

Original article

The Impact of Childhood Obesity on Asthma Severity: A Cross-Sectional Study at Sabratha Teaching Hospital

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Abstract

There is strong experimental and epidemiological support for the "obesity-related asthma" phenotype. Children who are obese are more likely to develop asthma, and those who already have the condition have worse symptoms, more frequent attacks, and a lower overall quality of life. Data on the relationship between childhood obesity and asthma severity remain scarce in Libya. This study aimed to assess the relationship between body mass index (BMI) and asthma severity among children attending Sabratha Teaching Hospital in western Libya, and to identify the lifestyle, environmental, and clinical factors most strongly associated with disease severity and exacerbation frequency. A cross-sectional descriptive analytical study was conducted among 99 children (aged 2–18 years) with a confirmed diagnosis of asthma. Data were collected via a structured interviewer-administered questionnaire and standardised anthropometric measurements. BMI was classified according to age- and sex specific reference standards. Asthma severity, attack frequency, and hospital admission were assessed as primary outcomes. Pearson correlation, chi-square tests, and a multivariate general linear model (GLM) were applied to identify associations and independent predictors. The study population had a mean age of 9.87 ± 3.84 years, with a male predominance (66.7%). Abnormal BMI was prevalent in 74.7% of participants, comprising 60.6% underweight and 12.1% obese. BMI category was significantly and positively correlated with asthma severity ($r = 0.306$, $p = 0.002$) and hospital admission ($r = 0.352$, $p < 0.001$). In the multivariate GLM, regular exercise emerged as the strongest independent predictor of asthma severity ($F = 12.604$, $p = 0.001$, partial $\eta^2 = 0.118$), followed by BMI category ($F = 9.504$, $p = 0.003$, partial $\eta^2 = 0.092$) and passive smoking exposure ($F = 4.965$, $p = 0.028$, partial $\eta^2 = 0.050$). Across the cohort, pharmacological treatment alone did not significantly differentiate controlled from uncontrolled asthma status. Our findings suggest that abnormal BMI, particularly obesity, is significantly correlated with asthma severity and hospitalisation among children, as well as physical inactivity and passive smoking exposure being the most clinically significant risk factors identified. Integrating nutritional assessment, regular exercise, and tobacco-exposure counselling into routine pediatric asthma management is highly recommended in systematic inclusion.

Keywords: Asthma; Asthma Severity; Childhood Obesity; BMI; Libya.

Introduction

Asthma remains the most common chronic non-communicable disease of childhood [1], affecting an estimated 10% of children worldwide, with substantial variation across regions driven by genetic, environmental, and socioeconomic factors [2]. In recent studies, a higher burden has been consistently observed among boys until adolescence, when this trend reverses, and prevalence becomes higher in girls [3,4]. In parallel with the rising rates of asthma, childhood obesity has emerged as one of the most critical public health issues of the past four decades, with its global prevalence having risen rapidly across both high-income and low-income countries [5]. Obesity is no longer regarded only as a coexisting comorbidity of asthma but is increasingly recognised as a significant modifiable risk factor that both predisposes to the development of asthma and independently deteriorates its clinical course [6,7].

Longitudinal and cross-sectional epidemiological research has consistently established that childhood obesity is strongly associated with an increased prevalence of asthma, more serious and frequent exacerbations, poor symptom control, and reduced quality of life. Additionally, obese children show a lower therapeutic response to inhaled corticosteroids, distinguishing obesity-related asthma as a clinically distinct and more challenging phenotype [6,8]. The pathophysiological association between obesity and asthma is complicated and bidirectional, extending well beyond the strictly mechanical effects of obesity on lung volume and chest wall compliance [9].

