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To cite this article: Andrey Wirgues Sousa, Anna Lúcia Barros Cabral, Milton Arruda Martins & Celso R. F. Carvalho (2019): Barriers to daily life physical activities for Brazilian children with asthma: a cross-sectional study, Journal of Asthma, DOI: [10.1080/02770903.2019.1594249](https://doi.org/10.1080/02770903.2019.1594249)

To link to this article: <https://doi.org/10.1080/02770903.2019.1594249>



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Published online: 28 Mar 2019.



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Barriers to daily life physical activities for Brazilian children with asthma: a cross-sectional study

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BACKGROUND

Objective: To identify barriers to daily life physical activities (DLPA) and to evaluate physical activity levels for children with asthma and without asthma.

Method: This is a cross-sectional study that enrolled 130 children with asthma and 54 non-asthma, from 7 to 12 years old. All of the children in both groups used an accelerometer for 6 consecutive days to assess DLPA and completed a questionnaire to evaluate barriers to physical activity. Accelerometer was used to measure each child's total number of steps, as well as the number of steps and the time spent in moderate-to-vigorous physical activity (MVPA). The barrier questionnaire to DLPA included 11 questions, divided into three domains: personal, social and environmental.

Results: The most commonly described barrier to DLPA in the asthma and non-asthma groups was an unsafe environment (23.6% vs 28.5%, respectively). The asthma group reported having asthma (19%) and lack of parental encouragement (17.3%) as being other important barriers to DLPA. It was also observed that the asthma and non-asthma groups presented similar values for the total number of steps ($13,379 \pm 3,837$ vs $14,055 \pm 3,914$, respectively, $p > 0.05$), number of steps in MVPA ($5,654 \pm 1,988$ vs. $6,025 \pm 2,058$, $p > 0.05$), and time spent in MVPA (46 ± 16 min vs. 50.8 ± 14.7 min, $p > 0.05$).

Conclusions: An unsafe environment is the main barrier to physical activity for Brazilian children. Moreover, a lack of parental encouragement and having asthma were considered to be barriers to physical activity. And lastly, children have similar levels of physical activity whether they have asthma or do not have asthma.

ARTICLE HISTORY

Received 25 May 2018
Revised 9 February 2019
Accepted 8 March 2019

KEYWORDS

Accelerometer; sedentary lifestyle; weather conditions; unsafe environment

Introduction

Asthma is the most common chronic inflammatory disease of the airways and is characterized by episodes of wheezing, dyspnea, chest tightness and coughing, most commonly at night [1]. These symptoms may occur at rest or may be triggered by exercise; the fear of inducing breathlessness inhibits many patients from taking part in regular exercise [2]. Although exercise can induce dyspnea, the regular practice of exercise leads to several benefits, such as the improvement of aerobic capacity and health-related quality of life, as well as a reduction in dyspnea, the consumption of inhaled corticosteroids, the number of exacerbations and the intensity of exercise-induced bronchoconstriction [3–5]. Consequently, current international asthma guidelines suggest that individuals with asthma should be encouraged to remain physically active (i.e., perform 150 min of moderate-to-vigorous physical activity per week) [1].

Despite the benefits of regular daily life physical activity (DLPA) for people with asthma, there is evidence that most children with asthma do not perform the recommended minimal amount of DLPA [6,7]. Therefore, it seems relevant to understand the reasons why children, especially children with asthma, are physically inactive [8]. The barriers that inhibit DLPA are multifactorial including personal, social and environmental features, and can change according to the characteristics of different diseases [9]. There are few studies that evaluate barriers to DLPA in children. A recent systematic review suggests that children with motor or intellectual disabilities report a greater number of barriers to DLPA as compared to children without disabilities [10]. In addition, most studies that evaluated barriers to DLPA were qualitative [10]. To the best of our knowledge, there are only two studies that evaluate barriers to DLPA in children with asthma [11,12]. Fereday et al. (2009) performed a

quantitative study evaluating the barriers to DLPA in children with chronic illnesses including cystic fibrosis, type 1 diabetes and asthma [11]. The authors reported that these children did not perceive their diseases as barriers; however, children with asthma reported avoiding DLPA outdoors during the winter [11]. Glazebrook et al. (2006) also evaluated barriers for children with asthma and, in contrast to the observations made by Fereday and coworkers, the Glazebrook study showed that children with asthma, and their parents, perceived asthma as a barrier to DLPA [12]. The study also showed that children with asthma presented lower physical activity levels and more overweight, compared to their non-asthma peers [13,14].

