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ORIGINAL ARTICLE / ARAŞTIRMA YAZISI Physical Medicine and Rehabilitation/Fiziksel Tıp ve Rehabilitasyon

Association of Obesity with Asthma Control and Physical Activity in Children with Asthma: A Cross-Sectional Pilot Study

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ABSTRACT

Purpose: Obesity and asthma are two prevalent chronic conditions in childhood that frequently coexist and may be associated with adverse disease outcomes. This study aimed to evaluate the association between body mass index (BMI), asthma control, physical activity levels, and selected demographic and early-life factors in children with asthma.

Methods: This cross-sectional pilot study included 24 children aged 9–17 years with physician-diagnosed asthma. Participants were categorized into two groups: obese (n = 12) and normal-weight (n = 12) according to age- and sex-specific BMI percentiles defined by the Centers for Disease Control and Prevention (CDC). Asthma control was assessed using the Asthma Control Test (ACT). Physical activity levels were evaluated using the Physical Activity Questionnaire for Older Children (PAQ-C) and the Children's Leisure Activities Study Survey (CLASS).

Results: Poor asthma control was significantly more frequent in the obese group compared with the normal-weight group (75% vs 16.7%, p = 0.028). PAQ-C mean scores were slightly higher in the obese group (2.03 ± 0.75) compared with the normal-weight group (1.78 ± 0.65); however, this difference was not statistically significant (p = 0.436). No significant differences were observed in CLASS-derived physical activity indicators between groups (all p > 0.05).

Conclusion: Obesity was associated with poorer asthma control in children with asthma. Although obese children showed slightly higher PAQ-C scores compared with normal-weight children, this difference was not statistically significant. These findings suggest that BMI may be an important factor in asthma control, while its relationship with physical activity levels warrants further investigation in pediatric asthma populations.

Keywords: Asthma; Obesity; Child; Exercise; Breast Feeding

ÖZET

Amaç: Obezite ve astım, çocukluk çağında sık görülen ve sıklıkla birlikte seyreden iki yaygın kronik hastalıktır ve olumsuz hastalık sonuçları ile ilişkili olabilir. Bu çalışma, astımlı çocuklarda vücut kitle indeksi (VKİ), astım kontrolü, fiziksel aktivite düzeyleri ile seçilmiş demografik ve erken yaşam faktörleri arasındaki ilişkiyi değerlendirmeyi amaçlamıştır.

Yöntem: Bu kesitsel pilot çalışmaya, hekim tarafından astım tanısı konulmuş 9–17 yaş arası 24 çocuk dahil edilmiştir. Katılımcılar, Hastalık Kontrol ve Önleme Merkezleri (CDC) tarafından tanımlanan yaş ve cinsiyete özgü VKİ persentillerine göre iki gruba ayrılmıştır: obez (n = 12) ve normal kilolu (n = 12). Astım kontrolü Astım Kontrol Testi (ACT) ile değerlendirilmiştir. Fiziksel aktivite düzeyleri ise Büyük Çocuklar İçin Fiziksel Aktivite Anketi (PAQ-C) ve Çocukların Boş Zaman Etkinlikleri Çalışma Anketi (CLASS) kullanılarak ölçülmüştür.

Bulgular: Kötü astım kontrolü, obez grupta normal kilolu gruba göre anlamlı olarak daha sık görülmüştür (%75'e karşı %16,7; p = 0.028). Obez çocuklarda PAQ-C skorları normal kilolu gruba göre daha yüksek olmakla birlikte bu fark istatistiksel olarak anlamlı bulunmamıştır (2,03 ± 0,75'e karşı 1,78 ± 0,65; p = 0.436). CLASS skorları açısından gruplar arasında anlamlı bir fark saptanmamıştır (p > 0.05).

Sonuç: Obezite, astımlı çocuklarda daha kötü astım kontrolü ile ilişkili bulunmuştur. Obez çocuklarda PAQ-C skorları normal kilolu çocuklara göre hafifçe daha yüksek olmasına rağmen, bu fark istatistiksel olarak anlamlı değildir. Bu bulgular, pediatrik astımda VKİ'nin astım kontrolünde önemli bir faktör olabileceğini, ancak fiziksel aktivite düzeyi ile ilişkisine yönelik daha ileri çalışmalara ihtiyaç olduğunu düşündürmektedir.

