age group (years)	
5-8	80 (66.7)
8-12	33 (27.5)
12-15	7 (5.8)
Low birth weight	73 (60.8)
Normal birth weight	47 (39.2)

As per the calculated BMI out of 120 patients, 102 (85%) fell into underweight category, 18 (15%) in normal weight category, none in overweight category. Among males, 59 (88%) were underweight, 8 (11.9%) were normal weight and among females 43 (81.1%) were underweight, 10 (18.86%) were normal weight. (Table 3).

Table 3: BMI distribution as per gender (n=120).

Sex	Normal BMI n (%)	Underweight n (%)
Male	59 (88.1)	8 (11.9)
Female	43 (81.1)	10 (18.9)

Among male patients 10 (14.9%) had mild intermittent, 32 (47.7%) had mild persistent, 22 (32.8%) had moderate persistent, 3 (4.4%) had severe persistent asthma. Among females 2 (3.7%) had mild intermittent, 24 (45.2%) had mild persistent, 27 (50.9%) had moderate persistent asthma. (Table 4).

Table 4: Distribution of severity of asthma as per gender (n=120).

Asthma Severity	Male n (%) (n = 67)	Female n (%) (n = 53)
Mild intermittent	10 (14.9)	2 (3.8)
Mild persistent	32 (47.8)	24 (45.3)
Moderate persistent	22 (32.8)	27 (50.9)
Severe persistent	3 (4.5)	0 (0.0)

When the distribution of severity of asthma with the BMI categories was plotted, it was found that among underweight children, most 52 (50.9%) had mild persistent asthma followed by 36 (35.2%) having moderate persistent asthma and the least having mild intermittent asthma 11 (10.7%). Among children with normal BMI most children 13 (72.2%) had moderate persistent asthma followed by mild persistent asthma in 4 (22.2%) while none had severe persistent asthma (Table 5).

Table 5: Severity of asthma as per BMI categories (n=120).

Asthma Severity	Normal BMI n (%) (n = 18)	Underweight n (%) (n = 102)
Mild intermittent	1 (5.6)	11 (10.8)
Mild persistent	4 (22.2)	52 (51.0)
Moderate persistent	13 (72.2)	36 (35.3)
Severe persistent	0 (0.0)	3 (2.9)

It was found that the severity of asthma increased as the BMI decreased. The mean BMI in children with mild intermittent asthma, mild persistent asthma, moderate persistent asthma and severe asthma were 15.1 (SD 2.2), 14.8 (SD 2.8), 13.3 (SD 3.3) and 12.4 (SD 0.1) respectively and the relation

was statistically significant with a p value of 0.038. (Figure 1)

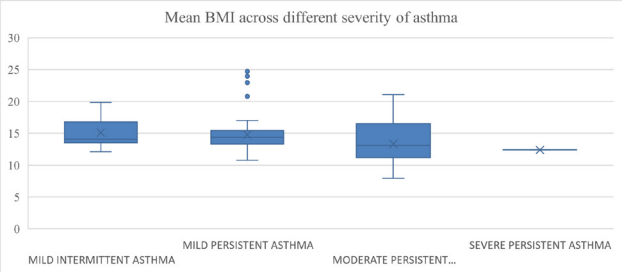

Figure 1: Mean BMI across different severity of asthma (n=120).

DISCUSSION

We conducted a hospital based observational study among children who had bronchial asthma. The severity of which was categorized on the basis of GINA guidelines. The aim was to study the asthma severity in relation to body mass index.

Most of our cohort (66.7%) had an age in between 5 to 8 years. Previous studies by Arora K et al have also found the prevalence to be highest in the same age group.[13]

We found that most of the asthmatic children were underweight, where 102 (85%) of the patients belonged to underweight BMI category and 18 (15%) belonged to normal BMI category whereas none were in the overweight category. It was been shown in literatures that lower BMI has been associated with higher incidence of asthma.[6, 14]

Lower lung function and lower body fat in underweight children has been found to be associated with alteration in normal lung physiology leading to easy respiratory muscle fatigue which adds to the worsening severity of asthma. This was in concordance to the results of our study where we found that the severity of asthma was higher in children with decrease in BMI. Similar results have been shown by previous authors as well.[15]

In addition, literatures have shown obesity in children also to be associated with increment in asthma severity in children. Obesity has been postulated to affect the respiration owing to the alterations in lung volume, augmented resistance and gas exchange at the alveolar level.[8, 9, 16]

However, our study failed to show any such relation between obesity and worsening of asthma severity, as none of the children in our cohort were obese. This reflects the difference between the nutritional status between children in our part of the world as compared to the western literatures where most of the studies on childhood asthma originate. In our study 73 (60.8%) had birth weight below 2500 gm which was supported by other studies too.[17-20]

Conclusions

Our study showed that childhood asthma is prevalent among underweight children as compared to those who have normal BMI. We also found that the severity of childhood asthma increases as the BMI keeps decreasing. The relation is likely bidirectional. These results suggest that lower BMI was associated with increase in severity of asthma and further longitudinal study might be required to establish the causality. The study suggests a need of nutritional assessment as a part of routine asthma care. However, because of the cross-sectional design and lack of adjustment for confounders, further longitudinal and multicenter studies are needed.

