

# Asthma and physical activity in childhood

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## Summary

Asthma is one of the most common chronic diseases in children in the world. Asthma is caused by multiple factors, both genetic and environmental. Known environmental factors for developing asthma are exposure to cigarette smoke, air pollution, open fire cooking, antibiotic use early in life, diet and obesity. Low levels of physical activity are also considered as possible risk factor for developing asthma. Since the second half of the twentieth century, children (and adults) have been participating less in physical activity. The WHO Global Recommendations for Physical Activity and Sedentary Behaviour (2020) advises children to participate in moderate-to-vigorous physical activity for at least 60 minutes per day on average. Currently, only 20% of all adolescents globally meet this recommendation.

Asthma and physical activity are possibly associated: earlier studies have shown that individuals with asthma are less physically active compared to individuals without asthma. Possible explanations can be found in vigorous activity acting as a trigger for asthma symptoms (especially in exercise-induced asthma), or by poorly controlled asthma or fear of an asthma attack. As a consequence, children who engage less in physical activity become deconditioned and a vicious circle arises with shortness of breath when exercising. Physical training improves asthma control and possibly lung function in asthmatics. Asthma organisations and doctors advise asthmatic patients to stay physically active.

The aim of this thesis is to investigate the relation between asthma and physical activity.

**Chapter 2** describes a validation study in which we evaluated whether physician diagnosed asthma as reported by the parents corresponds to the medical information recorded by their general practitioner (GP). This showed only moderate agreement. In studies that use questionnaires to define asthma, the advice is not only to ask for physician diagnosed asthma, but to use a combination of questions, such as medication use and current asthma symptoms. Preferably, a uniformly applicable asthma definition is used, as proposed by the Mechanisms of the Development of Allergy (MeDALL) collaboration, which consists of a combination of asthma diagnosis, recent medication use and/or symptoms of wheezing (2 out of 3 criteria).

In the following chapters we describe 4 studies on asthma and physical activity in different directions: Chapter 3 describes asthma symptoms prior to physical activity, Chapter 4 provides an overview of the literature of cross-sectional and longitudinal studies with physical activity as a risk factor for developing asthma in children and adults. Chapters 5 and 6 describe original studies with physical activity as a risk factor for childhood asthma.

**Chapter 3** addresses the influence of early wheeze (before the age of 2) on physical activity patterns and overweight (at age 4 to 5 years) within the KOALA birth cohort study. Physical activity was measured with motion sensors. Boys were physically more active if they had experienced wheezing before the age of 2 but had outgrown it, compared with boys who had never experienced wheezing. No difference was found in girls. Children aged 4 to 5 who had experienced wheezing in the past year were equally physically active compared to children who did not wheeze. There was no relation between wheezing and overweight or physical activity and overweight.

**Chapter 4** provides an overview of the available literature on asthma and physical activity. At the time of this study (2012), no longitudinal studies in children with physical activity as exposure and asthma as outcome were available. In adults, the available evidence in longitudinal studies indicated that higher physical activity levels might be protective for asthma development. Cross-sectional studies in childhood showed conflicting results. This lack of longitudinal studies in childhood was the motivation for performing two original, longitudinal studies with physical activity as exposure and asthma development in children, as described in chapter 5 and 6. **Chapter 5** describes an original study within the KOALA birth cohort on physical activity and sedentary behaviour (measured with motion sensors and questionnaires) at the age of 4 to 5 years and asthma and lung function between 6 and 10 years. No association between physical activity or sedentary behaviour and subsequent asthma development

was found. In a small subgroup for which both accelerometry and lung function data were available, sedentary behaviour was associated with lower FEV<sub>1</sub>/FVC ratio. **Chapter 6** describes a large collaborative study that we initiated, in which we brought together information from 26 European cohorts on physical activity, sedentary behaviour and the development of asthma and lung function between birth and 18 years. Again, no association was found between physical activity, sedentary behaviour and the development of asthma. We found no confirmation of our previous finding of a possible association between sedentary behaviour and lung function.

Finally, in **chapter 7** the results of this thesis are discussed in relation to the existing literature and considerations. In **chapter 8** the results of this thesis are placed in a bigger picture, with attention to the societal impact.

In conclusion, this thesis shows that physical activity does not play a large role in asthma development. Prevention programs should focus on broader lifestyle advice, in particular the prevention of cigarette smoke exposure, a healthy diet, and the prevention of obesity.