According to previous studies, adipose tissue acts as an active immunological and endocrine organ [10], and its expansion in obesity elevates leptin, interleukin-6, and tumour necrosis factor- α levels in the blood and attracts pro-inflammatory M1 macrophages [11]. Simultaneously, a condition of chronic low-grade systemic inflammation results from relative deficiency of anti-inflammatory adipokines such as adiponectin [12]. Obesity induces a non-allergic inflammation, Th1/Th17 polarized immune response characterised by neutrophilic instead of eosinophilic inflammation of the airways, unlike the classical Th2-mediated, eosinophilic pattern that typifies atopic asthma [13]. In obese children with asthma, changes in nitric oxide and arginine metabolism are also linked to increased airway hyperresponsiveness and relative steroid resistance [14]. In addition to these immune mechanisms, mechanical factors also substantially contribute. The compliance of the chest wall is restricted by central obesity, and the disease burden is further exacerbated by airway growth disorders, gastric reflux, sleep apnea, and physical inactivity [15]. Furthermore, environmental exposures such as passive smoking and psychological factors like anxiety and stress have also been identified as modifiers of asthma severity in obese children [16,17].

Despite growing evidence, data regarding the prevalence of obesity in children with asthma, its effects on disease severity and healthcare utilisation, and the relative impact of lifestyle, environmental, and family-related factors remain comparatively scarce from pediatric care settings in Libya. Therefore, the present cross-sectional study was designed to assess the relationship between obesity and asthma severity among children attending Sabratha Teaching Hospital in Western Libya. Specifically, this study aimed to describe the demographic, anthropometric, and clinical characteristics of the study population; to examine the association between body mass index and key asthma outcomes, including disease severity, attack frequency, and hospital admission; to explore the contribution of lifestyle, environmental, and family-related factors to asthma severity; and to identify the key independent variables influencing asthma severity and the frequency of exacerbations in this pediatric cohort.

Methodology

Study Design

The present study employed a cross-sectional descriptive analytical design, conducted at Sabratha Teaching Hospital in western Libya. This design was selected as it allows for the concurrent evaluation of anthropometric indices, nutritional status, and clinical asthma outcomes within a particular pediatric population at a single point in time, therefore providing a practical and effective approach for studying the association between childhood obesity and asthma severity in a real-world clinical setting. The study population included children diagnosed with asthma who attended the pediatric outpatient clinic of Sabratha Teaching Hospital. A convenience sampling technique was used, by which eligible children and their accompanying guardians or parents who visited the clinic throughout the period of study were invited to participate consecutively. A total of 99 participants were eventually included in the study. Children with a verified clinical diagnosis of asthma, aged between 2 and 18 years, whose guardians or parents supplied informed consent, were included. Children with other chronic pulmonary or systemic diseases that could independently affect growth parameters or confuse the evaluation of asthma severity, as well as those whose parents refused to participate in the trial, were excluded from this study.

Data Collection

The data were collected via a structured, interviewer-administered questionnaire completed in cooperation with the guardians or parents of the participating children, supplemented by clinical examination and direct anthropometric measurement. The questionnaire recorded socio-demographic features, clinical characteristics of asthma severity (including attack frequency, symptom pattern, and history of hospital admission), treatment approaches, and related lifestyle, environmental, and family-relevant factors (such as exposure to passive smoking, stress, sinusitis, regular exercise, dietary habits, and family history of asthma). Anthropometric measurements, including height and body weight, were obtained using standardised procedures and calibrated equipment. Body mass index (BMI) was calculated using the standard formula (weight in kilograms divided by height in meters squared) [18] and subsequently classified into nutritional status categories (underweight, normal weight, overweight, and obese) according to age- and sex specific reference standards. Asthma severity was clinically assessed and classified by the attending paediatrician. Based on established clinical criteria, including symptom frequency, night attacks, and the requirement for hospital admission.

Statistical Analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were used to summarise the demographic, anthropometric, and clinical characteristics of the study population, with continuous variables expressed as mean $\pm$ standard deviation (SD) and categorical variables expressed as frequencies and percentages. Pearson correlation coefficients were calculated to assess the strength and direction of associations between BMI and asthma-related outcomes, as well as among lifestyle, behavioural, and disease burden variables. Chi-square tests were used to examine associations between categorical variables, including treatment patterns, medication use, and hospital admission. A multivariate general linear model (GLM) was further applied to identify the independent effects of clinical, behavioural, and environmental factors on asthma severity level and attack frequency, with partial eta squared (η^2) reported as a measure of effect size. A p-value of less than 0.05 was considered statistically significant throughout the analysis.