Anahtar Kelimeler: Astım; Obezite; Çocuk; Egzersiz; Emzirme

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Asthma is the most common chronic respiratory condition affecting children and adolescents globally, with an estimated 14% of this population experiencing symptoms (1). Despite its high prevalence, pediatric asthma outcomes remain suboptimal, and a substantial burden of morbidity and preventable mortality persists worldwide (2). Typical symptoms include wheezing, shortness of breath, and coughing, which are often triggered by various factors (3). Established factors associated with asthma include family history of asthma, exposure to secondhand smoke, premature birth, low birth weight, obesity, and air pollution (4,5). Moreover, some pharmacological treatments used in asthma management have been associated with increases in body mass index (BMI) (6).

Obesity and asthma are among the most common chronic conditions in children and adolescents, and their coexistence is frequently observed (7). Evidence suggests a complex and bidirectional association between obesity and asthma (8). Although the relationship between BMI and asthma has been widely investigated, the underlying mechanisms remain incompletely understood (9). Proposed explanations include exercise-induced bronchospasm, which may limit physical activity, and obesity-related changes in respiratory mechanics, such as decreased lung compliance and increased airway resistance (10). In addition, factors such as physical activity and diet may influence this relationship (11).

Understanding the association between BMI, a modifiable factor, and asthma-related outcomes in children is therefore important. Previous literature has described early-life and environmental factors in relation to asthma, including dietary habits, vitamin D use and duration, breastfeeding, maternal smoking during pregnancy, and maternal infections during pregnancy (12). Some of these factors have also been linked to obesity, suggesting potential overlapping pathways (13).

In this cross-sectional pilot study, we aimed to evaluate the association between obesity and asthma control, physical activity levels, and selected demographic and early-life characteristics in children with asthma. We hypothesized that obesity is associated with poorer asthma control and lower physical activity levels in this population.

Material and Method

This cross-sectional pilot study included 24 children aged 9–17 years attending a pediatric outpatient clinic. The study was conducted in accordance with the principles of the Declaration of Helsinki. It was approved by the Hatay Mustafa Kemal University Ethics Committee (approval no: 2021/14; decision no: 14; date: 23 December 2021). The study was registered at ClinicalTrials.gov (Identifier: NCT05918874). Written informed consent was obtained from both parents and children.

Grouping and Sample Selection

Participants were divided into two groups: obese children with asthma (obese group, n = 12) and normal-weight children with asthma (normal-weight group, n = 12). Group classification was based on BMI percentiles according to the Centers for Disease Control and Prevention (CDC) age- and sex-specific standards. All eligible children presenting to the clinic during the study period were invited to participate, resulting in a convenience sample.

Inclusion and Exclusion Criteria

Inclusion criteria were: diagnosis of asthma by a pediatrician according to the Global Initiative for Asthma (GINA) guidelines, age between 9–17 years, being in a stable phase (no acute exacerbation), and absence of significant systemic or cognitive disorders.

Exclusion criteria included: presence of chronic pulmonary diseases other than asthma, cardiac disease, acute infection at the time of assessment, serious postural disorders, idiopathic scoliosis, idiopathic rheumatic disease, history of orthopedic surgery, and neurological disorders.

Data Collection

Demographic characteristics, asthma type (allergic/non-allergic), vitamin D supplementation during infancy (yes/no) and duration (months), feeding habits (good/moderate/poor), and breastfeeding duration (months) were recorded. Maternal factors, including smoking during pregnancy (yes/no) and treatment for urinary tract infection during pregnancy (yes/no), were collected based on parental report. Asthma type classification was based on clinical history, physician assessment, and available allergy testing.

Assessment Procedures

All evaluations were conducted by trained physiotherapists during clinic visits. The following instruments were used:

Asthma Control Test

It is a questionnaire consisting of a total of 5 questions used to assess asthma control. A total score of 25 points indicates 'optimal asthma control', scores between 20–24 indicate 'partial asthma control', and scores below 19 indicate 'poor asthma control' (14).

Children's Leisure Activities Study Survey

The questionnaire comprised 31 physical activities and 14 sedentary behaviors. Children were asked to indicate whether they had engaged in each physical activity within one week and one weekend since the beginning of the school term by ticking either 'YES' or 'NO'.

