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ARTICLE

Asthmatic Symptoms, Physical Activity, and Overweight in Young Children: A Cohort Study

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ABSTRACT

OBJECTIVE. Prevalence of asthma and overweight has increased simultaneously during the past decades. Several studies have reported an association between these two health problems, but it is unclear whether this relation is causal. We hypothesize that children with asthmatic symptoms are less physically active, which may contribute to the development of overweight.

PATIENTS AND METHODS. The study included children from the KOALA Birth Cohort Study who were invited at 4 to 5 years of age to wear an Actigraph accelerometer for 5 days (n = 305; 152 boys). Information on wheezing was gathered by repeated questionnaires completed by parents at child ages 7 months and 1, 2, and 4 to 5 years. Questionnaires on physical activity were completed at child age 4 to 5 years, and height, weight, and abdominal circumference were measured. Accelerometer data were expressed as mean counts per minute, minutes per day performing vigorous activity, and moderate-to-vigorous physical activity during ≥1 minute.

RESULTS. Children who had wheezed in the last 12 months showed very similar activity levels compared with children who had never wheezed. By contrast, boys who had wheezed at least once but not in the last 12 months were more physically active than boys who had never wheezed (geometric mean: 694 vs 625 cpm; adjusted geometric mean ratio: 1.11). This was not found for girls. Similar results were found in parent-reported physical activity data. No association was found between wheezing at any age and overweight at the age of 4 to 5 years.

CONCLUSIONS. These results do not support our hypothesis and previous studies that showed that wheezing children are less physically active. Our data provide no evidence that asthmatic symptoms induce a lower physical activity level and more overweight. Additional research could concentrate on the effect of physical activity and overweight on the development of asthmatic symptoms.

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Key Words
physical activity, accelerometer, overweight, wheeze, asthma, child

Abbreviations
MVPA—moderate-to-vigorous physical activity
GM—geometric mean
GMR—geometric mean ratio
CI—confidence interval
OR—odds ratio

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THERE HAS BEEN an increase in the prevalence of asthma.[1–4] Studies have shown that the prevalence of asthma is highest in Western countries. The United Kingdom and the United States have especially high asthma prevalence, at 15.3% and 10.9% of the population, respectively. Although asthma prevalence in developing countries was low, it is rising with increasing Westernization.[4] An explanation for the increasing asthma prevalence could be found in changes in environmental factors, such as air pollution, exposure to infectious diseases, use of antibiotics, breastfeeding, family size, diet, and smoking.

Another Western health concern is overweight, the prevalence of which has increased dramatically as well.[5–7] Although trends in overweight could not explain the increase in asthma, overweight might be a marker of recent lifestyle changes associated with both asthma and overweight.[8]

The available evidence suggests an association between asthma and overweight, in adults as well as in children,[9–14] although it is not yet clear whether overweight causes asthma or vice versa. The prevailing hypothesis for this association is that overweight is a cause of asthma. Prospective studies with healthy, nonasthmatic participants

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showed that a gain in weight increased the risk of asthma in adults and adolescents.[15,16] Flaherman and Rutherford[17] found that a BMI above the 85th centile in childhood increases the risk of asthma in adulthood by 50%. Several explanations have been suggested, such as mechanical effects of overweight, increased perception of symptoms in obese persons, gastroesophageal reflux, changes in inflammatory responses, and influence of hormones.[18,19] However, the evidence does not rule out the possibility that the causal direction is reversed. In this study, we hypothesize that asthmatic children engage in less physical activity, which subsequently can lead to overweight. Possible reasons for this self-restriction in wheezing children could be overprotective parents or because these children may easily get out of breath when physically active. The results from cross-sectional studies on the association between childhood asthma and physical activity have been inconclusive. A number of studies showed that children who wheezed were less physically active than children who did not wheeze.[20–22] By contrast, others did not find such association[9] or even found the reverse.[23] Because these studies were cross-sectional in design, they provide no information about the direction of the association. Moreover, all of the studies were based on self-reported physical activity. Substantial differences in physical activity level have been reported between self-reported data and data obtained with accelerometers.[24] Firrincieli et al[25] used accelerometers to assess the physical activity level of asthmatic and nonasthmatic children. In their cross-sectional study, they found that a lower level of physical activity was associated with a higher risk of asthma.