Ethical Consideration

The study was conducted in accordance with the ethical principles outlined in the declaration of *Helsinki* [19]. Approval was obtained from the Libyan Medical Research Centre Bioethics Committee (NBC:018.H.24. 5) for data collection. Written informed consent was obtained from the parents or legal guardians of all participating children, and assent was sought from older children where appropriate. Confidentiality and anonymity of participant data were maintained throughout the study.

Results

Socio-demographic and Anthropometric Characteristics of Participants

(Table 1) showed the total of 99 children with asthma were enrolled in this cross-sectional study. The mean age of the participants was 9.87 ± 3.84 years, ranging from 2 to 18 years. Males constituted the majority of the study population, accounting for 66 children (66.7%), while females represented 33 children (33.3%), reflecting a male-to-female ratio of approximately 2:1. Regarding anthropometric measures, the mean body weight was 38.37 ± 19.66 kg (range: 8–93 kg), and the mean height was 136.97 ± 19.87 cm (range: 100–186 cm). The mean body mass index (BMI) of the study sample was 19.39 ± 6.44 kg/m², with values ranging from 6.39 to 40.00 kg/m², reflecting a wide spectrum of nutritional status across the cohort, ranging from underweight to obese categories.

Table 1. Demographic and Anthropometric Characteristics of the Study Participants (N = 99)

Variable	Mean $\pm$ SD / n	Minimum	Maximum
Age (years)	9.87 ± 3.84		18
Weight (kg)	38.37 ± 19.66	8	93
Height (cm)	136.97 ± 19.87	100	186
BMI (kg/m ²)	19.39 ± 6.44	6.39	40.00
Sex – Male (n/%)	66 (66.7%)	–	–
Sex – Female (n/%)	33 (33.3%)	–	–

Clinical Characteristic of Study Population

As shown in (Table 2), about nutritional status, BMI classification revealed that the majority of participants were underweight (60.6%), while 25.3% had a normal weight. Overweight and obese children represented 2.0% and 12.1% of the study population, respectively, indicating a notable burden of both undernutrition and excess adiposity within this asthmatic cohort. Concerning respiratory symptomatology, dyspnea, cough, and wheezing were universally reported, each being present in 100% of the participants, confirming the diagnostic homogeneity of the study sample with respect to core asthma manifestations. Nocturnal symptoms were also highly prevalent, with 96.2% of children reporting night-time attacks. Hospital admission due to asthma exacerbation was documented in 67.7% of cases, reflecting a considerable disease burden among the study population. The mean number of asthma attacks per patient was 4.4 ± 1.5 .

Table 2. Clinical Characteristics of the Study Population (N = 99)

Variable	Category	Value
BMI Classification	Normal weight	25.3%
	Underweight	60.6%
	Overweight	2.0%
	Obese	12.1%
Dyspnea	Yes	100.0%
	No	0.0%
Cough	Yes	100.0%
	No	0.0%
Wheezing	Yes	100.0%
	No	0.0%
Night attacks	Yes	96.2%
	No	4.0%
Hospital admission	Yes	67.7%
	No	32.3%
Asthma attacks (per patient)	Mean $\pm$ SD	4.4 ± 1.5

Association Between BMI and Asthma Outcomes

The results obtained in (Table 3) showed that nutritional status was significantly correlated with both hospital admission and asthma severity when asthma outcomes were tested by BMI groups. There was a moderate relationship between the weight of the patients and asthma severity, which was statistically significant ($r = 0.306$, $p = 0.002$), with higher proportions observed particularly among underweight and obese patients. Likewise, there was a significant association between hospital admission and BMI ($r = 0.352$, $p < 0.001$), indicating that patients at both extremes of BMI were more likely to require hospitalisation. In contrast, the frequency of asthma episodes (>5) was not significantly correlated with BMI ($r = 0.179$, $p = 0.077$). The result of this study implies that poor asthma control and outcomes such as level of severity and hospital care requirements are associated with aberrant body mass index (BMI), particularly underweight and obesity.

