

EXERCISE

Exercise-Related Quality of Life in Subjects with Asthma: A Systematic Review

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Objective. The purpose of this review was to analyze, based on a review of the current literature, the effects of physical activity on the quality of life (QoL) of subjects with asthma. **Methods.** The authors conducted a search of randomized controlled trials (RCTs) between January 2000 and August 2010 in a group of major databases of health sciences (Academic Search Complete, Directory of Open Access Journals, Elsevier—Science Direct, Highwire Press, PubMed, Scielo Global, Scirus, Scopus, SpringerLink, Taylor & Francis, and Wiley Interscience) with the keywords *asthma, QoL, physical activity, exercise, training, and program* in all possible combinations. Citations and references of each study selected were also examined. **Results.** Of the 1075 studies identified, only 11 were included. Five of these studies were performed in children between the ages of 7 and 15 and the remaining studies were performed on adults. Intervention programs were divided into aerobic training programs and breathing exercises programs. All aerobic training programs showed improvements in QoL, demonstrating a positive influence of aerobic training on asthma. **Conclusions.** There is a noticeable trend in the benefit of aerobic training programs in the QoL for individuals with asthma. The breathing exercises programs were few and heterogeneous, making it difficult to reach a positive conclusion on whether it could be recommended for the improvement of QoL in this pathology. There is a great need for more RCTs with methodological rigor.

Keywords asthma, systematic review, physical activity, quality of life, randomized controlled trials

INTRODUCTION

Asthma is a chronic inflammatory disease of the airways that, in susceptible individuals, can lead to recurrent episodes of wheezing, chest tightness, and coughing, particularly at night or in the early morning. These symptoms are usually associated with a generalized but variable airway obstruction, which is reversible either spontaneously or through treatment (1, 2).

Physical activity is seen today as an essential complement to a healthy lifestyle, both from the standpoint of physical development and performance of the individual and because of its recreational and psychological effects. However, physical activity presents a unique component in subjects with asthma. Regular exercise and sports participation are considered to be useful for asthma control by improving the cardiorespiratory condition of the subject with asthma (3). However, certain types of exercise, taking into account the intensity, duration, and environment in which they occur, may cause increased airway resistance, leading to exercise-induced bronchoconstriction (EIB) (4, 5).

EIB emerges here as a barrier to physical activity which in turn will lead to a decrease in the subjects' performance. It is not, therefore, surprising that some studies have reported that patients with asthma have lower

cardiorespiratory performance than their peers (6, 7). EIB causes, in subjects with asthma, feelings of powerlessness and fear concerning exercise practice, which can have a psychological effect.

However, other studies reported that an exercise program created for subjects with asthma improves their aerobic fitness (3, 8), which will raise the ventilatory threshold, thereby lowering the minute ventilation during mild and moderate exercise. Consequently, both breathlessness and the likelihood of provoking EIB will be reduced. Exercise training may also reduce the perception of breathlessness through the strengthening of the respiratory muscles (9).

If physical activity can bring improvements in cardiorespiratory fitness of subjects with asthma, these subjects may also feel more able to participate in increasing amounts of physical activity. Because they do not fear triggering the symptoms related to asthma, they may be less likely to limit their participation in sports, recreational, or leisure activities (10, 11).

In addition to the magnitude of the disease from its clinical point of view, asthma causes suffering at various levels, such as physical, psychic, and social. This is often extensible to the surrounding professional, family, and social environments, causing constraints upon their normal activity, which may induce a progressive deterioration of their quality of life (QoL) and their well-being (10–12).

QoL is a multidimensional concept that comprises physical, psychological, emotional, and social well-being (11, 13). Some studies have reported a lower QoL in children and adolescents with asthma when compared

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with their peers (10, 13), with these children presenting disorders in social relations with other children of the same age. Asthma may have an adverse impact on the asthmatics' daily life by interfering with sleep, ability to work, socialization, and participation in activities such as sports, recreation, or leisure (10, 11). Various studies reported that even patients with relatively mild disease limit or avoid activities because of their concerns over triggering asthma symptoms (6, 10, 14). This limitation of activities can be detrimental if it results in inactivity and consequently in other disorders. This issue is of even greater importance in children and young adults because they are at an age where healthy habits must be established (10, 13).