Ethics approval: Ethical approval was obtained from the Institutional Review Committee, College of Medical Sciences-Teaching Hospital (Ref. No.: 2023-71).

Conflict of interest: The author declares no conflict of interest

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Availability of data and materials: All data analysed during this study will be made available upon reasonable request from the corresponding author.

Author contributions

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REFERENCES

1. Paramesh H. Epidemiology of asthma in India. The Indian Journal of Pediatrics. 2002 Apr;69(4):309-12. [DOI]
2. Beasley R, Semprini A, Mitchell EA. Risk factors for asthma: is prevention possible?. The Lancet. 2015 Sep 12;386(9998):1075-85. [DOI]
3. Burbank AJ, Sood AK, Kesic MJ, Peden DB, Hernandez ML. Environmental determinants of allergy and asthma in early life. Journal of Allergy and Clinical Immunology. 2017 Jul 1;140(1):1-2. [DOI]
4. Soriano JB, Abajobir AA, Abate KH, Abera SF, Agrawal A, Ahmed MB, Aichour AN, Aichour I, Aichour MT, Alam K, Alam N. Global, regional, and national deaths, prevalence, disability-adjusted life years, and years lived with disability for chronic obstructive pulmonary disease and asthma, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet Respiratory Medicine. 2017 Sep 1;5(9):691-706. [DOI]
5. McCormack MC, Enright PL. Making the diagnosis of asthma. Respiratory care. 2008 May;53(5):583-92. [PubMed]
6. Hawlader MD, Noguchi E, El Arifeen S, Persson LÅ, Moore SE, Raqib R, Wagatsuma Y. Nutritional status and childhood wheezing in rural Bangladesh. Public health nutrition. 2014 Jul;17(7):1570-7. [DOI]
7. Ahmadizar F, Vijverberg SJ, Arets HG, de Boer A, Lang JE, Kattan M, Palmer CN, Mukhopadhyay S, Turner S, Maitland-van der Zee AH. Childhood obesity in relation to poor asthma control and exacerbation: a meta-analysis. European Respiratory Journal. 2016 Sep 30;48(4):1063-73. [DOI]
8. Aragona E, El-Magbri E, Wang J, Scheckelhoff T, Scheckelhoff T, Hyacinthe A, Nair S, Khan A, Nino G, Pillai DK. Impact of obesity on clinical outcomes in urban children hospitalized for status asthmaticus. Hospital pediatrics. 2016 Apr 1;6(4):211-8. [DOI]
9. Okubo Y, Nochioka K, Hataya H, Sakakibara H, Terakawa T, Testa M. Burden of obesity on pediatric inpatients with acute asthma exacerbation in the United States. The Journal of Allergy and Clinical Immunology: In Practice. 2016 Nov 1;4(6):1227-31. [DOI]
10. Shore SA. Obesity and asthma: possible mechanisms. Journal of Allergy and Clinical Immunology. 2008 May 1;121(5):1087-93. [DOI]
11. Global Initiative for Asthma. Global strategy for asthma management and prevention. Global Initiative for Asthma; 2025. [Link]
12. Oldham HG, Bevan MM, McDermott M. Comparison of the new miniature Wright peak flow meter with the standard Wright peak flow meter. Thorax. 1979 Dec 1;34(6):807-9. [DOI]
13. Arora K, Das RR, Pooni PA, Rustagi R, Singh D. A study of the prevalence and risk factors of asthma in urban schools of Ludhiana, Punjab. Indian Journal of Health Sciences and Biomedical Research kleu. 2015 Jul 1;8(2):104-8. [Link]
14. Berntsen SL, Lødrup Carlsen KC, Hageberg R, Aandstad A, Mowinckel P, Anderssen SA, Carlsen KH. Asthma symptoms in rural living Tanzanian children; prevalence and the relation to aerobic fitness and body fat. Allergy. 2009 Aug;64(8):1166-71. [DOI]
15. K Rugmini KD, K E Elizabeth, Sanjay Masaraddi. Association of body composition with severity of asthma. MedPulse International Journal of Pediatrics. May 2021;18(2):35-8. [DOI]

16. Parameswaran K, Todd DC, Soth M. Altered respiratory physiology in obesity. Canadian respiratory journal. 2006;13(4):203-10. [DOI]
17. Shaheen SO, Sterne JA, Montgomery SM, Azima H. Birth weight, body mass index and asthma in young adults. Thorax. 1999 May 1;54(5):396-402. [DOI]
18. Barker DJ. The fetal and infant origins of adult disease. BMJ: British Medical Journal. 1990 Nov 17;301(6761):1111. [DOI]
19. Xu XF, Cheng F, Du LZ. Epigenetic regulation of pulmonary arterial hypertension. Hypertension Research. 2011 Sep;34(9):981-6. [DOI]
20. Xu XF, Lv Y, Gu WZ, Tang LL, Wei JK, Zhang LY, et al. Epigenetics of hypoxic pulmonary arterial hypertension following intrauterine growth retardation rat: epigenetics in PAH following IUGR. Respir Res. 2013;14(1):20. [DOI]

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