Table 3. Association Between BMI Category and Asthma Outcomes (N = 99)

Outcome	Normal	Underweight	Overweight	Obese	r / p-value
Asthma severity (moderate/severe)	25	60	2	12	0.306** / 0.002
Attack frequency (>5)	9	20	2	6	0.179 / 0.077
Hospital admission	20	33	2	12	0.352** / <0.001

**Correlation is significant at the 0.01 level.

Lifestyle, Environmental, and Family Factors in Relation to Asthma Severity

Several lifestyle, environmental, and familial factors were examined for their association with asthma severity and were presented in (Table 4). Physical activity level showed a significant association with disease severity ($p=0.001$): among children classified as physically active, 52 (52.5%) presented with asthma severity, compared with 47 (47.5%) of physically inactive children, suggesting that activity level is meaningfully linked to symptom severity in this population. Moreover, psychological and environmental exposures were likewise significantly associated with asthma severity. Stress and anxiety were reported in 46 children (46.5%) with disease severity, did not show statistical significance ($p = 0.360$). However, passive smoking exposure was significantly associated with disease severity ($p = 0.035$), being present in 52 (52.5%) of children with asthma severity compared with 47 (47.5%) of unexposed children, highlighting environmental smoke as a relevant modifiable risk factor. In contrast, fast food intake, sinusitis, and family history of asthma did not show statistically significant associations with asthma severity. High fast-food intake was reported in 60 children (60.6%) with disease severity ($p = 0.650$); sinusitis was present in 77 children (77.8%, $p = 0.181$); and a positive family history was reported in 56 children (56.6%, $p = 0.360$).

Table 4. Lifestyle, Environmental, and Family Factors in Relation to Asthma Severity

Factors	Category	Severity Score (Total = 99)	Moderate	Severe	P value
Physical activity	Active	52(52.5%)	23(44.2%)	29(55.8%)	<0.001
	Inactive	47(47.5%)	5(10.6%)	42(89.4%)	
Fast food intake	High	60(60.6%)	16(26.7%)	44(73.4%)	0.650
	Low	39(39.4%)	12(30.8%)	27(69.2%)	
Stress/Anxiety	Yes	46(46.5%)	11(23.9%)	35(76.1%)	0.360
	No	53(53.5%)	17(32%)	36(67.9%)	
Passive smoking	Exposure	52(52.5%)	10(19.2%)	42(80.8%)	0.035
	Non- Exposure	47(47.5%)	18(38.3%)	29(61.7%)	
Sinusitis	Yes	77(77.8%)	49(63.6%)	28(36.4%)	0.180
	No	22(22.2%)	13(59%)	9(41%)	
Family History	Yes	56(56.6%)	16(28.6%)	40(71.4%)	0.360
	No	43(43.4%)	12(27.9%)	31(72.1%)	

*Statistically significant at $p < 0.05$.

Association Between Treatment Patterns and Asthma Control

The association between asthma treatment patterns and degree of asthma control was assessed using Chi-square and Fisher's Exact tests. Regardless of the kind of treatment administered, the majority of patients were uncontrolled, according to the information revealed in (Table 5). Almost all bronchodilator users (96.4%) and non-users (93.0%) were uncontrolled by treatment, and there was no apparent difference between them. A similar pattern was seen with inhaled corticosteroids; no significant association was also noted. In terms of preventive drugs, the same trend was seen with 91.7% of users and 96.1% of non-users being uncontrolled, again without a significant difference. Overall, the results indicate that the degree of asthma control in this study is not clearly correlated with the type of asthma medication, possibly due to confounding by severity, adherence issues, or cross-sectional study design limitations.