Considering that children with asthma may be less physically active than their non-asthma peers, [13] and that regular exercise leads to a better clinical condition [3], it is necessary to understand the barriers to DLPA for these children. The purpose of this study was to identify barriers to DLPA and to evaluate the physical activity levels of children with asthma and children without asthma.

Methods

Participants

This cross-sectional study included 184 children of both sexes, from 7 to 12 years of age, of which 130 were on-going outpatient children with asthma and 54 were children without asthma (non-asthma group). The children with asthma had been diagnosed in accordance with the *Global Initiative for Asthma* (GINA) [1]. The children were recruited during a regular medical visit to a University tertiary hospital, from 2014 to 2015. The children with asthma in the study had been under optimal medical treatment for at least 12 months, were clinically stable (i.e., Children Asthma Control Test ≥ 20) and had not presented any exacerbations or changes in medication for at least 30 days. Asthma severity was classified according to the treatment required to achieve good asthma control according to GINA [1]. Briefly, this means that children in steps 1 and 2 required a low daily dose of an inhaled corticosteroid (ICS), those in step 3 required a low daily dose of an ICS associated with a long-acting beta₂-agonist (LABA), and children in steps 4 and 5 required a moderate or high daily dose of an ICS associated with a LABA. The exclusion criteria for the asthma group were: the presence of any pulmonary, cardiovascular, neurological or musculoskeletal disease that might interfere in the practice of exercise.

The inclusion criteria for the non-asthma group were: the absence of asthma and/or rhinitis (International Study of Asthma and Allergy (ISAAC) score ≤ 5) [15], and the absence of any pulmonary, cardiovascular, neurological or musculoskeletal diseases. The non-asthma group consisted of 43 (79.6%) cousins and/or neighbors of the children in the asthma group and 11 (20.4%) children of employees of the university hospital. To avoid bias during comparisons, the children in the non-asthma group were recruited proportionately with the asthma group utilizing group (or frequency) matching [16] according to three categories: sex (male or female), age group (7–8, 9–10, 11–12 years old), and body mass index (either eutrophic or overweight/obese).

The Hospital Ethics Committee approved the study and written informed consent was obtained from the patients and their parents. The researcher covered the cost of transportation for all of the children and their parents, and no financial compensation was offered for participation in the study.

Study design

Study participants underwent two evaluations at the hospital, 7 days apart. During the first hospital visit, all of the children underwent anthropometric analysis that included age, sex, weight, height and body mass index (BMI). Only the asthma group performed the lung function test and c-ACT. The non-asthma group completed the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire to exclude any participants with symptoms of asthma, rhinitis and eczema. Utilizing group matching, the non-asthma group participants were recruited from children of hospital employees as well as from cousins and/or neighbors of study participants in the asthma group. Then, all of the children received an accelerometer and were instructed to use it for 6 consecutive days, including week and weekends. During the second visit, all of the children returned the accelerometers and answered the questionnaire on barriers to DLPA. For both the asthma and non-asthma groups, the data from the accelerometers and the information from the completed questionnaires on barriers to DLPA were evaluated by the same researcher.

Anthropometrical data

Weight

Weight was measured using a digital scale with a precision of 0.1 kg (Toledo, Brazil) and the children wore minimal clothing and no shoes.

Height

Height was measured in meters (m) using a stadiometer with a precision of 0.1 cm (Toledo, Brazil).