Children who responded positively to the activities question were asked to report the frequency and duration of each activity in minutes or hours. In the sedentary behavior section of the questionnaire, children were asked to report the total time they spent being sedentary on weekdays and weekends separately. The data were recorded in metabolic equivalent (MET)-hours per week. In our study, the Turkish version of the questionnaire, which has been tested for reliability and validity, was used (15).

Physical Activity Questionnaire for Older Children

In the 10-item scale, the first nine items ask about activity participation, and the 10th item asks about the illness that affects the person's activity participation. Responses are scored on a 5-point scale (1 = no activity, 5 = 7 times or more), and a mean score is calculated. Higher scores indicate higher physical activity levels. In our study, the Turkish version of the questionnaire, which has been tested for reliability and validity, was used (16).

Data Management and Confidentiality

All data were anonymized and coded to protect participant confidentiality. Incomplete questionnaires were excluded from the analysis.

Statistical Analysis

Data were analyzed using SPSS 27.0. Descriptive statistics (frequency, mean ± SD) were calculated for demographic variables. The normality of data distribution was assessed using the Shapiro–Wilk test. Continuous variables were analyzed using the independent samples t-test or Mann–Whitney U test, depending on data distribution. Categorical variables were compared using the chi-square test or Fisher's exact test. Statistical significance was set at $p < 0.05$.

Results

The study included 24 children diagnosed with asthma. The mean age was 13.95 ± 1.89 years, with 41.7% girls and 58.3% boys. Mean height was 164.12 ± 9.56 cm, mean weight was 63.41 ± 17.21 kg, and mean BMI was 23.54 ± 4.86. Family history of asthma was reported in 66.7% of participants, and 95.8% had allergic asthma. Poor asthma control was observed in 45.8% of participants. Most children (87.5%) had used vitamin D, with a mean duration of 11.08 ± 6.15 months. Half of the participants (50%) had moderate dietary habits. Breastfeeding was reported in 91.7% of children (mean duration 13.35 ± 9.51 months), and the mean age at cow's milk introduction was 18.35 ± 16.10 months. Maternal urinary tract infection during pregnancy was reported in 25%, and maternal smoking in 8.3% (Table 1).

Participants were divided according to BMI into obese (n = 12) and normal-weight (n = 12) groups. No significant differences were observed between groups regarding age, breastfeeding duration, dietary habits, vitamin D use, age at cow's milk introduction, or allergic asthma prevalence. However, poor asthma control was significantly more frequent in the obese group (75% vs 16.7%, $p = 0.028$). As expected based on group definition, height, weight, and BMI were significantly higher in the obese group compared with the normal-weight group (Table 2).

PAQ-C mean scores were slightly higher in the obese group (2.03 ± 0.75) compared with the normal-weight group (1.78 ± 0.65), although this difference was not statistically significant ($p = 0.436$). Physical activity indicators derived from the CLASS questionnaire, including MET-hours per week and sedentary and activity intensity categories, showed no significant differences between groups (all $p > 0.05$) (Table 3).

Table 1. Demographic and Clinical Characteristics of the Study Population	
Characteristic	**Value**
Age (years, mean ± SD)	13.95 ± 1.89
Sex	Girls: 42%, Boys: 58%
Height (cm, mean ± SD)	164.12 ± 9.56
Weight (kg, mean ± SD)	63.41 ± 17.21
Body Mass Index (mean ± SD)	23.54 ± 4.86
Family history of asthma	Yes: 67%, No: 33%
Asthma type	Allergic: 96%, Non-allergic: 4%
Asthma control level	Well-controlled: 25%, Partially controlled: 29%, Poorly controlled: 46%
Vitamin D use	Yes: 88%, No: 12%
Duration of vitamin D use (months, mean ± SD)	11.08 ± 6.15
Dietary habits	Good: 29%, Moderate: 50%, Poor: 21%
Breastfeeding	Yes: 92%, No: 8%
Duration of breastfeeding (months, mean ± SD)	13.35 ± 9.51
Breastfeeding duration categories	<12 months: 50%, 12–24 months: 29%, ≥24 months: 21%
Age at cow's milk introduction (months, mean ± SD)	18.35 ± 16.10
Cow's milk introduction	≤12 months: 54%, >12 months: 46%
Maternal urinary tract infection during pregnancy	Yes: 25%, No: 75%
Maternal smoking during pregnancy	Yes: 8%, No: 92%
CLASS score (MET-hours/week, mean ± SD)	134.22 ± 70.56
PAQ-C mean score (range: 1–5, mean ± SD)	1.90 ± 0.70
SD = standard deviation; BMI = body mass index; MET = metabolic equivalent; CLASS = Children's Leisure Activities Study Survey; PAQ-C = Physical Activity Questionnaire for Older Children.	