The aim of the current, prospective study was to evaluate whether wheezing in the first 2 years of life results in a lower physical activity level at the age of 5 years. In addition, the relation among wheezing, a lower physical activity level, and a subsequent rise in BMI was evaluated. To our knowledge, this is the first study that combines repeated measurements of wheezing symptoms early in life with the use of both accelerometers and self-reported data to assess physical activity later in life.

PATIENTS AND METHODS

This prospective study was embedded in the KOALA (Child, Parent and Health: Lifestyle and Genetic Constitution [in Dutch]) Birth Cohort Study in the Netherlands,[26] which aims to identify factors that influence the clinical expression of atopic disease and overweight. The study consists of 2 recruitment groups, women with "alternative" and "conventional" lifestyles. Healthy pregnant women with conventional lifestyles were recruited from an ongoing study on pregnancy-related pelvic girdle pain.[27] Inclusion criteria were being well versed in the Dutch language and ≥18 years old. In total, 2539 pregnant women were included and completed a questionnaire at 34 weeks' gestation. Information about wheezing during infancy among the children born from these pregnancies was gathered by questionnaire at the ages of 7 months and 1 and 2 years.

For the present study, 929 children were selected from the KOALA cohort who had reached the age of 4 years in or before 2006 and were able to complete a questionnaire in the child's first year of life (either at 7 months or at 1 year) and at the age of 2 years. In addition, the parents had to live within 20 km from the communal building in 1 of the following cities: Maastricht, Geleen, Heerlen, Roermond, Eindhoven, or Tilburg, Netherlands. Children were excluded from the study if they were born with congenital defects, born before 34 weeks' gestational age, or had used growth hormones.

Parents and children were invited to a communal building in 1 of the above-mentioned cities in which height, weight, and abdominal circumference of the children were measured. They also were asked to wear an Actigraph accelerometer for ≥5 days. Furthermore, the parents were asked to complete a questionnaire including questions about wheezing and physical activity level of their child during the last 4 weeks.

All of the participants gave written informed consent. Ethical approval was obtained from the medical ethics committee of the University of Maastricht and Academic Hospital of Maastricht.

Questionnaires

In the questionnaires at 7 months and 1, 2, and 4 to 5 years of age, the International Study of Asthma and Allergies in Childhood (ISAAC) questions[28] on wheezing were phrased as follows: "Did your child experience wheezing in the last period?" Asthma medication use and physician's diagnosis of asthma were asked as follows: "Did your child use asthma medication prescribed by a physician in the last 12 months?" and "Did a physician ever diagnose asthma in your child?" which all could be answered by "yes" or "no." Children were classified into 3 groups: children who wheezed in the last 12 months (recent wheeze), children who wheezed at any moment in the first 2 years of life but not in the last 12 months (past wheeze), and children who never wheezed (never wheeze).

In the questionnaire at 4 to 5 years of age, parents were also asked about the physical activity level of their child during the last 4 weeks: "How many times a week does your child exercise in school or a sports club?" and "How many days a week does your child play outside?" These could be answered by "never or less than 1 day a week," "1 day a week," "2 days a week," "3 days a week," "4 days a week," and "5 days a week or more." Furthermore, the duration of these activities was asked. From these answers, the number of hours of physical activity per week was calculated.

The following potential confounders were addressed in the questionnaires, based on a priori expectations from the literature: breastfeeding, maternal smoking during pregnancy, exposure to environmental tobacco smoke during the first 2 years of life and at 4 to 5 years, a positive family history for asthma, educational level of the parents, obesity of the parents, and birth weight of the child.

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Measurements

The Actigraph accelerometer (Actigraph, Fort Walton Beach, FL) is the most studied one-dimensional motion sensor in children and gives a good reproducibility, validity, and feasibility.[29] Children were instructed to wear the accelerometer on the right hip during daytime for ≥5 days. The accelerometer was only removed when water was involved, as in swimming, showering, and bathing. Data were collected with period lengths of 15 seconds, because young children engage in physical activity in frequent bursts of short duration.[30]

Four levels of activity were distinguished, that is, sedentary, light, moderate, and vigorous physical activity, using count cutoffs for 4-year-old children established and validated by Sirard[31]: 0 to 363 counts per 15 seconds for sedentary activity, 364 to 811 counts per 15 seconds for light physical activity, 812 to 1234 counts per 15 seconds for moderate physical activity, and >1234 counts per 15 seconds for vigorous physical activity. The number of minutes per day was summed within each of these categories. Moreover, the mean counts per minute per day were determined.

