



# Adipose tissue content and distribution in children and adolescents with bronchial asthma



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Received 18 June 2014; accepted 12 November 2014

Available online 3 December 2014

## KEYWORDS

Bronchial asthma;  
Children;  
Skin-fold thicknesses;  
Fat distribution;  
Spirometry

## Summary

**Background:** The excess of adipose tissue and the pattern of adipose tissue distribution in the body seem to play an important role in the complicated dependencies between obesity and risk of developing asthma. The aim of the present study was to determine nutritional status in children and adolescents with bronchial asthma with special emphasis on adipose tissue distribution evaluated on the basis of skin-fold thicknesses, and to determine the relationships between patterns of adipose tissue distribution and the course of the disease.

**Methods:** Anthropometric data on height, weight, circumferences and skin-fold thicknesses were extracted from the medical histories of 261 children diagnosed with asthma bronchitis. Values for children with asthma were compared to Polish national growth reference charts. Distribution of subcutaneous adipose tissue was evaluated using principal components analysis (PCA). Multivariate linear regression analyses tested the effect of three factors on subcutaneous adipose tissue distribution: type of asthma, the severity of the disease and the duration of the disease.

**Results:** Mean body height in the children examined in this study was lower than in their healthy peers. Mean BMI and skin-fold thicknesses were significantly higher and lean body mass was lower in the study group. Excess body fat was noted, especially in girls. Adipose tissue was preferentially deposited in the trunk in girls with severe asthma, as well as in those who had been suffering from asthma for a longer time. The type of asthma, atopic or non-atopic, had no observable effect on subcutaneous adipose tissue distribution in children examined.

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**Conclusions:** The data suggest that long-treated subjects and those with severe bronchial asthma accumulate more adipose tissue on the trunk. It is important to regularly monitor nutritional status in children with asthma, especially in those receiving high doses of systemic or inhaled glucocorticosteroids, and long-term treatment as well.

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## Introduction

Both asthma and obesity are currently major social health problems among children and adults in developing countries [1,2]. The parallel rise in both conditions has motivated researchers to look for a link between them.

In spite of extensive study, the basis of the pathological links between asthma and obesity has not yet been adequately elucidated. Most studies, both cross-sectional and longitudinal, indicate that obesity increases the risk of developing asthma and wheezing in children and adults [2–5]. Some population studies also indicate that the link between obesity and the risk of developing bronchial asthma is stronger in females [3,6,7].

Several mechanisms have been proposed to explain the mechanism by which obesity causes changes in the respiratory tract that can lead to asthma. The release of certain inflammatory cytokines like IL-6 and TNF- $\alpha$  from adipose tissue causes transformations in the airway and increases airway hyper-reactivity [8]. Obesity complicates treatment of asthma and often aggravates the symptoms [9]. In overweight asthma sufferers who lose weight, the course of the disease improves, and so do respiratory parameters [10]. Excess body weight increases susceptibility to indoor pollutants among children with asthma, which further aggravates the symptoms and complicates treatment [11].

In some studies, obesity increases the risk of developing non-atopic asthma rather than atopic asthma. Non-atopic asthma often has a more serious course of disease than atopic asthma [2,12,13]. Excess body weight has also been reported to be a factor that increases the risk of asthma, but not the risk of atopy [1].

There are clear differences in the clinical picture between asthma patients that are overweight and those with a correct body weight. It has therefore been proposed that obesity-associated asthma be considered as a new and separate phenotype of the disease [14].

Other studies, on the other hand, have not found a link between obesity and asthma [15,16]. These are population studies on children, generally pre-pubertal, in which information about nutritional status and asthma symptoms

was usually compiled from questionnaires completed by the parents.

In the complicated dependencies between obesity and risk of developing asthma, not only does excess adipose tissue play an important role, but the pattern of adipose tissue distribution in the body seems to, as well. The few studies heretofore conducted on this topic have not provided unambiguous results. This is because of differences in methods of evaluating adipose tissue distribution, and also because of differences in selecting samples of children with asthma in terms of the severity of the disease.

For example, compared to their healthy peers, children with mild or moderate asthma do not exhibit abnormalities in adipose tissue content as determined by waist/hip ratio [17,18]. In a study from Australia, abdominal obesity determined on the basis of waist circumference significantly increased the risk of developing asthma in adults [12]. The authors, however, pointed out that, in children and adolescents, the best indicators of obesity are skin-fold thicknesses because fat deposition is predominantly subcutaneous and peripheral rather than visceral and central during this stage of life [19].

In light of these often conflicting studies, it was determined that a study should be done specifically on a group of children and adolescents who had been definitively diagnosed with bronchial asthma and had been receiving long-term treatment.

The aim of the present study was to determine nutritional status and pulmonary function in children and adolescents with bronchial asthma. Nutritional status was estimated on the basis of subcutaneous adipose tissue distribution. Relationships between patterns of adipose tissue distribution and the course of the disease were also explored.

## Material and methods

The study was carried out using anthropometric measurements and information on the severity and course of the disease on 261 children with bronchial asthma. The sample consisted of 155 boys and 106 girls from 5 to 18 years old, with an average of 12 years old (Table 1).

All of the subjects were patients of the Pulmonary Medicine and Allergology Center in Karpacz, Poland. The study lasted from August, 2005, to September, 2006, while the children were being treated as in-patients at the Center. The study protocol was approved by the Institute of Mother and Child Ethics Committee, and written informed consent was obtained from the parents of each subject.

In testing for sensitivity to common environmental antigens, 89.7% of the subjects exhibited serum Class E

**Table 1** Age statistics for the children examined.

Sex	N	Mean age	SD	Age range
Boys	155	11.8	3.2	4.6–18.4
Girls	106	12.3	3.4	4.5–18.3
Total	261	12.0	3.3	4.5–18.4

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