Table 2. Comparison of Demographic and Clinical Characteristics Between Obese and Normal-Weight Groups			
Characteristic	**Obese (n=12)**	**Normal-weight (n=12)**	**p**
Sex	Girls: 25%, Boys: 75%	Girls: 58%, Boys: 42%	0.214[a]
Asthma type	Allergic: 92%, Non-allergic: 8%	Allergic: 100%, Non-allergic: 0%	1.000[a]
Asthma control	Well-controlled: 8%, Partially controlled: 17%, Poorly controlled: 75%	Well-controlled: 42%, Partially controlled: 42%, Poorly controlled: 17%	0.028[a]*
Dietary habits	Good: 25%, Moderate: 50%, Poor: 25%	Good: 33%, Moderate: 50%, Poor: 17%	0.842[a]
Age (years, mean ± SD)	13.91 ± 2.02	14.00 ± 1.85	0.906[b]
Height (cm, mean ± SD)	169.08 ± 6.74	159.16 ± 9.59	0.012[b]*
Weight (kg, mean ± SD)	77.08 ± 12.42	49.75 ± 7.71	<0.001[b]*
BMI (mean ± SD)	27.31 ± 3.94	19.76 ± 1.70	<0.001[b]*
Breastfeeding duration (months, mean ± SD)	14.67 ± 9.87	12.04 ± 9.38	0.560[b]
Age at cow's milk introduction (months, mean ± SD)	15.45 ± 7.38	21.00 ± 21.29	0.654[b]
BMI = body mass index; [a]: Chi-square test; [b]: Mann-Whitney U test; *p < 0.05 indicates statistical significance.			

Table 3. Comparison of Physical Activity Levels Between Obese and Normal-Weight Groups

Variable	Obese (n=12) mean ± SD	Normal-weight (n=12) mean ± SD	p
PAQ-C mean score (1–5)	2.03 ± 0.75	1.78 ± 0.65	0.436
Sedentary MET-hours/week	10.96 ± 7.90	15.73 ± 16.03	0.356
Moderate MET-hours/week	7.60 ± 7.25	10.62 ± 6.89	0.488
Moderate-to-vigorous MET-hours/week	15.18 ± 10.23	19.41 ± 9.17	0.840
Vigorous MET-hours/week	7.57 ± 5.84	8.79 ± 7.23	0.771
Sedentary MET score/hour	9.11 ± 6.32	8.35 ± 3.69	0.885
Moderate MET score/hour	0.71 ± 1.02	0.70 ± 0.46	0.644
Moderate-to-vigorous MET score/hour	1.69 ± 1.22	1.75 ± 1.03	0.564
Vigorous MET score/hour	0.96 ± 0.82	1.05 ± 0.94	0.953

*METs = Metabolic Equivalents; PAQ-C: Physical Activity Questionnaire for Older Children; *p < 0.05 indicates statistical significance.*

Discussion

The objective of this study was to assess factors associated with asthma outcomes in children with asthma and to investigate their relationship with obesity. The findings of this study indicate that obesity was associated with poorer asthma control in children with asthma. Although obese children had slightly higher PAQ-C scores compared with normal-weight children, this difference was not statistically significant. Furthermore, physical activity levels were generally low in children with asthma, irrespective of obesity status. It is also noteworthy that 50% of children with asthma were breastfed for less than 12 months, and 54.2% started consuming cow's milk at an age younger than 12 months.

The relationship between sex and asthma shows that the prevalence of asthma and allergic diseases is higher in boys than in girls. In line with the existing literature, 58.34% of the study population consisted of boys. When individuals were grouped according to BMI, the proportion of boys was higher in the obese group. Although obesity has been associated with poorer asthma outcomes in both sexes, previous studies have also shown that obesity may complicate asthma management (17). Our findings are consistent with the existing literature. Although the groups were comparable in most baseline characteristics, differences in sex distribution and height may represent potential confounding factors that could have influenced the observed associations. Poor asthma control was more frequent in the obese group (75%) compared with the normal-weight group (16.7%). It is also noteworthy that poor asthma control was observed in 45.84% of the overall asthma population, suggesting that asthma control remains a significant challenge and may be further impaired in the presence of obesity.