Outcome Measures

The primary outcome was the amount of physical activity at the age of 4 to 5 years. This was presented as the mean counts per minute and the number of minutes that the children were practicing vigorous activity per day. In addition, we measured the number of episodes of moderate-to-vigorous physical activity by counting the number of times the activity level was reaching or exceeding moderate intensity (MVPA) for ≥1 minute. Participants were included in the analysis when the accelerometer was worn for ≥3 weekdays and 1 weekend day during ≥400 minutes per day. The amount of physical activity obtained by the questionnaires was presented as the number of reported hours of physical activity per week.

Other outcomes were BMI (weight/length^2 [kg/m^2]) and abdominal circumference at 4 to 5 years. Children were classified into weight groups, namely, underweight, normal weight, overweight, and obesity, using international reference standards based on age- and gender-specific values.[32]This corresponds with BMI values for overweight and obesity at the age of 5 years of 17.42 and 19.30 kg/m^2 for boys and 17.15 and 19.17 kg/m^2 for girls.

Statistical Analysis

Data were analyzed by using SPSS 13.0 for Windows (SPSS Inc, Chicago, IL), using linear regression for the association between wheezing and parent-reported physical activity and wheezing and objectively measured physical activity and between parent-reported and objectively measured physical activity and overweight. Continuous outcome variables were the number of reported hours of physical activity per week, counts per minute, vigorous activity, and MVPA of ≥1 minute. Differences in activity levels between groups were estimated by linear regression analysis by including categories as dummy variables, and models were adjusted by including all of the potential confounders simultaneously. Because activity levels were not normally distributed, logarithmic transformation was performed. Levels within groups are expressed as geometric means (GMs), and differences between groups are expressed as GM ratios (GMR), with 95% confidence intervals (CIs). The GMR is equivalent to the logarithmic ratio of the group means on the untransformed scale. For the association between wheezing and physical activity, separate analyses were performed for boys and girls because of known gender differences from the literature on wheezing[33,34] and physical activity.[35,36] Logistic regression analysis was used for exploring the association between wheezing and overweight. Pearson correlation (r) was used for exploring the correlation between physical activity measured by accelerometer (in counts per minute) and reported hours of physical activity.

RESULTS

Of the 929 children who were invited for the present study, 363 children (39.1%) participated. Three children refused to wear the accelerometer, and 1 accelerometer got lost while worn by the child. Eight accelerometers did not record any data. In 44 children, the wearing time was <3 weekdays and 1 weekend day for ≥400 minutes a day. In 1 child, the measurement date registered by the accelerometer differed from the date that the accelerometer was worn. Finally, the questionnaire of 1 child was not returned. These data were excluded. Statistical analysis was conducted on the remaining data (n = 305). Participant characteristics are summarized in Table 1. There were no striking differences between the total cohort and the participating group on the variables considered. Mean age was 4.9 years (range: 4.1–5.6 years).

At the age of 4 to 5 years, 18 boys (12%) and 11 girls (7%) had recent wheeze, and 54 boys (36%) and 36 girls (24%) had past wheeze. Boys showed a mean physical activity level of 650 cpm, were on average 5.4 minutes per day active at the vigorous activity level, and performed on average 3.0 episodes of MVPA for ≥1 minute per day. For girls, these values were 606 cpm, 5.7 minutes, and 2.6 episodes per day, respectively.

We found an almost similar physical activity level in 4- to 5-year-old children with recent wheeze compared with children who had never wheezed, both for boys and for girls (Table 2). For boys with past wheeze, we found a slightly higher activity level compared with boys who had never wheezed. For girls, no such differences were apparent.

Thirty-three children (9.1%) had used asthma medication in the last 12 months, and 22 children (6.1%) had ever been diagnosed with asthma by a physician. These children showed very similar physical activity levels compared with children without an asthma diagnosis and asthma medication use (results not shown).

Children with overweight at the age of 4 to 5 years showed similar physical activity levels compared with children with a normal weight in all 3 of the physical activity variables (Table 3). Obese children (n = 6) showed significantly less vigorous activity and less MVPA for ≥1 minute than normal weight children.

