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ORIGINAL ARTICLE

Asthma-Obesity Association among under 5 Years Children

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Abstract

Background: The association between asthma and obesity is well-studied in school-age and older children, but such research among preschool children is limited. The aim of this study was to measure obesity prevalence and evaluate its association with asthma among young children under 5 years.

Methods and Results: This case–control study was conducted in pediatric hospitals and pediatric wards of general hospitals in Mosul city, in northern Iraq. The study included 271 asthmatic children (with an allergic type of asthma) and 271 non-asthmatics of both sexes aged <60 months.

Body mass index (BMI) was used to classify children as underweight, normal weight, overweight, or obese, based on the percentile line on the gender-appropriate BMI/age growth chart provided by the World Health Organization. According to WHO definitions, children were divided into the following groups: BMI <3rd centile (underweight), BMI 3rd–85th centile (normal weight), BMI 85th–97th centile (overweight), BMI >97th centile (obese).

The prevalence of obesity (36.5%) was significantly higher among asthmatic children than non-asthmatics (23.2%) (P=0.000). The OR of being obese and asthmatic was 1.9 [95% CI: 1.30–2.76]. In addition, the mean BMI for cases and controls was 18.24±3.14 kg/m^2 and 17.49±2.48 kg/m^2, respectively, and, by Z-test, there was a significant difference between the groups: asthmatic patients had a higher BMI than controls (P=0.0021). Significantly more obese asthmatic children had a high frequency of severe asthmatic attacks requiring hospital admissions (>4 admissions/year) (67.7% vs. 37.8%, P=0.000), and the increase in the BMI was positively correlated with such a number (R^2=0.12, P=0.01). Asthmatic obese young children experienced poor control of their asthma symptoms when using long-term control drugs than the non-obese ones (75.8 % vs 46.5 %, P=0.000). The mean ages of onset of asthma among obese asthmatic and non-obese asthmatic patients were 7.91±7.75 and 14.61±14.41 months, respectively (P<0.0001).

Conclusion: Obesity is prevalent among asthmatic young children, and it affects the disease profile in many aspects, including the age of onset, frequency of severe attacks, and the difficulty in controlling the symptoms.(**International Journal of Biomedicine. 2026;16(2):207-211.**)

Keywords: asthma • obesity • children • case–control study

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Introduction

There is significant epidemiological and research evidence of an obesity-related asthma phenotype. Compared to children with healthy weight, children with obesity have a higher chance of developing asthma. Obesity in children has an increasing prevalence all over the world.[1,2] The asthma–obesity syndrome remains poorly understood and lacks a specific treatment strategy.[3] Obesity causes significant changes to the chest wall and lungs' mechanics, and these mechanical changes cause asthma and asthma-like symptoms such as dyspnea, wheezing, and airway hyperresponsiveness. Excess adiposity is also associated with increased production of inflammatory cytokines and immune cells, which may lead to disease.[4] A recent study reported, a prevalence of 72.9% of obesity among school-age and adolescent asthmatic children.[5]A systematic review conducted by Malden et al.[6] reported that obese children aged <10 years were at significant risk for the development of asthma with an odds ratio (OR)=1.5.

The aim of this study was to measure obesity prevalence and evaluate its association with asthma among young children under 5 years.

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Materials and Methods

This case–control study was conducted in pediatric hospitals and pediatric wards of general hospitals in Mosul city, in northern Iraq, from December 1, 2022, to May 1, 2023. The study included 271 asthmatic children (with an allergic type of asthma) and 271 non-asthmatics of both sexes aged <60 months. The diagnosis of asthma was established by specialist pediatricians based on a history of asthma symptoms, a wheezy chest on examination, a history of asthma symptom recurrence, and chest X-ray findings consistent with asthma. Drugs for long-term control of symptoms, including short-acting inhaled β_2-agonists, long-acting β_2-agonists, leukotriene modifiers (montelukast), systemic steroids (prednisolone and dexamethasone), and oral theophylline were all recorded. Classification of asthma control was based on the symptoms during the day, nighttime awakenings, need for short-acting β-agonist drugs, and interference with normal child activity, as shown below.

Component of control	Well controlled	Not well controlled	Very poorly controlled
Impairment symptoms	≤ 2day/week, but less than once on each day	> days/ week or multiple times on ≤2day/week	Throughout the day
Night time awaking	≤1/month	>1/month	>1/week
Short acting B2-agonist use for symptoms	≤ 2day/week	> days/ week	Several times per day
Interference with normal activity	None	Some limitation	Extremely limited

Adapted from Kliegman RM, St Geme JW III, Blum NJ, Shah SS, Tasker RC, Wilson KM, editors. Nelson textbook of pediatrics. 20th ed. Philadelphia (PA): Elsevier; 2016. p. 1195.).[7]

Children with other diseases that mimic asthma were excluded by their doctors. The control group was age-matched to 271 healthy children attending the hospital's vaccination units who had no history of asthma symptoms. The exclusion criteria for both cases and controls were children with any disease that causes chronic respiratory complaints, children with edema due to different causes, and children with chronic use of drugs that can affect their BMI, like systemic steroids.

