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ORIGINAL ARTICLE

The influence of gender and atopy in the relationship between obesity and asthma in childhood☆

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Abstract
Background: The objective of the study was to examine the relationship between asthma and overweight–obesity in Spanish children and adolescents and to determine whether this relationship was affected by gender and atopy.
Methods: The study involves 8607 Spanish children and adolescents from the International Study of Asthma and Allergies in Childhood phase III. Unconditional logistic regression was used to obtain adjusted odds ratios (OR) and 95% confidence intervals (95% CI) for the association between asthma symptoms and overweight–obesity in the two groups. Afterwards, it was stratified by sex and rhinoconjunctivitis.
Results: The prevalence of overweight and obesity in 6–7-year-old children was 18.6% and 5.2% respectively and in 13–14 year-old teenagers was 11.4% and 1.1% respectively. Only the obese children, not the overweight children, of the 6–7 year old group had a higher risk of any asthma symptoms (wheezing ever: OR 1.68 [1.15–2.47], asthma ever: OR 2.29 [1.43–3.68], current asthma 2.56 [1.54–4.28], severe asthma 3.18 [1.50–6.73], exercise-induced asthma 2.71 [1.45–5.05]). The obese girls had an increased risk of suffering any asthma symptoms (wheezing ever: OR 1.73 [1.05–2.91], asthma ever: OR 3.12 [1.67–5.82], current asthma 3.20 [1.65–6.19], severe asthma 4.83[1.94–12.04], exercise-induced asthma 3.68 [1.67–8.08]). The obese children without rhinoconjunctivitis had a higher risk of asthma symptoms.

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Conclusions: Obesity and asthma symptoms were associated in 6–7 year-old children but not in 13–14 year-old teenagers. The association was stronger in non-atopic children and obese girls.

Introduction

Overweight–obesity and asthma are two of the most significant chronic paediatric health problems worldwide.[1,2] The worldwide prevalence of overweight and obesity in children and adolescents has increased substantially in children and adolescents in developed and in developing countries.[2] The worldwide prevalence of childhood asthma increased between phase I and phase III of the International Study of Asthma and Allergies in Childhood (ISAAC study).[1]

Although findings are not always consistent, several studies suggest an association between asthma and overweight–obesity. A recently published systematic review and meta-analysis reported a significant association between high body weight and asthma in childhood.[3] Furthermore, several prospective studies and systematic reviews suggest that asthma tends to be preceded by obesity and that obesity is associated with the persistence and intensity of asthma symptoms.[4,5]

Several studies have found that a relationship between asthma and overweight–obesity exists only in males,[6,7] only in females[8] or in both sexes.[9] Thus, the relevance of gender in the relationship between asthma and obesity is unclear.

Additionally, there is some evidence that the link between asthma and excess of body weight is stronger for non-allergic asthma.[10,11] In 1997 Braun-Fahrländer et al. concluded that the ISAAC core questions on rhinitis are sufficiently specific and consequently useful in excluding atopy.[12] Since then, only one study has used the item of rhinoconjunctivitis from the ISAAC core questionnaire as a marker of atopy.[9]

The aim of this study is to evaluate the relationship between asthma symptoms and overweight–obesity. Secondly, it was to analyse the effect of gender and rhinoconjunctivitis, as a marker of atopy, in the relationship between asthma and overweight/obesity in two different age groups.

Methods

The International Study of Asthma and Allergies in Childhood (ISAAC) is an international, multicentre, multiphase cross-sectional study. It was developed to investigate childhood asthma, allergic rhinoconjunctivitis and atopic eczema at the population level. The ISAAC study consists of three phases and the data used in this study correspond to the third phase of the ISAAC study conducted in the Pamplona metropolitan area.

According to the ISAAC protocol, parents or guardians of 6–7 year-old children and 13–14 year-old adolescents, who were attending schools in Pamplona metropolitan area, Spain, were asked to complete the written ISAAC phase III questionnaire. The questionnaire was translated into Spanish and Basque.

The first part of the questionnaire concerns symptoms of asthma, rhinoconjunctivitis and eczema. The second part asks about possible risk factors for the development of asthma and allergies. Our study analysed answers related to asthma symptoms, rhinoconjunctivitis, weight, height, and potential confounding factors, such as the presence of breastfeeding, maternal education or the presence of tobacco in the family environment.

For the purpose of this study, ''*wheezing ever*'' was defined as a positive answer to the question ''Has your child/have you ever had wheezing or whistling in the chest at any time in the past?''

''*Asthma ever*'' was defined as a positive answer to the question ''Has your child/have you ever had asthma?''

''*Current asthma*'' was defined as a positive response to the question ''Has your child/have you had wheezing or whistling in the chest during the last 12 months?''

''*Current severe asthma*'' (CSA) was defined by fulfilling one or more criteria:

- Four or more asthma attacks in the past 12 months, or
- Sleep was disturbed $\geq$1 night/week in the last 12 months, or
- Wheezing limiting speech to one or two words at a time between breaths in the last 12 months.

''*Exercise-induced asthma*'' was defined as a positive answer to the question ''In the last 12 months, has your child's chest sounded wheezy during or after exercise?/have you had wheezing or whistling in the chest during or after exercise?''

Rhinoconjunctivitis was defined as a positive response to the following two questions;

- ''In the past 12 months, has your child/have you had a problem with sneezing or a runny or blocked nose when he/she did not have a cold or the flu?'' And
- ''If yes, has this nose problem been accompanied by itchy watery eyes?''.[13,14]

Self-reported height and weight or those measurements reported by the parents were used to calculate body mass index (BMI) in kg/m^2. Obesity, overweight and normal weight were defined according to the BMI cut-off points set by Cole et al.[15] for each group by age and sex.

Non-conditional multiple logistic regression was used to obtain adjusted prevalence odds ratios (OR) and 95% confidence intervals (95% CI) for the association between obesity–overweight and asthma symptoms in both groups, taking as reference the normal weight group. Secondly, stratification was done by rhinoconjunctivitis and by gender.

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