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TABLE 1 **Characteristics of Children in the Total Cohort, Children Invited for This Study, and Participants: KOALA Birth Cohort Study, Netherlands**

Variable	Total Cohort ($n = 2539$), *n* (%)	Invited Group ($n = 929$), *n* (%)	Participating Group ($n = 305$), *n* (%)
Gender			
Male	1229 (51)	468 (50)	152 (50)
Female	1240 (49)	461 (50)	153 (50)
Parental history for asthma			
Blank	2105 (83)	774 (83)	260 (85)
Positive (one or both parents)	434 (17)	155 (17)	45 (15)
Obesity of parents			
No obesity of parents	2365 (93)	867 (93)	284 (93)
Obesity of one or both parents	174 (7)	62 (7)	21 (7)
Birth weight			
<2500 g	41 (2)	19 (2)	6 (2)
2500–4000 g	2157 (85)	811 (87)	264 (87)
>4000 g	341 (13)	99 (11)	35 (12)
Smoking during pregnancy			
Yes	170 (7)	85 (9)	15 (5)
No	2369 (93)	844 (91)	290 (95)
Parental smoking near child at 2 y			
Yes	268 (11)	130 (14)	31 (10)
No	2271 (90)	899 (86)	274 (90)
Breastfeeding			
Yes, until 6 mo	1032 (41)	281 (30)	101 (33)
Yes, but stopped before 6 mo	1026 (40)	395 (43)	134 (44)
Never	381 (15)	194 (21)	50 (16)
Unknown	100 (4)	59 (6)	20 (7)
Educational level of mother			
Low	244 (10)	102 (11)	25 (8)
Moderate	1071 (42)	422 (45)	118 (39)
High	1224 (48)	405 (44)	162 (53)
Wheeze			
Never	1779 (70)	648 (70)	221 (73)
At least once in first 2 y of life	760 (30)	281 (30)	84 (28)

Wheezing at any age was not associated with overweight or obesity at the age of 4 to 5 years (in recent wheeze, adjusted OR: 0.51, 95% CI: 0.06–4.32 for overweight and adjusted OR: 3.34, 95% CI: 0.27–40.93 for obesity, and in past wheeze, adjusted OR: 0.80, 95% CI: 0.26–2.46 for overweight and adjusted OR: 0.27, 95% CI: 0.02–3.93 for obesity, respectively).

A weak correlation was found between physical activity measured by accelerometer and the number of hours of physical activity reported by the parents in the

TABLE 2 **Wheezing in the First 5 Years of Life**

Wheeze Category	*n*	Total Activity, cpm			Vigorous Activity, Minutes > 1234 Counts per 15 s			MVPA, No. of Times > 812 Counts per 15 s for ≥1 min		
		GM	GMR (95% CI)	Adjusted GMR (95% CI)[a]	GM	GMR (95% CI)	Adjusted GMR (95% CI)[a]	GM	GMR (95% CI)	Adjusted GMR (95% CI)[a]
Boys										
Recent wheeze	18	635	1.02 (0.90–1.14)	1.06 (0.94–1.20)	5.0	1.03 (0.68–1.56)	1.17 (0.76–1.81)	2.8	1.07 (0.68–1.67)	1.28 (0.81–2.01)
Past wheeze	54	694	1.11 (1.02–1.20)[b]	1.11 (1.02–1.20)[b]	6.5	1.35 (1.02–1.78)[b]	1.38 (1.03–1.85)[b]	3.8	1.43 (1.05–1.93)[b]	1.38 (1.01–1.88)[b]
Never wheeze	80	625	1.00 (Reference)	1.00 (Reference)	4.8	1.00 (Reference)	1.00 (Reference)	2.6	1.00 (Reference)	1.00 (Reference)
Girls										
Recent wheeze	11	596	0.98 (0.85–1.13)	0.99 (0.85–1.14)	5.2	0.90 (0.59–1.40)	0.95 (0.61–1.48)	2.9	1.15 (0.65–2.03)	1.19 (0.67–2.11)
Past wheeze	36	606	1.00 (0.92–1.09)	1.02 (0.93–1.12)	5.6	0.98 (0.75–1.28)	0.99 (0.74–1.32)	2.7	1.09 (0.77–1.54)	1.17 (0.80–1.70)
Never wheeze	106	607	1.00 (Reference)	1.00 (Reference)	5.7	1.00 (Reference)	1.00 (Reference)	2.5	1.00 (Reference)	1.00 (Reference)

Physical activity was measured by Actigraph accelerometer at the age of 4 to 5 years. Recent wheeze indicates wheeze in the last 12 months (measured by the questionnaire at 4 to 5 years of age); past wheeze indicated wheeze in the past (measured by the questionnaires at 7 months and 1 and 2 years of age), but not in the last 12 months.