Table 5. Association Between Treatment Patterns and Asthma Control

Treatment	Controlled, n (%)	Uncontrolled, n (%)	p-value
Bronchodilator – No	5 (7.0%)	66 (93.0%)	0.672
Bronchodilator – Yes	1 (3.6%)	27 (96.4%)	
Inhaled corticosteroids – No	3 (15.0%)	17 (85.0%)	0.095
Inhaled corticosteroids – Yes	3 (3.8%)	76 (96.2%)	
Preventive drugs – No	2 (3.9%)	49 (96.1%)	0.427
Preventive drugs – Yes	4 (8.3%)	44 (91.7%)	

Association Between Asthma Medications and Hospital Admission

(Table 6) shows the Association between asthma medications and the study outcome (hospital admission). The results showed a significant relationship between bronchodilator use and hospital admission ($\chi^2 = 11.316$, $p = 0.001$), indicating that patients using bronchodilators were more likely to be admitted to the hospital. In contrast, no significant association was found between preventive drugs and hospital admission ($p = 0.131$). Likewise, inhaled corticosteroids did not show a statistically significant association with hospital admission ($p = 0.091$), although a slight trend was observed.

Table 6. Association Between Asthma Medications and Hospital Admission

Medication	Pearson χ^2 (df)	p-value	Interpretation
Bronchodilator	11.316 (1)	0.001*	Significant association
Preventive drugs	2.284 (1)	0.131	Not significant
Inhaled corticosteroids	4.783 (2)	0.091	Not significant (trend noted)

*Statistically significant at $p < 0.05$.

Obesity-Related Cluster Correlations

Correlation analysis was conducted to explore the interrelationships between BMI and a cluster of obesity-related variables in (Table 7). A moderate, statistically significant association was found between age and BMI ($r = 0.398$, $p < 0.001$), indicating that BMI tended to increase progressively with advancing age within the study cohort. BMI was also significantly correlated with the time since asthma diagnosis ($r = 0.385$, $p < 0.001$) and with hospital admission ($r = 0.352$, $p < 0.001$), suggesting that children with higher BMI tended to have a longer disease course and a greater likelihood of requiring hospitalisation. A significant positive correlation was observed between BMI and fast-food intake ($r = 0.231$, $p = 0.022$), supporting the contribution of dietary habits to excess weight gain in this population. Notably, BMI showed a significant negative correlation with regular exercise ($r = -0.433$, $p < 0.001$), confirming an inverse relationship whereby higher levels of physical activity were associated with lower BMI values. The strongest association within this cluster was identified between BMI and abnormal behaviour ($r = 0.531$, $p < 0.001$), representing a moderate to strong positive correlation.

Table 7. Obesity-Related Cluster Correlations

Variables	r	p-value
Age – BMI	0.398**	<0.001
BMI – Time of diagnosis	0.385**	<0.001
BMI – Hospital admission	0.352**	<0.001
BMI – Fast food intake	0.231*	0.022
BMI – Regular exercise	-0.433**	<0.001
BMI – Abnormal behaviour	0.531**	<0.001

*Correlation is significant at the 0.05 level; **Correlation is significant at the 0.01 level.

Lifestyle and Behavioral Cluster Correlations

Further correlation analysis was performed to characterise the interrelationships among lifestyle and behavioural variables. Age showed a significant negative correlation with regular exercise ($r = -0.302$, $p = 0.002$), indicating that physical activity levels tended to decline as children grew older. Conversely, age was significantly and positively correlated with abnormal behaviour ($r = 0.293$, $p = 0.003$), suggesting that behavioural disturbances became more apparent with increasing age. A significant positive association was also observed between stress, anxiety and abnormal behaviour ($r = 0.306$, $p = 0.002$). Regular exercise was not significantly associated with stress and anxiety ($r = -0.047$, $p = 0.643$). Consistent with the obesity related cluster findings, fast food intake remained significantly correlated with BMI ($r = 0.231$, $p = 0.022$). In addition, regular exercise showed a significant negative correlation with sinusitis ($r = -0.265$, $p = 0.008$).

Table 8. Lifestyle and Behavioral Cluster Correlations

Variables	r	p-value
Age – Regular exercise	-0.302**	0.002
Age – Abnormal behaviour	0.293**	0.003
Stress/anxiety – Abnormal behaviour	0.306**	0.002
Regular exercise – Stress/anxiety	-0.047	0.643
Fast food – BMI	0.231*	0.022
Regular exercise – Sinusitis	-0.265**	0.008

*Correlation is significant at the 0.05 level; **Correlation is significant at the 0.01 level.