As far as we know, to date, there are no systematic reviews that have analyzed the effects of physical activity in QoL of subjects with asthma. The last systematic review reports in 2000 (9), but presents only the effects of physical activity in the clinical component of the disease, reporting that there are no studies that analyze its effect on QoL. Nevertheless, there has been a growing interest in assessing this variable, having arisen in several studies since then.

Thus, there is the need to understand the effects of physical activity in the QoL of these individuals, while looking for evidence of the type and intensity of exercise that is best suited to this pathology.

METHODS

Search Strategy

An electronic search was conducted in the main Health Sciences databases (Academic Search Complete, Directory of Open Access Journals, Elsevier—Science Direct, Highwire Press, PEDro, PubMed, Scielo Global, Scirus, Scopus, SpringerLink, Taylor & Francis, and Wiley Interscience), using the keywords *asthma*, *quality of life*, *QoL*, *physical activity*, *exercise*, *training*, and *program* in all possible combinations using the different Boolean operators.

We also searched the citations and the references in the studies that were included and conducted a manual search in paper journals.

Inclusion and Exclusion Criteria

All of the randomized controlled trials (RCTs) between January 2000 and August 2010 that compared a training/exercise program with conventional treatment in subjects with asthma diagnosed according to the criteria of the *American Thoracic Society (ATS)*, *European Respiratory Society (ERS)*, *British Thoracic Society (BTS)*, and *The Global Initiative for Asthma (GINA)*, or when not specified, the disease had been diagnosed by a specialist, were included. We only included the studies written in English and that presented the evaluation of QoL as an outcome.

As exclusion criteria, we defined (i) studies that included patients with other concomitant diseases; (ii) intervention programs that lasted less than 4 weeks; (iii)

QoL scales not validated; (iv) studies with access only to abstract; and (v) studies with *scores* less than 4/10 on the *Physiotherapy Evidence Database (PEDro)* scale (15).

Selection of Studies

All of the studies obtained from the electronic search were alphabetically ordered and the duplicates were excluded. Two reviewers examined titles and abstracts of each article excluding those which did not apply to this study. Potential articles were later forwarded to the full-text read, which was done independently by two reviewers to verify the inclusion and exclusion criteria. The methodological quality of the studies was evaluated by two independent reviewers with the PEDro scale, which is based on the Delphi list, developed by Verhagen and colleagues (16). The PEDro scale has moderate levels of interrater reliability (intraclass correlation coefficient: 0.68, 95% confidence interval: 0.57–0.76) (17, 18).

To improve the reliability of this analysis, any discrepancy or disagreement in the classification of the methodological quality was resolved through discussion or intervention of the leading investigator.

Later, the leading investigator extracted the data by filling a grid that was specifically created for this research. An independent reviewer verified the data grid for greater accuracy. Discrepancies or disagreements were also resolved by discussion or by a third independent reviewer.

RESULTS

Literature searches identified 1075 studies, of which only 19 were assessed in detail. Of these, nine were excluded for various reasons, as detailed in Figure 1 (19–27).

Methodological Quality/Risk of Bias

The results from the methodological quality evaluation of the selected articles, according to the PEDro scale, are described in Table 1.

Participants

Four of these studies were performed in children aged 7–15 (28–31), while the remaining six were conducted in adults (Tables 2 and 3).

Diagnosis

There were several criteria for the diagnosis of asthma severity used by the authors in the included studies (32–34). Despite this difference, we considered that all of them are current, accurate, and homogeneous with respect to diagnosing the severity of asthma at different ages.

Only three of the studies did not report the severity of asthma of individuals included in their study (28, 29, 35).

Intervention Programs

Intervention programs are divided mainly into two branches: aerobic training programs (28–31, 36–38) and breathing exercises programs (35, 39, 40) (Tables 2 and 3).