Body mass index (BMI)

BMI was expressed as kg/m^2 and presented in comparison to the median BMI percentile. Children were classified as overweight or obese if their BMI equaled or exceeded the age-adjusted cutoff point (≥ 85 th percentile), while normal weight was defined as a BMI below the age-adjusted cutoff point (< 85 th percentile) [17].

Assessments

Barriers to DLPA questionnaire

Participants were evaluated using the questionnaire described by Martins [18], and questions were divided into three domains: personal, social and environmental/geographic, as described by Leslie et al. [19]. Barriers in the personal domain included muscle discomfort, lack of interest, time constraints and not knowing how to exercise. Barriers in the social domain included a lack of the following: parental encouragement, company, equipment and financial resources. Barriers in the environmental domain included an unsafe environment, weather conditions and lack of infrastructure. For each barrier, participants were asked to select one of five responses: “never”, “rarely”, “sometimes”, “almost always” or “always.” Situations were considered to be barriers when the participant selected the options “always” or “almost always”. Domains were also compared. A domain was considered to be a factor that hampered physical activity when the participant selected either the option “always” or “almost always” for, at least, 50% of the barriers in any domain. Having asthma was included in the questionnaire in the personal domain. All participants responded to the questionnaire without parental interference. The barriers to physical activity were the primary outcomes, and the domains were considered secondary.

Daily life physical activity (DLPA)

Daily life physical activity (DLPA) was quantified using an accelerometer (Power Walker-610, Yamax, Japan). The device measures the total number of steps and the number of steps and the time spent engaged in moderate to vigorous physical activity (MVPA, ≥ 110 steps per minute) [20,21]. All of the children enrolled in the study, and their caregivers were instructed that the accelerometer should be put on

every child each morning and removed only to bathe and sleep. In addition, the children were instructed not to change their habitual DLPA while using the device. To be considered physically active, a child's accelerometer had to register ≥ 60 min per day of MVPA; otherwise, the child was classified as physically inactive [22].

Lung function test

The technical procedure, eligibility criteria and reproducibility were established as recommended by the American Thoracic Society [23]. The spirometer (Koko DigiDoser, Louisville, Kentucky, USA) was coupled with a microcomputer, and the following parameters were evaluated: forced expiratory volume in the 1st second (FEV_1), forced vital capacity (FVC), and FEV_1/FVC . Spirometry was performed before and after the inhalation of 400 μg of salbutamol to measure the percentage of the bronchodilator response.

ISAAC questionnaire

This questionnaire evaluates asthma and rhinitis symptoms; the score ranges from 0 to 14 points and is translated to and validated in Portuguese [24]. The absence of asthma symptoms was defined by a total score ≤ 6 . The children completed the questionnaire with assistance from their parents or guardians [25].

Childhood asthma control test (c-ACT)

Asthma control was classified as controlled, partly controlled or uncontrolled, in accordance with GINA guidelines [1]. Asthma control was defined by the presence/absence of daytime symptoms, limitation of activities, nocturnal symptoms/awakening, need for rescue treatment, and FEV_1 . The c-ACT assessed asthma control during the 4 weeks prior to the first hospital visit evaluation and the results were then translated to, and validated in, Portuguese [26]. The c-ACT questionnaire had seven questions regarding asthma symptoms and the effect of asthma on daily functioning. The first four questions were answered by the children, and the last three were answered by their parents. Each question had four options for the children, from 0 (worst) to 3 (best) and 6 options for parents, from 0 (worst) to 5 (best). Possible scores ranged from 0 (totally uncontrolled asthma) to 27 (totally controlled asthma); scores ≥ 20 represented good asthma control [27]. Permission was obtained to use the c-ACT questionnaire.

Statistical analysis

The number of children recruited for the study was based on a convenience sample according to the inclusion criteria. The data collected were analyzed using the Statistical Package for Social Science (SPSS) software, version 17.0 (Chicago, IL). The Kolmogorov-Smirnov normality test was used to determine if a data set was correlated with a normal distribution model. Data from the total number of steps, as well as steps and time in MVPA, were evaluated using a Student's *t* test. The Chi-square test was used to evaluate the frequency of the barriers reported by the children and to compare group matching strata. The level of statistical significance was set at 5% for all tests ($p < 0.05$), and the power was set at 80%.