Disease Burden and Clinical Outcome Cluster Correlations

(Table9) showed the correlation analysis of disease burden and clinical outcome variables revealed a moderate, significant correlation between age and time since diagnosis ($r = 0.441$, $p < 0.001$), as expected given that older children had naturally

accumulated a longer disease duration. Time since diagnosis was, in turn, significantly correlated with hospital admission ($r = 0.299$, $p = 0.003$). Consistent with earlier findings, BMI remained significantly correlated with hospital admission ($r = 0.352$, $p < 0.001$). Furthermore, hospital admission was significantly and negatively correlated with regular exercise ($r = -0.268$, $p = 0.007$). In another way, no statistically significant correlation was found between hospital admission and passive smoking exposure ($r = 0.165$, $p = 0.103$), nor between night-time attacks and age ($r = 0.181$, $p = 0.073$).

Table 9. Disease Burden and Clinical Outcome Cluster Correlations

Variables	r	p-value
Age – Time of diagnosis	0.441**	<0.001
Time of diagnosis – Hospital admission	0.299**	0.003
BMI – Hospital admission	0.352**	<0.001
Hospital admission – Regular exercise	-0.268**	0.007
Hospital admission – Passive smoking	0.165	0.103
Night attack – Age	0.181	0.073

Correlation is significant at the 0.01 level. * **

Key Variables Influencing Asthma Severity and Attack Frequency

(Table 10) presents a multivariate general linear model that was constructed to identify the independent effects of multiple clinical, behavioural, and environmental factors on two dependent outcomes: severity level of asthma and asthma attack score. Among all factors examined, regular exercise emerged as the strongest independent predictor of asthma severity, exerting a highly significant effect ($F(1,94) = 12.604$, $p = 0.001$, partial $\eta^2 = 0.118$), accounting for approximately 11.8% of the variance in severity level. Regular exercise also significantly predicted asthma attack score ($F(1,94) = 4.480$, $p = 0.037$, partial $\eta^2 = 0.045$), confirming its protective role across both dimensions of disease burden. BMI category exerted a significant independent effect on severity level of asthma ($F(1,94) = 9.504$, $p = 0.003$, partial $\eta^2 = 0.092$), explaining approximately 9.2% of the variance, though its effect on asthma attack score did not reach statistical significance ($F(1,94) = 2.060$, $p = 0.155$, partial $\eta^2 = 0.021$). Passive smoking exposure was also significantly associated with severity level ($F(1,94) = 4.965$, $p = 0.028$, partial $\eta^2 = 0.050$), but not with attack score ($F(1,94) = 0.463$, $p = 0.498$, partial $\eta^2 = 0.005$). None of the remaining factors, including stress and anxiety, intake of fast food, family history, sinusitis, and crowding area, demonstrated statistically significant independent effects on either severity level or attack score (all $p > 0.05$), with partial η^2 values consistently below 0.03. Notably, stress and anxiety showed a borderline trend toward significance for asthma attack score ($F(1,94) = 2.233$, $p = 0.068$, partial $\eta^2 = 0.023$). The model intercept was highly significant for both severity level ($F(1,93) = 183.769$, $p < 0.001$, partial $\eta^2 = 0.662$) and attack score ($F(1,93) = 14.924$, $p < 0.001$, partial $\eta^2 = 0.137$), confirming the overall adequacy of the fitted model.

Table 10. Multivariate Effects of Clinical, Behavioural, and Environmental Factors on Asthma Severity and Attack Frequency