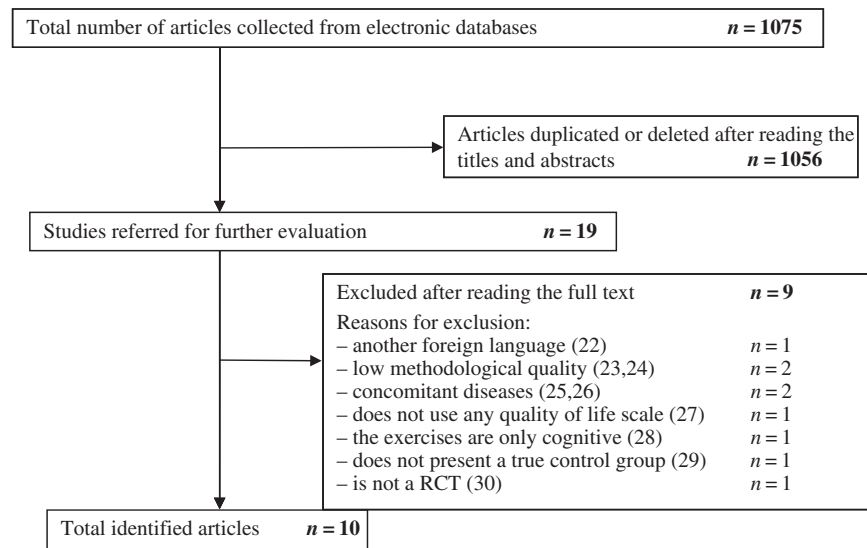


FIGURE 1.—Schematic representation: from the search to the identification of articles.

TABLE 1.—Methodological quality of the included studies according to PEDro scale.

Study	Random allocation	Concealed allocation	Baseline comparability	Subject blinding	Therapist blinding	Assessor blinding	Adequate follow-up	Intention-to-treat analysis	Between-group statistical comparisons	Variability measurements	Total score
Basaran et al. (31)	Y	N	Y	N	N	N	Y	N	Y	Y	5/10
Fanelli et al. (30)	Y	N	Y	N	N	Y	N	N	Y	Y	5/10
Flapper et al. (28)	Y	N	Y	N	N	N	Y	Y	Y	Y	6/10
Gonçalves et al. (38)	Y	N	Y	N	N	N	Y	N	Y	Y	5/10
Mendes et al. (36)	Y	N	Y	N	N	N	Y	Y	Y	Y	6/10
Moreira et al. (29)	Y	Y	Y	N	N	N	Y	Y	Y	Y	7/10
Sabina et al. (40)	Y	Y	Y	N	N	Y	N	Y	Y	Y	7/10
Thomas et al. (35)	Y	N	Y	N	N	N	N	Y	Y	Y	5/10
Turner et al. (37)	Y	N	Y	N	N	N	Y	Y	Y	Y	6/10
Vempati et al. (39)	Y	N	Y	N	N	N	Y	N	Y	Y	5/10

Note: Y, yes; N, no.

From the aerobic training programs, all studies included an experimental group that carried out the training program and a control group that followed the conventional treatment. Of the seven studies included, all present a program of aerobic training.

Of the three studies included in the breathing exercises programs, two present a program of breathing exercises, including education sessions versus a control group that attended only the education sessions (35, 39), while the third study compared a program of breathing exercises versus a nonspecific exercise program (40).

Scales of Quality of Life

Eight different scales were used in the included studies (Tables 2 and 3). The Pediatric Asthma Quality of Life Questionnaire (29–31) and the Asthma Quality of Life Questionnaire (AQLQ) (35, 37, 39) were the most used. These scales are specific to the assessment of QoL in individuals with asthma. Another scale also specific to individuals with asthma was used (TACQOL-asthma: TNO-AZL Children Quality of Life Questionnaire) (28).

Three scales of generic QoL were also used: SF36 (Medical Outcomes Study Short-Form 36; 37), DUX-25 (The Dutch Children Quality of Life Questionnaire and TACQOL-generic; 28), and QQL-EPM (Escola Paulista de Medicina—Quality of Life Questionnaire; 36, 38).

All of them were reported as previously validated scales and with adequate reliability to actually measure what they propose, in this case, the QoL (41–47).

More specific details about each study and their intervention programs are described in Tables 2 and 3.

Effects of Physical Activity in the QoL of Subjects with Asthma

This systematic review showed that there is a noticeable trend in the benefit of physical activity in the QoL of patients with asthma, particularly aerobic training programs.

Although physical activity is an extensively studied area in asthma, a surprisingly small number of studies assess the influence of exercise in the QoL of subjects with asthma.

TABLE 2.—Summary of studies with aerobic training programs.

