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Resistance training in asthma: clinical benefits, safety and implications for exercise prescription – a narrative review

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Abstract

Background: Asthma is a chronic inflammatory airway disease that can limit exercise tolerance and promote physical deconditioning. While aerobic exercise is widely studied and recommended, resistance training remains under-investigated despite potential clinical benefits.

Objective: This narrative review summarizes the rationale, physiological mechanisms, and clinical effects of resistance training in adults with asthma, with a focus on practical exercise prescription.

Methods: Evidence from randomized controlled trials, systematic reviews, and observational studies addressing resistance, aerobic, and combined exercise interventions in adults with asthma was reviewed. Outcomes included asthma control, muscle strength, exercise capacity, and quality of life.

Results: Resistance training improves muscle strength, functional capacity, and exercise tolerance, with a low risk of exercise-induced bronchoconstriction. Combined resistance and aerobic programs further enhance cardiorespiratory fitness, muscle function, and quality of life. Physiological mechanisms involve counteracting deconditioning, enhancing muscle mass, and modulating dyspnoea perception. Structured exercise programs with warm-up, progressive intensity, and symptom monitoring optimize safety and effectiveness.

Conclusion: Resistance training is a safe and clinically relevant adjunct to aerobic exercise in asthma management, offering complementary benefits for physical function and quality of life. Further well-designed studies are needed to define optimal protocols, particularly for older adults and severe asthma populations**.**

Keywords: asthma, resistance training, strength training, strength exercise, aerobic training, exercise-induced bronchoconstriction, pulmonary rehabilitation

Introduction

Asthma is a chronic inflammatory disease of the airways characterized by variable respiratory symptoms and fluctuating airflow limitation (Global Initiative for Asthma [GINA], 2025). Although the risk of exercise-induced bronchoconstriction has traditionally been perceived as a barrier to vigorous exercise participation, contemporary guidelines emphasize that regularly performed physical activity is a key non-pharmacological component of asthma management when appropriately prescribed (GINA, 2025).

Most research exploring exercise interventions in asthma has concentrated on aerobic training (AT). Randomized and controlled studies demonstrate that AT improves asthma control, cardiorespiratory fitness, and health-related quality of life (Jaakkola et al., 2019; Hansen et al., 2020). Moreover, systematic reviews indicate that increasing physical activity is beneficial even in individuals with more severe disease (McLoughlin et al., 2022; Liu et al., 2025), and exercise-based pulmonary rehabilitation is increasingly recognized as a valuable adjunct in management (Xiong et al., 2023; Guarnieri et al., 2025).

By contrast, resistance training (RT) remains relatively under-investigated in asthma despite its established role in general health promotion and in rehabilitation of other chronic respiratory conditions. Observational studies have shown that reduced muscle strength is associated with poorer quality of life and worse clinical outcomes in adults with asthma, including reduced exercise capacity and symptom control (Visser et al., 2023; Hong et al., 2025). Preliminary interventional research suggests that RT or combined RT and AT may improve physical fitness and asthma outcomes, although available trials are few, sample sizes are small, and training protocols are heterogeneous (Olenich et al., 2018; Lo Bello et al., 2025). Evidence in paediatric populations indicates that structured exercise programs are generally safe and effective (Sanz-Santiago et al., 2020; Xu et al., 2025), but data specifically isolating RT in adults with asthma remain limited, highlighting the need for further research to clarify clinical effects, safety, and optimal prescription in this population.

Taken together, current literature supports the role of exercise in asthma management while emphasizing that important uncertainties persist regarding the specific benefits, safety profile, and optimal implementation of resistance training in adults..

Objective of the article

The primary aim of this review is to synthesize the available evidence on resistance training (RT) in asthma, with a particular focus on adults. Specifically, it seeks to evaluate the clinical effects of RT on asthma control, muscle strength, and quality of life, to assess the safety and tolerability of such interventions, and to provide practical recommendations for exercise prescription, considering adult-specific needs and, where relevant, comparing outcomes with other exercise modalities.

Methods

This narrative review was developed through a structured, non-systematic approach to identifying and selecting relevant literature related to exercise interventions in asthma. The review was not intended to follow systematic review protocols or quantitative synthesis frameworks, but rather to provide an informed overview of the existing body of research.

A literature search was conducted using the PubMed and Google Scholar databases, covering publications from January 2015 to January 2026. Search terms were applied in various combinations and included: asthma, resistance training, strength training, aerobic training, exercise, physical training, and pulmonary rehabilitation. Only articles published in English were considered.

The selection process began with screening titles and abstracts to identify potentially relevant publications. Studies were excluded if they were incomplete, not focused on asthma populations, or unrelated to structured exercise interventions. Full-text articles were subsequently reviewed to determine their suitability for inclusion based on relevance to the scope of the review and clarity of methodological reporting. Eligible publication types included original research articles, narrative and systematic reviews, and clinical guidelines.