Results

A total of 221 children were invited to participate in the study, and 184 of them were selected to be included in the study. One hundred thirty children with asthma were assigned to the asthma group, and 54 children without asthma were assigned to the non-asthma group (Figure 1). In the asthma group, participants were classified in accordance with the step definition of their asthma: steps 1 or 2 ($n = 57$), step 3 ($n = 42$) and steps 4 or 5 ($n = 31$). In both the asthma

and the non-asthma groups, there were more boys than girls. Other than that, there were no significant differences between the two groups relative to age, height, weight and BMI ($p > 0.05$, Table 1). Most of the children in the asthma and non-asthma groups were classified as physically inactive (respectively, 73.8% and 65.8%, Table 1). The total number of steps, the number of steps and time spent in moderate-to-vigorous physical activity (MVPA), were similar for the asthma and non-asthma groups (Table 1).

The number of barriers reported in each group was similar. Most of the children reported up to 1 barrier in both the asthma and non-asthma groups (65% and 59%, respectively), and a lower percentage in both groups reported ≥ 2 barriers (35% and 41%, respectively). It was also observed that children who perceived no more than one barrier to DLPA were more physically active than those children who perceived ≥ 2 barriers (78% vs 25%, respectively, $p = 0.01$, Figure 2). In both groups, the total numbers of steps recorded for obese and non-obese children were similar; however, the MVPA of obese children was lower than the MVPA of non-obese children (Table 2).

The three most commonly reported barriers (60%) in the asthma group were an unsafe environment, having asthma and lack of parental encouragement (Table 3). In the non-asthma group, the three most commonly reported barriers (70.2%) were unsafe

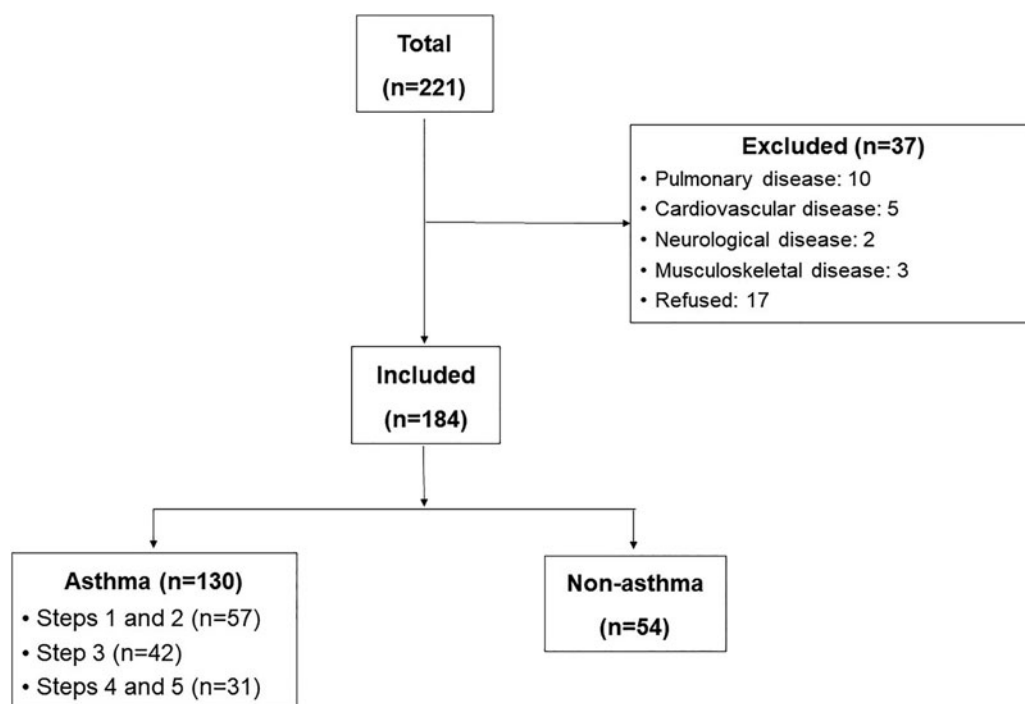
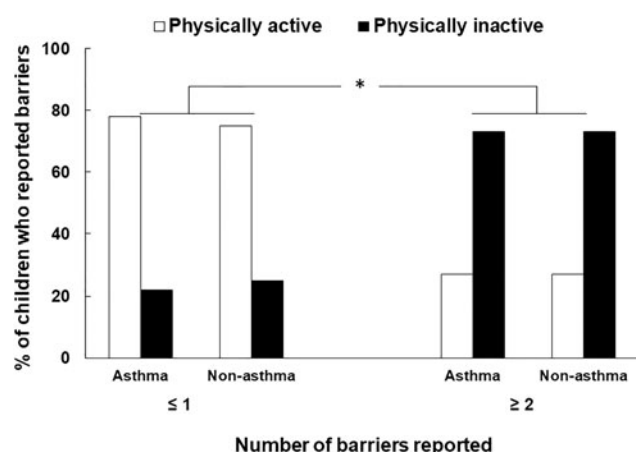