Subjects	Diagnosis	QoL scale	Intervention			Results	PEDro
			Time and number of evaluations	Duration of the program	Frequency of the program	Training/exercise program	
Basaran et al. (31) <i>n</i> = 62 Age: 7–15 [10.4 ± 2.1]	Mild to moderate asthma	PAQLQ	Baseline and 8th week	2 months	3 t/week; 1 h/session	EG (<i>n</i> = 31): Regular home respiratory exercise program (breathing exercises and relaxation) + submaximal aerobic training (moderate intensity): warm-up and calisthenics (15 min); basketball training (30–35 min); cool-down and flexibility exercises (10 min) CG (<i>n</i> = 31): Conventional treatment + regular home respiratory exercise program (breathing exercises and relaxation)	8th week: Statistically significant improvement of QoL (total score and three domains: activity limitation, symptoms, and emotions) on both groups but the degree of improvement was higher in the EG (<i>p</i> < .001) 5/10
Fanelli et al. (30) <i>n</i> = 38 Age: 7–15 [10.5 ± 2]	Moderate to severe asthma	PAQLQ	Baseline and 16th week	4 months	2 t/week; 1.5 h/session	EG (<i>n</i> = 21): Educational program + training program (90 min)—15 min: warm-up and stretching exercises; 30 min: aerobic exercise on cycle and/or treadmill; 30 min: UL and LL and abdomen endurance exercises; 15 min cooling down, stretching, and relaxation. Aerobic training was performed at the HR corresponding to 2/3 of the difference between the AnT and RCP as obtained in the incremental cardiopulmonary exercise testing (CPET). Endurance exercises intensity: 70% of a 10-maximal repetition test CG (<i>n</i> = 17): Educational program	16th week: Statistically significant improvement of all domains of QoL in the EG when compared with CG. Total score: <i>p</i> < .04; activity limitation: <i>p</i> < .04; symptoms: <i>p</i> < .02; emotional function: <i>p</i> < .03 5/10
Flapper et al. (28) <i>n</i> = 36 Age: 7–12 (10)	Asthma (severity not specified)	TACQOL-generic; TACQOL-asthma; DUX-25	Baseline, 3rd, 6th, and 9th month	3 months	1 t/week; 2.5 h/session	EG (<i>n</i> = 18): Conventional treatment + education-exercise program: 1.5 h of education (with games and learning materials) and 1 h of exercise: 10 min warm-up, 20 min fitness training, 15–20 min different physical activities CG (<i>n</i> = 14): Conventional treatment	3rd month: Statistically significant improvement in the EG for two total self-reported scores: TACQOL-asthma (<i>p</i> = .023) and DUX-25 (<i>p</i> = .02); and four proxy-reported domains (TACQOL-asthma situations and TACQOL-generic motor, cognitive, and autonomic) 6th month: Changes in HR QoL were clinically important and greater in the EG 9th month: Gains consistent with 6th month findings but for fewer number of children 6/10
Gonçalves et al. (38) <i>n</i> = 20 Age: 20–50 [34.6 ± 13]	Moderate to severe asthma	QQL-EPM	Baseline and 3 months	3 months	2 t/week; 30 min/session	EG (<i>n</i> = 10): Educational program + respiratory exercise program: 30 min (according to Manocha et al. [25]) + aerobic conditioning program 30 min on a treadmill (training intensity: 70% of maximum power obtained in the cardiopulmonary effort test)	3rd month: Statistically significant improvement in the EG total score (<i>p</i> < .001) and the following domains: physical limitation (<i>p</i> < .001), symptom frequency (<i>p</i> = .002), and psychosocial (<i>p</i> = .003) when compared with CG 5/10

TABLE 2.—(Continued).