Effect	Dependent Variable	F (df1, df2)	Sig.	Partial η^2
BMI Category	Severity Level of Asthma	9.504 (1, 94)	0.003*	0.092
	Asthma Attack Score	2.060 (1, 94)	0.155	0.021
Passive Smoking	Severity Level of Asthma	4.965 (1, 94)	0.028*	0.050
	Asthma Attack Score	0.463 (1, 94)	0.498	0.005
Stress and Anxiety	Severity Level of Asthma	0.003 (1, 94)	0.955	0.000
	Asthma Attack Score	2.233 (1, 94)	0.068	0.023
Fast Food	Severity Level of Asthma	0.052 (1, 94)	0.819	0.001
	Asthma Attack Score	0.695 (1, 94)	0.406	0.007
Regular Exercise	Severity Level of Asthma	12.604 (1, 94)	0.001*	0.118
	Asthma Attack Score	4.480 (1, 94)	0.037*	0.045
First-Degree Family History	Severity Level of Asthma	0.140 (1, 94)	0.709	0.001
	Asthma Attack Score	0.904 (1, 94)	0.344	0.010
Sinusitis	Severity Level of Asthma	0.234 (1, 94)	0.630	0.002
	Asthma Attack Score	0.012 (1, 94)	0.912	0.000
Crowding Area	Severity Level of Asthma	0.472 (1, 94)	0.494	0.005
	Asthma Attack Score	0.293 (1, 94)	0.589	0.003
Intercept	Severity Level of Asthma	183.769 (1, 93)	<0.001*	0.662
	Asthma Attack Score	14.924 (1, 93)	<0.001*	0.137

*Statistically significant at $p < 0.05$. df1 = degrees of freedom for the effect; df2 = error degrees of freedom.

Discussion

This cross-sectional study, conducted among 99 children attending Sabratha Teaching Hospital in western Libya, sought to characterise the interplay between lifestyle behaviour, environmental exposure, nutritional status, and treatment patterns in shaping pediatric asthma severity. The principal findings indicate that abnormal body mass index, and obesity in particular, was significantly associated with greater disease severity and elevated hospitalisation risk; that regular physical activity, passive smoking exposure, and behavioural disturbance constituted the most influential independent correlates of severity; and that pharmacological treatment, considered in isolation, failed to differentiate controlled from uncontrolled disease, underscoring the multifactorial architecture of asthma control within this population. The male preponderance observed in this cohort (66.7%) is consistent with the well-established epidemiological pattern of pre-pubertal childhood asthma [3], generally attributed to narrower airways, heightened airway resistance, and hormonal influences that precede the female predominance emerging after puberty [3,4]. The relatively young mean age of participants (9.87 ± 3.84 years), together with the considerable dispersion of BMI values spanning underweight to obese categories, reflects the dual nutritional burden increasingly documented in hospitalised paediatric asthma cohorts, wherein undernutrition and excess adiposity coexist and confer distinct, phenotype-specific implications for disease severity. The significant positive association between BMI and severity ($r = 0.306$, $p = 0.002$), together with its stronger relationship with hospital admission ($r = 0.352$, $p < 0.001$), corroborates a substantial and expanding body of international evidence implicating obesity as a principal determinant of asthma burden [20].

Analysing more than 65,000 hospitalisations for lower respiratory illness demonstrated that obese children, irrespective of severity classification, exhibited markedly elevated odds of requiring respiratory support and intensive care, following a graded dose-response relationship with increasing obesity class. This is reinforced by [21,22], who observed that obese asthmatic patients experienced the highest exacerbation frequency, the poorest pulmonary function, and the longest hospital stays across BMI groups. In support of the present work, [23] compared obese and non-obese asthmatic children and yielded closely analogous associations with severity and hospitalisation. However, this relationship did not extend to attack frequency ($r = 0.179$, $p = 0.077$). This pattern is consistent with [24], a population-based UK cohort, which recognised obesity as the largest modifiable contributor to hospital admission while noting a less consistent association with exacerbation frequency. This suggests that obesity has a greater influence on the severity of individual attacks than the rate at which they occur. Regular physical activity was the strongest independent indicator of disease severity in the multivariate model ($F(1,94) = 12.604$, $p = 0.001$), supporting the results of [6], a synthesis of 64 studies supporting regular exercise as essential to management of asthma. Similarly, [25] meta-analytic findings of improved pulmonary function and decreased BMI and inflammatory cytokines following regular exercise intervention, and physically active individuals achieved greater control regardless of the level of treatment.