Figure 1. STROBE diagram of the study participants.

Table 1. Anthropometric, lung function and daily life physical activity data of the asthma and non-asthma groups.

	Asthma (130)	Non-asthma (54)	<i>p</i>
Anthropometric data			
Sex, male (%)	90 (68)	31 (57)	0.75
Age, years	9 ± 1.75	9 ± 1.74	0.66
Height, meters	1.40 ± 0.10	1.40 ± 0.11	0.89
Weight, kilograms	37.5 ± 9.9	36.9 ± 11.2	0.75
BMI, percentile	59 ± 32.5	65.8 ± 27.9	0.22
Overweight / obese (%)	40 (31)	19 (35)	0.44
Lung function			
FVC, % of predicted	98.4 ± 10.1	–	
FEV ₁ , % of predicted	87.2 ± 10.3	–	
% of change post BD	27.2 ± 15.6	–	
mL of change post BD	417.5 ± 225.9	–	
FEV ₁ /FVC	0.80 ± 0.08	–	
c-ACT			
Mean score	23 ± 2.5	–	
Daily Life Physical Activities			
Total number of steps	13,379 ± 3,837	14,055 ± 3,914	0.45
Number of steps in MVPA	5,654 ± 1,988	6,025 ± 2,058	0.41
Minutes spent in MVPA	46 ± 16	50.8 ± 14.7	0.31
Percentage of physically inactive children	73.8	65.8	0.36

Legend: Data are presented in mean and standard deviation, except where noted (gender, overweight/obese and percentage of physically inactive children). BMI: body mass index; FVC: forced vital capacity; FEV₁: forced expiratory volume in 1st second; BD: bronchodilator; mL: milliliters; c-ACT: children-asthma control test; MVPA: moderate-to-vigorous physical activity.

**Figure 2.** Reporting rate of physically active and physically inactive children according to the number of barriers. In both groups, children who perceived lower barriers presented more physical activity. Chi-squared statistical test was used; *statistical significance: $p < 0.05$.**Table 2.** Total number of steps taken, number of MVPA steps taken, and amount of time spent in MVPA, by the obese and non-obese children in the study.