Subjects	Diagnosis	QoL scale	Intervention			Results	PEDro
			Time and number of evaluations	Duration of the program	Frequency of the program	Training/exercise program	
Mendes et al. (36) <i>n</i> = 101 Age: 20–50 ($\bar{x}$ = 39.5)	Moderate to severe asthma	QQL-EPM	Baseline and 3 months	3 months	2 t/week; 30 min/session	CG (<i>n</i> = 10): Educational program + respiratory exercise program equal to EG EG (<i>n</i> = 44): Educational session (4 h) + respiratory exercise program + aerobic training program—30 min on the treadmill (program intensity: 70% of VO ₂ max obtained in the cardiopulmonary effort test) CG (<i>n</i> = 45): Educational session (4 h) + respiratory exercise program equal to EG	6/10 3rd month: Statistically significant improvement ($p < .001$) of QoL only in the EG for total score and three domains: physical limitation, symptom, and psychosocial
Moreira et al. (29) <i>n</i> = 34 Age: school-aged children [12.7 ± 3.4]	Children with atopy and controlled asthma	PAQLQ	Baseline and 3 months	3 months	2 t/week; 50 min/session	EG (<i>n</i> = 16): Submaximal aerobic exercise program (moderate intensity): warm-up with UL and LL exercises (10 min), aerobic exercises, strength training, and some balance and coordination exercises (30–35 min), and a cool-down period (7–10 min). An accelerometer was used to measure the intensity of physical activities CG (<i>n</i> = 16): Conventional treatment	7/10 3rd month: EG shows statistically significant improvement in all domains of PAQLQ with a moderate improvement (>1.0) in the activity domain. The CG shows statistically significant improvement only in the activity domain ($p < .004$). However, the authors were unable to find statistically significant differences between groups
Turner et al. (37) <i>n</i> = 34 age: ≥ 40 [67.8 ± 10.6]	Moderate to severe asthma with fixed airway obstruction	AQLQ SF-36	Baseline, 6th week, and 3 months post-interv.	6 weeks	3 t/week; 80–90 min/session	EG (<i>n</i> = 19): 6 weeks—10–15 min warm-up including slow walking and stretching; 20 min walking training (80% of the average walking speed achieved on the 6-min walking test); 5–10 min cool-down period; 45 min of cycle ergometry training (10 min), step-ups, wall squats, and UL endurance training (circuit intensity: 12–14 measured with the Borg 6–20 rating perceived exertion scale). At the end of the training period subjects performed a home exercise program 3 t/week for 3 months. CG (<i>n</i> = 15): Conventional treatment	6/10 6th week: EG shows statistically significant improvement in the following domains: activity limitation ($p = .04$) and symptoms ($p = .001$). Level of minimum clinical importance (change in QoL > 0.5) achieved in all domains. Statistically significant differences between groups also for the physical component of the SF-36 ($p < .05$). 3rd month post-interv.: EG maintained statistically significant improvement in the following domains of the AQLQ: activity limitation ($p = .04$) and symptoms ($p = .005$) when compared to CG

Notes: Age described in range and (mean ± standard deviation) when provided by the authors. When the sum of the number of subjects per group differs from the total number of subjects it means that the analysis was by "intention to treat." PAQLQ, Paediatric Asthma Quality of Life Questionnaire; EG, experimental group; CG, control group; QoL, quality of life; UL, upper limb; LL, lower limb; HR, heart rate; AnT, anaerobic threshold; RCP, respiratory compensation point; TACQOL, TNO-AZL Children Quality of Life Questionnaire; DUX-25, The Dutch Children Quality of Life Questionnaire; QQL-EPM, Escola Paulista de Medicina—Quality of Life Questionnaire; VO₂max, maximal oxygen consumption; AQLQ, Asthma Quality of Life Questionnaire; SF-36, Medical Outcomes Study Short-Form 36.

TABLE 3.—Summary of studies with breathing exercises program.

Subjects	Diagnosis	QoL scale	Intervention			Results	PEDro
			Time and number of evaluations	Duration of the program	Frequency of the program	Training/exercise program	
Sabina et al. (40) <i>n</i> = 62 Age: 18–76 [$\bar{x}$ = 51]	Mild to moderate asthma	Mini-AQLQ	Baseline, 4th, 8th, 12th, and 16th week	1 month	2 t/week; 90 min/session	EG (<i>n</i> = 29): Principles of Iyengar yoga including postures (<i>asanas</i>), breathing techniques (<i>pranayama</i>), and meditation and relaxation (<i>dhyana</i>). Participants executed <i>pranayama</i> techniques in each of the 15 postures CG (<i>n</i> = 33): Basic muscle stretching exercises program (previously demonstrated that it did not produce observable rehabilitative effects in asthmatic participants) 1 h, 2 t/week Both groups were instructed to perform the same exercises at home (20 min/day; 3 t/week) during 3 months after the conclusion of the 4-week training period	Following evaluations: there were no statistically significant differences between groups for QoL at any point of the study 7/10
Thomas et al. (35) <i>n</i> = 183 Age: [$\bar{x}$ = 45]	Asthma (severity not specified)	AQLQ	Baseline, 1st, and 6th month	1 month	—	EG (<i>n</i> = 73): 1 month, 3 sessions: 1 educational (60 min) explanation of normal breathing and the possible effects of an abnormal dysfunctional breathing (over-breathing, mouth breathing, and upper-chest breathing); 2 individual sessions (30/45 min): was taught appropriate regular diaphragmatic breathing and nasal breathing (Papworth method) and encouragement to practice these exercises at home 10 min/day CG (<i>n</i> = 79): 1 month, 3 educational sessions: 1 in group and 2 individual (without providing personalized asthma advice)	1st month: No statistically significant differences between groups in QoL (total score of AQLQ: <i>p</i> = .78) 6th month: Statistically significant differences between groups for total score (<i>p</i> = .01) and all domains except the environment domain 5/10
Vempati et al. (39) <i>n</i> = 57 Age: >18 [33.5 ± 11.4]	Mild to moderate asthma	AQLQ	Baseline, 2nd, 4th, 6th, and 8th week	2 months	4 h/day—2 week <i>in situ</i> ; 1.5 h/day—6 weeks at home	EG (<i>n</i> = 29): Lifestyle modification program based on yoga with 4 h sessions: 1 h of postures (<i>asanas</i>) and breathing techniques (<i>pranayamas</i>); 30 min group support; 2 h of lecture and discussion (healthy nutrition, health education, stress management); 30 min of meditation and relaxation. After this 2 weeks, participants were instructed to perform the exercises at home for 1.5 h/day for 6 weeks CG (<i>n</i> = 28): Educational sessions about asthma	Following evaluations: Statistically significant differences between groups in the total score (<i>p</i> = .013) and in the following domains: activity limitation (<i>p</i> = .033), symptoms (<i>p</i> = .033), and emotions (<i>p</i> = .006). Without statistically significant differences in the environment domain 5/10