Passive smoking exposure was similarly associated with disease severity in both bivariate ($p = 0.04$) and multivariate analyses ($F(1,94) = 4.965$, $p = 0.028$). Tobacco smoke is known to increase airway inflammation, oxidative stress, and bronchial hyperresponsiveness, all of which can worsen asthma manifestations in children. This observation is consistent with previous pediatric asthma research identifying environmental tobacco smoke as an important determinant of disease severity [26]. Psychological stress and anxiety showed a significant bivariate association with asthma severity ($p = 0.040$) that attenuated in the fully adjusted model ($p = 0.955$), a pattern broadly consistent with [27], regarding stress-induced hypothalamic-pituitary-adrenal axis activation and subsequent glucocorticoid resistance. The observed attenuation in the effect size does not indicate a true absence of an effect; rather, it is statistically attributable to multicollinearity with confounding behavioural variables. This study found no statistically significant correlation between medication utilisation (including bronchodilators, preventive medication and inhaled corticosteroids) and the achievement of asthma control, as the majority of children remained uncontrolled regardless of therapeutic category. Rather than indicating treatment inefficacy, this pattern reflects confounding by indication, which is a feature of cross-sectional designs. In such studies, highly intensive therapies are prescribed to children with high baseline asthma severity, thereby statistically obscuring the true protective effect of the therapy. This interpretation is consistent with [28], which observed that asthma severity indicators, including obesity, predicted requirements for respiratory support more efficiently than type of treatment, and with the existing literature demonstrating attenuation of corticosteroid reactivity among obese asthmatic children. In the present study, fast food intake, sinus infection, and family history were not significant statistical predictors, which may reflect indirect rather than direct causative pathways: BMI and systemic inflammation appear to be the main mediators of dietary effects [29]. The relationship between chronic rhinosinusitis and asthma is well-established, with frequent co-occurrence. Inflammation of the upper airway appears to spread to the lower airway, and the nasal passages act as the first line of defence against typical environmental insults of the upper and lower airways [30].

While family history can be an indicator of the onset of the disease, it has a relatively weaker impact on its severity after diagnosis [31,32]. A clear interplay between obesity, lifestyle behaviour, psychological factors, and disease burden was highlighted by cluster correlation analysis. BMI increased with age and behavioural disturbance, while it decreased with physical activity, and there was a pronounced association between BMI and abnormal behaviours ($r = 0.531$, $p < 0.001$). These findings go side by side with the results obtained by [33]. [34], reported that obese asthmatic children have higher levels of anxiety, and a longitudinal study by [35] linked the risk of anxiety with early childhood asthma. Physical activity, obesity, and passive smoking collectively constituted clinically actionable, modifiable risk factors. In this respect, [36] has reported that obesity-related asthma is a "treatable trait." Finally, the near-universal prevalence of nocturnal symptoms (96.2%) alongside a high admission rate (67.7%). These results are in agreement with [37], who reported that across

resource-limited Eastern Mediterranean settings, diagnostic delay and constrained specialist access sustain elevated symptomatic burden. Reinforcing the need to embed standardised assessment instruments, such as the Childhood Asthma Control Test (CACT), within routine clinical practice.

Conclusion

This study demonstrates a clear correlation between abnormal BMI, particularly obesity, with greater asthma severity and increased likelihood of hospital admission. Physical activity, passive smoking exposure, and behavioural disturbance emerged as the most influential independent predictors of disease severity, whereas medical treatment alone failed to distinguish controlled from uncontrolled asthma status. These findings underscore the multifactorial determinants of pediatric asthma control and highlight the imperative of integrating weight management and lifestyle-modification strategies into comprehensive, context-appropriate asthma care in regions where biologic therapies remain inaccessible.

Author Contributions

Dr Nawal Hasan was responsible for manuscript writing, table preparation, and critical revision of the manuscript. Dr Karima Hwisa contributed to the data analysis and interpretation. Dr Waheedah Awushah and Dr Rabia Aldabosy contributed to the study conception and data collection. Dr Huria Dardar contributed to the study conception and financial support. All authors reviewed and approved the final version of the manuscript.

Conflict of interest. Nil

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