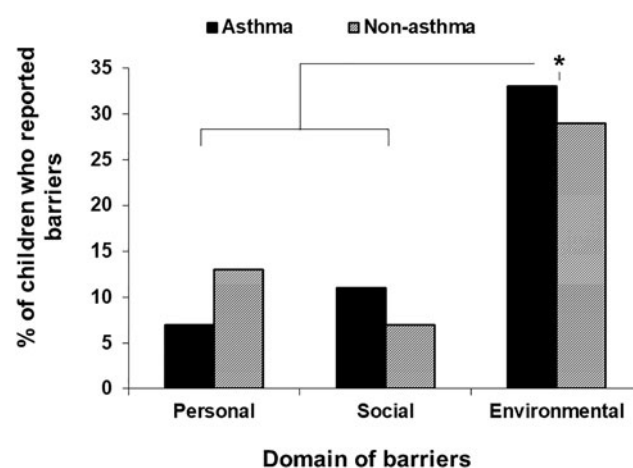
	Non-obese (125)	Obese (59)	<i>p</i>
Total number of steps	13,625 ± 4,571	12,874 ± 4,054	0.28
Number of steps in MVPA	6,284 ± 1,145	5,894 ± 1,210	0.03
Minutes spent in MVPA	48.8 ± 13	44 ± 12.2	0.02

Legend: Data are presented as mean and standard deviation. Children with a Body Mass Index ≥ 85 were classified as obese. MVPA: Moderate-to-vigorous physical activity; Step and minutes measurements represent an average total amount per day based on measurements over a 6-day period.

Table 3. Perceived barriers to daily physical activities among the asthma and non-asthma groups.

	Asthma (130)	Non-asthma (54)	<i>p</i>
Reported barriers			
Unsafe environment	31 (23.6)	16 (29.6)	0.66
Having asthma	25 (19)	–	–
Lack of parental encouragement	23 (17.3)	3 (7.1)	0.16
Lack of infrastructure	20 (15.2)	11 (20.3)	0.48
Weather conditions	18 (13.7)	11 (20.3)	0.24
Time constraints	17 (12.9)	10 (19)	0.8
Lack of company	14 (10.6)	8 (14.8)	0.72
Lack of interest	12 (9.1)	10 (19)	0.14
Muscle discomfort	10 (7.6)	3 (5.5)	0.77
Lack of equipment	9 (6.8)	6 (11.1)	0.45
Not knowing how to exercise	8 (6.1)	4 (7.1)	0.91
Lack of financial resources	1 (0.7)	3 (5.5)	0.29

Legend: The barriers are listed in order of decreasing importance as reported by the group with asthma. The order of importance is different for the two groups, except for the most important barrier reported by both groups: an unsafe environment. The other barriers were reported in similar proportion by both the asthma and non-asthma groups ($p > 0.05$); *N* = number of children.

**Figure 3.** Reporting rate of the domains that hamper physical activity. In both groups, the environmental domain is what most hampers the physical activity. Chi-squared statistical test was used; *statistical significance: $p < 0.05$.

environment, lack of infrastructure and weather conditions (Table 3). The individual barriers reported by the children were proportionately similar in both the asthma and non-asthma groups. (Table 3, $p > 0.05$). The lack of parental encouragement as barrier to physical activity was reported by 17.3% of the asthma group, and by 7.1% of the non-asthma group, a finding of no significant difference (Table 3, $p > 0.05$).

The environmental domain was the most reported domain in both the asthma and non-asthma groups. No significant difference was observed between the asthma and the non-asthma groups, in the personal (7% vs 13%, respectively, $p = 0.15$), social (7% vs 11%, respectively, $p = 0.320$) and environmental (33% vs 29%, respectively, $p = 0.54$) domains (Figure 3).

Discussion

The present study shows that an unsafe environment, having asthma and lack of parental encouragement were the main barriers to DLPA for children with asthma. In addition, the environmental domain was perceived as the main barrier to DLPA for children in both the asthma and non-asthma groups. Moreover, children that reported no more than one barrier to DLPA have higher levels of physical activity than children who reported two or more barriers. And lastly, children in the asthma and non-asthma groups presented similar levels of physical activity.