Note: AQLQ, Asthma Quality of Life Questionnaire; EG, experimental group; CG, control group; QoL, quality of life.

With the exception of one study (29), all of the studies with an aerobic training program showed improvements in the QoL for the experimental group. Also, with the exception of one study (28), all of the studies were according to the recommendations of the American College of Sports Medicine (ACSM) (48) for exercise in individuals with controlled asthma.

There were very few studies that included a breathing exercises program and that came to a positive conclusion about the effect of this type of intervention in subjects with asthma.

DISCUSSION

The studies that included an aerobic training program showed improvements in QoL for the experimental group, thus demonstrating a positive influence of aerobic training in asthma. Only the study of Moreira and colleagues (29) showed no statistically significant differences between groups having either an improvement of QoL in both the experimental and control group. This finding may first be explained by the inclusion of subjects already well controlled, leaving no room for major improvement of QoL and, second, by the possibility of a type II error due to the small sample of the study ($n = 34$). However, although the sample was even smaller ($n = 20$), Gonçalves and colleagues (38) showed in their study a statistically significant difference ($p < .001$) between groups in the QoL variable, favoring the experimental group.

Of the studies with an aerobic training program, only one included a team sport. Basaran and colleagues (31) feature basketball as a group activity that improves the QoL of children with asthma. This positive influence may be explained by the psychological benefits arising from participation in a team sport and sharing common concerns and experiences with other peers with common pathology. Children will feel well understood and integrated into a real group (10).

Although it was not a study variable in this review, nor in any of the included studies, surprisingly an educational component was found in four studies that included a program of aerobic training (28, 30, 36, 38) and in two of three articles that included a program of breathing exercises (35, 39). Here, you can see a greater concern and a tendency for increased health education in both children and young people or adults with asthma. This extra attention and increased knowledge of their condition may have contributed to the QoL benefits attributed to the exercise interventions.

The aerobic training programs range from aerobic walking, bicycle ergometer, treadmill, basketball, and various physical activities in a gym with more or less components, according to the study. Although there have been improvements in QoL in all studies, none has studied the possibility of maintaining the same training program after the intervention period. Only the studies of Turner and colleagues (37) and Flapper and colleagues (28) presented a longer

follow-up, allowing the evaluation of the participants 3, 6, and 9 months after the intervention program. In these two studies, it was possible to verify that the improvement of QoL was maintained for a long period of time. This finding may be explained by the varied training programs presented by the authors that may have enabled easy maintenance of the same program post-intervention.

In addition, in the study by Turner and colleagues (37), participants were given an exercise program to perform at home at the end of the intervention. This component appears to be of great importance since the exercise should be integrated into the daily life of every individual, avoiding the risk of losing the gains from an early intervention program. There are several barriers to exercise described by patients with asthma such as adverse weather, lack of time, and psychological factors. The health professional needs to know what the barriers experienced by each individual are in order to give them options, support, and encouragement for the maintenance of physical activity (10). Active participation in physical activities, exercise, and sports should be encouraged in children, adolescents, and adults (2).