It has been proposed that genetics may play a role in asthma development (18). In this study, 66.67% of children had a positive family history of asthma, supporting the role of genetic predisposition in asthma susceptibility.

A total of 95.84% of participants had allergic asthma. Additionally, 50% of children were breastfed for less than 12 months. Early-life factors such as breastfeeding duration and timing of complementary feeding have been suggested to influence immune system development and allergic disease susceptibility (19). However, due to the cross-sectional design, no causal inferences can be made.

In terms of nutrition, 50% of parents reported moderate dietary habits. When analyzed by group, 25% of the obese group and 33.4% of the normal-weight group exhibited adequate nutritional intake. Although no causal interpretation can be made, nutritional quality remains an important factor in both asthma and obesity management.

Complications during pregnancy may influence long-term health outcomes in offspring (20). Maternal urinary tract infections and antibiotic exposure have been associated with increased risk of asthma and obesity in children

(21,22). In this study, 25% of mothers reported urinary tract infections during pregnancy, which is consistent with previous literature suggesting a potential association between prenatal factors and childhood asthma.

The relationship between early-life nutrition and asthma remains controversial. While some studies suggest that shorter breastfeeding duration and early introduction of cow's milk may be associated with asthma risk, others have not confirmed this association (23,24). In this study, a considerable proportion of children had shorter breastfeeding duration and early introduction of cow's milk. However, these findings are descriptive and do not allow causal interpretation.

Lifestyle factors, particularly low physical activity, are important contributors to the asthma–obesity phenotype. Although findings in the literature are inconsistent, most studies indicate reduced physical activity levels in children with asthma compared with healthy controls (25,26). In this study, PAQ-C scores did not differ significantly between obese and normal-weight children, whereas CLASS-derived physical activity indicators also showed no significant differences between groups. The discrepancy between PAQ-C and CLASS findings may be related to differences in the constructs measured by these instruments, with PAQ-C reflecting perceived physical activity levels, whereas CLASS provides a more detailed assessment of activity patterns and sedentary behavior. This methodological difference may explain the lack of significant differences observed in CLASS-derived variables.

In this study, physical activity levels were generally low in the asthma population. Although obese children had slightly higher PAQ-C scores compared with normal-weight children, this difference was not statistically significant. These findings suggest that physical inactivity may still be a relevant concern in children with asthma, regardless of obesity status.

Limitations

This study is limited by its small, single-center sample size, which reduces statistical power and generalizability. Due to the pilot nature and limited sample size, correlation and multivariable regression analyses could not be performed, which limits the ability to adjust for potential confounders and evaluate independent associations. The cross-sectional design does not allow causal inference. In addition, self-reported data may introduce recall bias.

Conclusion

Obesity was associated with poorer asthma control in children with asthma. Although obese children showed slightly higher PAQ-C scores compared with normal-weight children, this difference was not statistically significant. Physical activity levels were generally low in the asthma population. Early-life factors such as breastfeeding duration and timing of cow's milk introduction were described in this study; however, no causal conclusions can be drawn due to the cross-sectional design.

Abbreviations/Acronyms

ACT: Asthma Control Test

BMI: Body Mass Index

CLASS: Children's Leisure Activities Study Survey

GINA: Global Initiative for Asthma

PAQ-C: Physical Activity Questionnaire for Children

MET: Metabolic Equivalents

Declarations

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Conflict of Interest

The authors declare that they have no conflict of interest.

Ethics Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Hatay Mustafa Kemal University Ethics Committee (approval no: 2021/14; decision no: 14; date: 23 December 2021). Written informed consent was obtained from all participants and their parents/legal guardians prior to participation.

Availability of Data and Material

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

Özden Gökçek: Conceptualization, methodology, supervision, formal analysis, interpretation of data, writing—review and editing.

Miray Başer: Data curation, investigation, data collection, statistical analysis, writing—original draft preparation.

Ferve Türkeli: Investigation, literature review, data collection, writing—original draft preparation.

Çiğdem El: Clinical supervision, patient recruitment, resources, validation, writing—review and editing.

All authors contributed to the study conception and design, critically revised the manuscript, and approved the final version of the manuscript.

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