An unsafe environment was the most commonly reported barrier to DLPA for both the asthma and non-asthma groups. This could have occurred because the study was conducted in the city of São Paulo, Brazil, a megalopolis in a developing country. As a consequence, children may prefer to stay at home, or they may be advised by their parents to do so [28,29]. This may explain why most children were physically inactive. Our study is supported by previous studies reporting that even healthy young children living in a megalopolis in developing countries avoid outdoor physical activities when they perceive the environment as unsafe [30]. Although an unsafe environment can be a difficult barrier to overcome because it depends on public policies, a reduction in physical inactivity can be achieved with simple actions such as increasing the number of parks or the opening of schools on weekends [30,31]. These steps can be important considering physical inactivity has been demonstrated to be a public health problem and economic burden [32].

The second most important barrier to DLPA reported by the asthma group was having asthma (Table 3). To our knowledge, there are only two studies that evaluate asthma perception as a barrier to DLPA [11,12]. Glazebrook et al. showed that children from the United Kingdom reported having asthma (66%) as the main barrier to DLPA [12]. In contrast, for Australian children with asthma, Fereday et al. showed that having asthma was not a barrier to performing DLPA [11]. Several factors could explain the difference between both studies, such as asthma severity and asthma control. Children with asthma in the present study as well as in the Fereday study [11] had good asthma control. In the Glazebrook study, however, asthma control was not reported [12], probably because the children in that study were evaluated prior to the initiation of clinical treatment. This difference could help explain why a majority of the children with asthma from Glazebrook's study [12]

reported having asthma as a major barrier to DLPA. Interestingly, 19% of the children in our study reported having asthma as a barrier, despite having good asthma control (ACT score ≥ 20). A probable explanation could be related to previous experience with asthma symptoms during DLPA prior to achieving good asthma control [33].

The third most reported barrier to DLPA in the asthma group was lack of parental encouragement (Table 3). This result may suggest that parents fear their children will experience asthma symptoms if they engage in physical activity, even though the children's asthma is well-controlled. In Glazebrook's study [12], 60% of the patients reported a lack of parental encouragement, which is 3.4 times higher than the percentage observed in our study (17.3%). It is difficult to compare the results between our study and Glazebrook's study [12]; however, we hypothesize three possible explanations for this difference. First, the children assessed by Glazebrook et al. (2006) did not present good asthma control, which could explain their parents' fear of encouraging them to engage in physical activity [12]. Second, Glazebrook et al. (2006) [12] evaluated children in the United Kingdom, where the climate is generally colder than the climate in Brazil. Children with asthma in the U.K. may experience more exercise-induced bronchoconstriction due to increased exposure to the colder climate [34]. Third, children with asthma present several phenotypes, which can complicate analyses of children from different countries [35].

It is interesting to note that weather conditions and lack of infrastructure were two of the five barriers to DLPA reported by both the asthma and non-asthma groups. Our data are supported by a previous study suggesting that weather conditions can reduce DLPA [36]. Although weather conditions cannot be controlled, their relevance as a barrier to DLPA can be reduced by public policies that promote the construction of indoor recreational facilities in communities [37,38]. This is even more important for children with asthma as dry weather, cold temperatures and pollution can provoke an increase in airway hyperresponsiveness [39,40]. In the city of São Paulo, the largest megalopolis in South of America, high levels of air pollution occur frequently and can exacerbate these triggers [41].

Previous studies have suggested that children with asthma are more physically inactive than their non-asthma peers [42]. However, other studies have shown that children with asthma who are clinically stable present similar physical activity levels to those of their peers [43,44]. In the present study, most of the

children in both the asthma and non-asthma groups were physically inactive (73.8% vs 65.8%, respectively). The physically inactive children reported a higher number of barriers to DLPA and were proportionately more obese than the physically active children. These results are supported by a previous study, which showed that most physically inactive children with asthma are obese [45]. Puglisi et al. reported that obese children without asthma reported a higher number of barriers to DLPA than the non-obese children without asthma [46]. In the present study, no difference was observed in the number of barriers to DLPA reported by obese and nonobese children in the asthma and non-asthma groups (data not presented). Physical inactivity can lead to obesity [47], and this is particularly relevant in children with asthma because it increases asthma symptoms and worsens asthma control [47,48]. Taken together, these findings suggest that physical inactivity is multifactorial and cannot be reduced solely by appropriate medical treatment.