According to the guidelines of the ACSM (48), individuals with controlled asthma should participate in continuous or intermittent physical activity, 20–30 min per day and 3–5 times per week. In this sense, only the study of Flapper and colleagues (28) does not seem to meet the ACSM recommendations as Flapper et al. proposed a weekly program.

As reported by the ACSM, there is still no consensus regarding the optimal intensity of training programs in individuals with respiratory disease. However, individuals with controlled asthma may follow exercise prescriptions for healthy individuals, taking into consideration triggering factors which should be avoided such as cold, dry, or polluted environments. According to this concept, Boulet and Turcotte (49) also report in their study a maximum bronchoconstriction after exercise that is performed in dry conditions. If performed in a damp environment, bronchoconstriction after physical activity is lower (49, 50), which increases exercise capacity (49).

For healthy patients, the ACSM recommends a combination of moderate-intensity exercise (40–60% of the oxygen uptake reserve ($\text{VO}_{2\text{R}}$)) and vigorous intensity (greater than 60% of $\text{VO}_{2\text{R}}$). The studies presented here included a large heterogeneity in the methods of quantification of exercise intensity as shown in Table 2. However, they all presented a method for quantifying and monitoring the intensity of exercise, except one study (28), which makes no reference to the intensity, and a study by Basaran and colleagues (31), which only refers to a “moderate” intensity.

Although there are guidelines for prescribing exercise, the ACSM recommends that all exercise prescriptions for individuals with diseases such as asthma should be made according to their condition, symptoms, and functional capacity.

In this systematic review, we identified only three studies (35, 39, 40) which evaluated the influence of

breathing exercises programs in QoL of subjects with asthma. Of these three, the study by Sabina and colleagues (40) found no statistically significant improvements in QoL, showing no clear evidence that the type of yoga used in this study is beneficial in asthma. However, they explain the absence of a possible therapeutic effect by an inadequate sample size, the high number of losses during the study, or an initial difference between groups in some parameters.

Thomas and colleagues (35) only confirmed statistically significant differences ($p = .01$) in QoL between groups at the sixth month of post-intervention. This result is explained by the authors by employing a health professional in both groups that also allowed the improvement of QoL in the control group (they were given educational sessions on the pathology by an experienced nurse in the area). Encouragement for the breathing exercises at home after the end of the sessions in the experimental group may have led to a statistically significant difference between groups in the sixth month. The crucial role of education in QoL of subjects with asthma is also stressed here.

Vempati and colleagues (39) also found improvements in QoL in both groups, but more marked in the experimental group with statistically significant differences between groups ($p = .013$). This study argues that a program of lifestyle modification based on yoga through its holistic approach results in measurable improvements in various components of asthma and hence the increase in QoL.

LIMITATIONS

It is possible to see, as shown in Table 1, that there have not been any studies that have positively fulfilled the criteria "subject blinding" and "therapists blinding." In this type of study, which involves interventions in different groups, it is not possible to blind who led the intervention and who receives, that is, it is not possible to blind the therapist and the subjects about the control and the experimental groups (18). This is an inevitable methodological limitation of this type of clinical studies. However, we chose to include in this review lack of blinded studies, as blinding in this type of intervention is impossible.

Moreover, the PEDro scale which does not overpenalize the studies that cannot be double blinded due to the nature of the interventions was chosen to evaluate different and important criteria. Therefore, we should take this into account when analyzing the results.

Despite the applicability of the results of this review being limited by a considerable number of factors like the number of studies, the small number of participants, and the heterogeneity of the intervention programs included, we found a noticeable trend in the benefit of exercise in QoL of subjects with asthma, particularly aerobic training programs. However, it is important to investigate the long-term effectiveness of exercise programs in the QoL of individuals with asthma as many of the studies reviewed here did not explore long-term outcomes.

This review found little evidence in the programs of breathing exercises and highlights a great need for RCTs with methodological rigor to examine different programs of breathing exercises in the treatment and control of asthma. It is important that these programs are properly designed, described, and evaluated.

CONCLUSIONS

Aerobic training programs seem to improve the QoL of patients with asthma; however, the symptoms, condition, and functional capacity of each individual should be taken into account before recommending exercise interventions, as well as the type, intensity, and environment of those interventions. More studies are needed to evaluate the effect of breathing exercises programs in the QoL of these individuals.

It is also important to investigate the long-term effectiveness of exercise programs on QoL of individuals with asthma.

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DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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