[a] Adjusted GMR indicates GMR adjusted for parental asthma, parental obesity, birth weight, smoking during pregnancy, environmental tobacco smoke exposure during the first 2 years of life, environmental tobacco smoke exposure at 4–5 years, breastfeeding in the first 6 months, education of the mother, and season of measurement.

[b] The *P* value was <.05 for comparison with the reference group (linear regression analysis); the associations between wheezing and physical activity were not statistically significantly different between boys and girls (test of interaction in the linear regression analyses: $P > .05$).

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TABLE 3 **Overweight and Physical Activity, Measured by Actigraph Accelerometer, Both at Age 4–5 Years**

Weight Category	*n*	Total Activity, cpm			Vigorous Activity, Minutes > 1234 Counts per 15 s			MVPA, No. of Times >812 Counts per 15 s for ≥1 min		
		GM	GMR (95% CI)	Adjusted GMR (95% CI)[a]	GM	GMR (95% CI)	Adjusted GMR (95% CI)[a]	GM	GMR (95% CI)	Adjusted GMR (95% CI)[a]
Underweight	35	609	0.97 (0.89–1.05)	0.98 (0.90–1.07)	4.8	0.84 (0.64–1.09)	0.89 (0.68–1.17)	2.8	0.98 (0.72–1.35)	1.07 (0.77–1.47)
Normal weight	242	629	1.00 (Reference)	1.00 (Reference)	5.7	1.00 (Reference)	1.00 (Reference)	2.8	1.00 (Reference)	1.00 (Reference)
Overweight	22	655	1.04 (0.94–1.15)	1.03 (0.93–1.14)	5.7	1.01 (0.73–1.40)	0.92 (0.66–1.28)	3.0	1.07 (0.72–1.57)	0.99 (0.67–1.47)
Obesity	6	576	0.91 (0.76–1.10)	0.88 (0.73–1.06)	3.6	0.63 (0.34–1.16)	0.49 (0.26–0.92)[b]	1.2	0.41 (0.20–0.85)[b]	0.35 (0.17–0.74)[b]

[a] Adjusted GMR indicates GMR adjusted for gender, parental asthma, parental obesity, birth weight, smoking during pregnancy, environmental tobacco smoke exposure during the first 2 years of life, environmental tobacco smoke exposure at 5 years, breastfeeding in the first 6 months, education of the mother, and season of measurement.

[b] The *P* value was <.05 for comparison with the reference group (linear regression analysis).

questionnaire ($r = 0.20$; $P = .01$). Using the parent-reported data, we found similar results as in analyses with accelerometer data: the number of reported hours of physical activity in children with recent wheeze was comparable to children who had never wheezed. The reported physical activity was slightly higher in boys with past wheeze than in boys who had never wheezed, but this was not statistically significant. Likewise, obese children showed a tendency to report less physical activity than normal weight children, but this was not statistically significant. Children with overweight were reported by their parents to have very similar physical activity levels compared with normal weight children (results not shown).

DISCUSSION

Our results indicate that 4- to 5-year-old children with recent wheeze have very similar physical activity levels compared with children who had never wheezed. We also found that boys with past wheeze were more physically active than boys who had never wheezed, whereas such a difference was not apparent in girls. We found a weak association between physical activity measured by accelerometer and obesity; there was a tendency in obese children to be less vigorously active and to show less MVPA for ≥1 minute. Comparable results were found in parent-reported data. We did not find an association between wheezing at any age and overweight or obesity.

The results do not confirm our working hypothesis, in which we postulated that wheezing children are hampered in physical activity because of their wheezing symptoms. This contradicts results from a similar study from Firrincieli et al.[25] They found that wheezing children are less physically active, although most outcome variables were not statistically significant. Only prolonged activity, defined as activity of >1000 cpm for ≥10 minutes, was statistically significantly decreased in wheezing children compared with nonwheezing children in the study from Firrincieli et al.[25] However, this cannot completely be compared with our study where MVPA for >1 minute was used, defined as >3248 cpm for ≥1 minute. Moreover, Firrincieli et al[25] performed measurements in only 54 children, compared with 305 children in the present study. To our knowledge, no other study used objective activity measurements for exploring the association between wheezing and physical activity. All of the other studies used questionnaires to assess the physical activity level.