Written parental consent was obtained to participate in the study, and specially designed questionnaires were used to collect information and determine study parameters during a direct interview.

The sample size of 271 children with asthma was calculated according to the equation (Cochran's Formula):

$N = Z^2PQ/d^2$, where

N = sample size, Z = statistical certainty, P = probability problem under study (as a fraction of 1), Q = 1.0 – p, d = desired margin of error

For both cases and controls, body weight was measured to the nearest 0.1kg using a digital scale (Seca) with lightly dressed, barefoot subjects. Then, standing heights or lying lengths were measured with a stability scale or infantometer to the nearest 0.1cm. Physical measurements of body weight and length were used to calculate BMI (kg/m^2). BMI was used to classify children as underweight, normal weight, overweight, or obese, based on the percentile line on the gender-appropriate BMI/age growth chart provided by the World Health Organization. According to WHO definitions, children were divided into the following groups: BMI <3rd centile (underweight), BMI 3rd–85th centile (normal weight), BMI 85th–97th centile (overweight), BMI >97th centile (obese).[8]

Microsoft Excel 2020 and SPSS (Statistical Package for the Social Sciences) v. 27 were used for statistical analysis. Baseline characteristics were summarized as frequencies and percentages for categorical variables and mean±standard deviation (SD) for continuous variables. The chi-square test was used for studying associations, Fisher's exact test was an alternative to the chi-square test for small samples, a two-sample Z-test was used to compare means, Pearson's correlation coefficient was used to study correlations, crosstabs statistics in SPSS was used for calculating OR and 95% confidence interval (CI), and linear regression was used to study relationships. Statistical significance was set at a *P*-value of <0.05.

Results

In the basic demographic data table for cases and controls, there were no significant differences in gender distribution or age groups (*P*=0.343). The means of the age of both groups were also matched. The mean age of cases in months was 29.0±18.3, the mean age of controls in months was 26.0±18.3, *P*=0.057 (Table 1).

Table 1.

Demographic characteristics of cases (asthmatics) and controls (non-asthmatics).

Variable		Cases (asthmatics)	Controls (non-asthmatics)	*P*-value
Gender	Male	120 (44.3%)	131 (48.3%)	0.343
	Female	151 (55.7%)	140 (51.7%)	
	Total	271 (100%)	271 (100%)	
Age groups (months)	≤ 12	77 (28.4%)	93 (34.3%)	0.189
	13 - 24	67 (24.7%)	69 (25.5%)	
	25 - 36	36 (13.3%)	38 (14.0%)	
	37 - 48	54 (19.9%)	34 (12.5%)	
	49 - 60	37 (13.7%)	37 (13.7%)	
	Mean ±SD	29.0± 18.3	26.0±18.3	0.057

The prevalence of obesity (36.5%) was significantly higher among asthmatic children than non-asthmatics (23.2%) (*P*=0.000) (Table 2). The OR of being obese and asthmatic was 1.9 [95% CI: 1.30–2.76]. In addition, the mean BMI for cases and controls was 18.24±3.14 kg/m^2 and 17.49±2.48 kg/m^2, respectively, and, by Z-test, there was a significant difference between the groups: asthmatic patients had a higher BMI than controls (*P*=0.0021).

Table 2.

Prevalence of overweight and obesity among cases and controls.

BMI	Cases	Controls	*P*-value
Obese BMI (> 97%)	99 (36.5%)	63 (23.2%)	0.000
Overweight BMI (85% - 97%)	61 (22.5%)	50 (18.5%)	0.242
BMI (< 85%)	111 (41.0%)	158 (58.3%)	0.000
Total	271 (100%)	271 (100%)	

Significantly more obese asthmatic children had a high frequency of severe asthmatic attacks requiring hospital admissions (>4 admissions/year) (67.7% vs. 37.8%, *P*=0.000), and the increase in the BMI was positively correlated with such a number (R^2=0.12, *P*=0.01) (Table 3 and Figure 1).

Table 3.

Frequency of hospital admissions/year among obese asthmatic patients and nonobese asthmatic patients.

Number of hospital admissions per year	Obese asthmatics	None-obese asthmatic	*P*-value
1 or less	1(1%)	8 (4.7%)	0.140
2-4	31(31.3%)	99 (57.5%)	0.000
5-6	48(48.5%)	49 (28,5%)	0.001
>6	19(19.2%)	16 (9.3%)	0.019
Total	99(100%)	172(100%)	

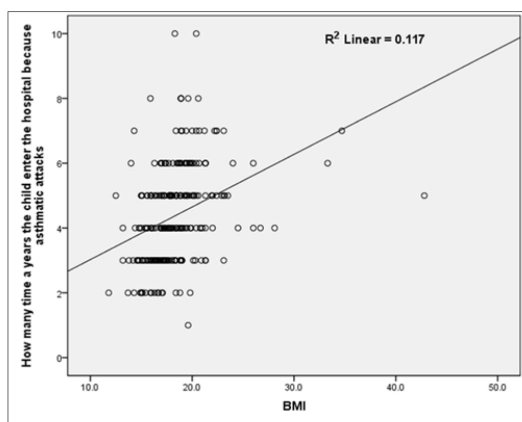

Figure 1. *Correlation between BMI and the number of yearly hospital admissions because of asthmatic attacks among asthmatic children.*

In the current study, significantly more asthmatic obese young children experienced not well control of their asthma symptoms when using long-term control drugs than the non-obese ones (75.8 % vs 46.5 %, *P*=0.000) (Table 4).