Our study has limitations. First, there is no standardized, specific instrument to evaluate barriers to DLPA in children. Therefore, we used a previously validated questionnaire for adults [18]. In our opinion, this was not a problem because the children were able to respond to all of the questions in the questionnaire. Second, the perception of a barrier is subjective, and it can be either over or underestimated [49]. However, we observed that children in both the asthma and non-asthma groups reported a similar number of barriers, which suggests that asthma itself did not influence the children's perceptions. Finally, the matching process is a difficult task; however, we believe that matching patients based on anthropometrical characteristics and socioeconomic status was done appropriately and adequately as no significant differences were observed between groups. It was also observed that families presented similar incomes. The fact that both groups reported an unsafe environment as the main barrier to DLPA suggests that both groups had a similar socioeconomic status.

Conclusion

Children with asthma and children without asthma present similar physical activity levels. The main barrier to physical activity for both groups is an unsafe environment. Having asthma, and a lack of parental encouragement, are also considered barriers to physical activity by most of the children, even by children with good asthma control. These results can be useful

for developing interventions to improve physical activity in children with asthma.

Acknowledgements

The authors acknowledge the cooperation of the university hospital that made this study possible. In addition, they thank the children and the families who participated in this study.

Declaration of interest

The protocol was submitted to, and approved by, the Ethics Committee of the University and the parents or legal guardians of the children gave their written, signed consent for their participation in the study. All the authors declare that no grants, gifts, equipment or drugs were provided by any company for this study or for any participant. Also, no tobacco company funded or was involved in any part of this study or manuscript. Any unexpected adverse effects or changes in protocols have been disclosed. The main author had access to the entire manuscript and takes full responsibility for the integrity and accuracy of the data.

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Table 1: Comparison between the asthma and non-asthma groups in accordance with stratified anthropometric characteristic.

Strata		Asthma n = 130	Non-Asthma n = 54	p- value
Age, in years				
7 and 8		36 (28%)	16 (29%)	0.95
9 and 10		47 (36%)	18 (34%)	
11 and 12		47 (36%)	20 (37%)	
Sex				
Male		90 (68%)	31 (57%)	0.14
Female		40 (32%)	23 (43%)	
Body Mass Index, in percentile				
Eutrophic		88 (67%)	33 (61%)	0.46
Overweight or obese		42 (33%)	21 (39%)	

Legend: The subjects are quantified numerically and as a percentage of their respective group (asthma or non-asthma). Body Mass Index (BMI) classification was performed according to Cole and Lobstein 2012. Group comparison was by Chi-square test.

Table 2: Comparison between the asthma and non-asthma groups, divided by sex and stratified by age in years and body mass index.

Age (in year) according sex	BMI	Asthma n = 130	Non-Asthma n = 54	p- value
Male				
7 and 8	Eutrophic	22 (16.9%)	7 (13%)	0.20
	Overweight / obese	4 (3%)	4 (7.4%)	
9 and 10	Eutrophic	23 (17.7%)	5 (9.2%)	0.45
	Overweight / obese	10 (7.7%)	4 (7.4%)	
11 and 12	Eutrophic	18 (13.8%)	7 (13%)	0.99
	Overweight / obese	13 (10%)	4 (7.4%)	
Female				
7 and 8	Eutrophic	5 (3.8%)	3 (5.5%)	0.99
	Overweight / obese	5 (3.8%)	2 (3.7%)	
9 and 10	Eutrophic	9 (7%)	6 (11.1%)	0.99
	Overweight / obese	5 (3.8%)	3 (5.5%)	
11 and 12	Eutrophic	11 (8.4%)	5 (9.2%)	0.67
	Overweight / obese	5 (3.8%)	4 (7.4%)	

Legend: The subjects are quantified numerically and as a percentage of their respective group (asthma or non-asthma). Body Mass Index (BMI) classification was performed according to Cole and Lobstein 2012. Group comparison was by Fischer test.