In our study, boys showed more physical activity and more wheezing symptoms than girls. This is in line with literature which describes that prevalences of asthma and wheezing are higher in boys than in girls until adolescence[33,34] and that boys tend to be more active than girls from an early age.[35,36] The higher physical activity level in boys with past wheeze compared with boys who had never wheezed could be explained by stimulation in physical activity. In the Netherlands, many physicians emphasize the importance of a normal level of physical activity in wheezing children, and they have to meet the same standard of health-enhancing physical activity as their healthy pears.[37] Several studies[38–40] have shown that, in asthmatic subjects, physical activity decreases symptoms and improves the quality of life. This could explain why these children do not wheeze anymore at age 4 to 5 years and still have a similar or even higher physical activity level than children who had never wheezed. Another explanation for the higher physical activity level in children with past wheeze could be that children who are more physically active at the age of 4 to 5 years were also more active in the first 2 years of life (eg, because of their temperament). Nystad[41] showed that children who are more physically active seem to report symptoms of wheezing more often. It is not clear whether being more physically active increases the risk for developing asthma or whether breathlessness is experienced more often, which could be misinterpreted as wheezing. This higher physical activity level in children with past wheeze was only clear in boys, which could be explained by a gender difference in airway structure, which favors girls. It seems that girls exhibit a better lung function than boys, although lungs in females are smaller. An explanation for this is that large lungs have longer and narrower airways than small lungs.[33] It is possible that physically active boys are more prone to be troubled with (transient) wheeze because of these anatomic differences. Unfortunately, we have no accelerometer data in the first 2 years of life to examine this possible explanation. In our data we did not find a significant gender difference in wheezing or physical activity.

Our results indicate that 4- to 5-year-old children

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with recent wheeze were not different from children who had never wheezed in terms of physical activity. This is an important finding, because it rules out the explanation that wheezing children are hampered in physical activity through overprotective parents or self-imposed restrictions. It also makes it less plausible that overweight in wheezing children is caused by a lower level of physical activity, at least until the age of 5 years. In line with this, we found no relation between wheezing and overweight, but it must be remarked that the CIs were very wide because of the small number of children with combined wheezing and overweight in our population. Several studies have shown that there is a positive relationship between overweight or obesity and asthmatic symptoms, in which overweight mostly precedes wheezing.[9–17] Our prospective results show no evidence that wheeze precedes overweight or that they occur at the same moment at age 4 to 5 years. It is possible that overweight in wheezing children does not occur until later. However, this is not expected, because our results show normal physical activity levels in wheezing children, which would exclude physical activity as an intermediate factor between asthma and overweight. We did find an indication of lower physical activity in the small group of obese children. It is possible that these less physically active children are more likely to develop both obesity and asthma later in life, as has been described in the literature before.[42,43] Additional research is needed to explore this association.

A limitation of this study was the response, which was not very high (only 39%), likely because of the efforts that the parents had to make to come to the communal building twice. The questionnaires until 2 years of age (all sent by mail) had a very high response rate: >87%.[26] However, relevant background characteristics of the participating children were similar to those in the total cohort. Furthermore, the invitation was strongly focused on physical activity and overweight and did not mention wheezing or asthma. This makes it unlikely that bias occurred through a higher response of wheezing children.

Important strengths of this study compared with previous studies were the prospective design, the large number of participants, and the use of accelerometers. Another strength was the simultaneous use of questionnaires and accelerometers to determine the child's physical activity level. We found a weak correlation between questionnaire-derived information and accelerometer data, which corresponds with earlier literature.[24] Although it seems that the use of accelerometers is more objective and more reliable than the use of questionnaires, disadvantages should be considered too. Accelerometers tend to underreport physical activity during cycling and cannot be worn during swimming. In addition, the season and weather conditions have a large effect on the activity level in children. The multivariable analyses corrected for seasonal influences, and no measurements were conducted in the summer holiday to avoid periods when children swim a lot. Another disadvantage of accelerometers is the short duration in time, which only covered 5 days. To counterbalance these disadvantages, we also used the information from questionnaires. Herewith, we found similar results compared with accelerometer data.

CONCLUSIONS

We found no difference in the physical activity level between children with recent wheeze and children who had never wheezed. Boys with past wheeze showed higher physical activity levels than boys who never wheezed. The results did not confirm our hypothesis of wheezing causing overweight through lower levels of physical activity. Additional research could concentrate on the effect of physical activity and overweight on the development and severity of asthmatic symptoms.

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