The mean ages of onset of asthma among obese asthmatic and non-obese asthmatic patients were 7.91±7.75 and 14.61±14.41 months, respectively. Obese patients had an earlier onset of their symptoms than the non-obese group (*P*<0.0001) (Figure 2).

Table 4.

Asthma control by drugs among obese and asthmatic patients and non-obese asthmatic patients.

Type of asthma control	Obese asthmatics	None-obese asthmatics	*P*-value
Well-controlled	23 (23.2%)	92 (53.5%)	0.000
Not well controlled	75(75.8%)	80 (46.5%)	0.000
Poorly controlled	1(1.0%)	0 (0%)	0.365
Total	99(100%)	172(100%)	

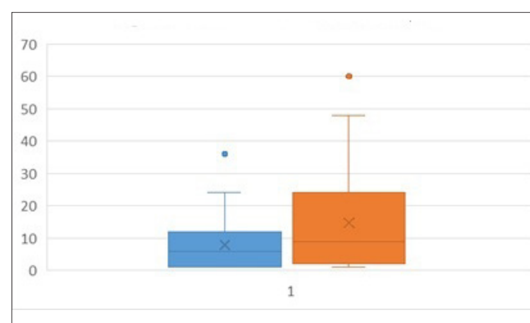

Figure 2*. Age of asthma onset (in months) among obese and non-obese asthmatic patients.*

Discussion

The worldwide prevalence of childhood obesity is about 10%, and in Iraq, this prevalence ranges from 19% to 21.1% in different cities.[9-11] In the current study, obesity prevalence was not far from this range among non-asthmatic children (23%), but a significantly higher prevalence (36.5%) was found among the asthmatic group, i.e., more than one-third of them were obese with a high OR (1.9), and such finding supports the association between these two morbidities. We think that the rather sedentary lifestyle due to the avoidance of strenuous physical activity or active play that may precipitate asthmatic attacks is the main cause of such a high prevalence of obesity among asthmatic children. Borgmeyer et al.[12] also found a high prevalence of obesity (19.6%) among the studied asthmatic children in their study, but it was less than ours, which is most likely explained by the regional variation of childhood obesity prevalence, because many studies in Iraq documented a higher prevalence of childhood obesity than the global one.[9,13-15] Although overweight was more prevalent among the asthmatic children in this study (22.5%) than in the control group (18.5%), this difference was not statistically significant, indicating the high prevalence of overweight in the pediatric population in general, and future studies on a large scale of the pediatric population may find different results. A lot of controversy exists about the association between obesity and asthma severity, expressed as the frequency of attacks and the patient's response to the controller drug therapy. Some studies support this association,[16-19] while others contradict

it [20,21] The current study found that significantly more obese asthmatic children had a higher annual frequency of severe asthmatic attacks requiring hospital admissions than the non-obese asthmatics, 67.7% vs. 37.8%, respectively (P=0.000). Moreover, the increase in BMI was positively correlated with such frequency (R^2=0.12, P=0.01).

The asthma–obesity phenotype and its effect on the response to drug treatment strategies are a matter of debate among studies. Some studies confirm this effect, while others deny it.[22-24] In this study, a significantly high percentage of obese asthmatic children had either partly controlled or poorly controlled asthma (based on their daytime and nighttime symptoms) using controller drugs than did their non-obese asthmatic peers. The other way in which obesity is likely to affect the asthma profile is the age of onset of asthma symptoms. According to this study, the asthma–obesity phenotype is associated with a significantly earlier mean age of onset of asthmatic symptoms compared to the non-obese group (7.91±7.75 and 14.61±14.41 months). A similar finding is reported by other investigators.[25]

In conclusion, obesity is prevalent among asthmatic young children, and it affects the disease profile in many aspects, including the age of onset, frequency of severe attacks, and the difficulty in controlling the symptoms.

Ethics Statement

This study was conducted in accordance with the World Medical Association Declaration of Helsinki (1975), as revised in 2013, and approved by Mosul University Collegiate Committee for Medical Research Ethics (Ethical approval number 91 dated 29/2/2022; CCMRE-NUR-22-25). Written informed consent was obtained from each patient's parent/ guardian/ relative.

Author Contributions

Noor A. Younes: Investigation, Data curation, Formal analysis, Writing – original draft, Visualization.
Khaleel I. Alsuwayfee: Conceptualization, Methodology, Supervision, Validation, Writing – review and editing.
All authors have approved the final article.

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Conflict of Interest

The authors have declared no conflict of interest.

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