Both adult and paediatric studies were reviewed to provide a comprehensive context; however, priority was given to studies involving adult populations. The final body of literature was selected based on relevance, methodological transparency, and contribution to the broader understanding of exercise-based approaches in asthma.

Results

1. Pathophysiology of asthma and exercise response

1.1. Airway inflammation and bronchoconstriction

Asthma is characterized by chronic airway inflammation, airway hyperresponsiveness, and episodic airflow limitation. Inflammatory processes involve interactions between immune cells, airway epithelial cells, and mediators such as histamine and leukotrienes, leading to smooth muscle contraction, mucus hypersecretion, and structural airway changes (Bonini & Palange, 2015; GINA, 2025). Exercise-induced bronchoconstriction (EIB) can occur in response to hyperventilation, increasing airway osmolarity and triggering mediator release, particularly in environments with cold or dry air (Bonini & Palange, 2015). The severity of EIB varies between individuals and does not always correlate with baseline lung function, highlighting the importance of individualized exercise strategies. Structured warm-up and progressive intensity have been shown to mitigate clinically significant EIB, allowing safe participation in physical activity (Hansen et al., 2020).

1.2. Systemic consequences – deconditioning and muscle dysfunction

Beyond airway pathology, asthma frequently results in systemic alterations that affect physical performance. Symptom-related activity avoidance, chronic inflammation, and long-term corticosteroid use can contribute to reductions in skeletal muscle mass and strength, particularly in lower-limb and respiratory muscles (Vermeulen et al., 2016; Visser et al., 2023; Hong et al., 2025). Evidence indicates that a substantial proportion of adults with moderate to severe asthma present with reduced muscle strength or low muscle mass, which is associated with lower exercise capacity, poorer asthma control, and decreased quality of life (Vermeulen et al., 2016; Visser et al., 2023; Xiong et al., 2023; Hong et al., 2025).

Exercise interventions, particularly RT or combined RT and AT programs, can counteract these systemic effects. RT improves muscle strength and functional capacity and is generally well tolerated by individuals with asthma, including those prone to exercise-induced bronchoconstriction (Olenich et al., 2018; Xiong et al., 2023). Enhanced muscle function may additionally reduce perception of dyspnoea and contribute to better overall asthma control (de Lima et al., 2023). These findings support the integration of resistance-based exercise as a key component of holistic asthma management.

2. Types of exercise interventions in asthma

2.1. Resistance training in asthma – rationale, evidence and safety

2.1.1. Effects on asthma control and symptoms

Evidence from clinical studies indicates that RT may improve symptom perception in adults with asthma, although its impact on asthma control remains less clear.

Olenich et al., (2018) conducted a pilot study in adults with asthma examining the effects of an eight-week program combining flexibility and RT performed twice weekly. Following the intervention, participants demonstrated a significant clinical improvement in asthma control, as measured by the Asthma Control Questionnaire (ACQ). Although the sample size was small, the results suggest that even moderate-intensity RT can improve tolerance to exertion and subjective symptom management.

Lo Bello et al., (2025) evaluated a 12-week pulmonary rehabilitation program comparing a combined RT and AT intervention with an AT-only program supplemented by sham mobility exercises. Both groups showed improvements in asthma-related quality of life (HRQoL), with no significant difference between them. This indicates that adding resistance training does not further enhance symptom control or HRQoL beyond the benefits of AT and education alone.

In summary, current evidence highlight the need for larger, well-controlled trials to clarify the role of resistance training in modulating asthma-specific outcomes.

2.1.2. Effects on muscle strength and functional capacity

Resistance training (RT) reliably improves peripheral muscle strength and functional capacity in adults with asthma, supporting daily activities and exercise tolerance.

Using data from a nationally representative sample of Korean adults with asthma, Hong et al. (2025) demonstrated a significant association between handgrip strength and health-related quality of life. Individuals with greater handgrip strength were more likely to report better quality of life, with particularly pronounced associations observed in women and in those with mild asthma severity. Overall, the findings indicate that muscular strength contributes meaningfully to perceived well-being and functional performance in adults with asthma, extending its clinical relevance beyond lung function alone.

Olenich et al., (2018) implemented an eight-week RT program with twice-weekly sessions targeting major muscle groups. Participants demonstrated significant improvements in lower-limb strength and functional exercise capacity, as assessed by sit-to-stand and timed stair-climb tests. These improvements suggest greater tolerance for routine physical activities, indicating that even brief RT interventions can produce clinically meaningful gains in muscle function.

Lo Bello et al., (2025) in a 12-week combined RT and AT program, also reported increases in peripheral muscle strength and improvements in six-minute walk test performance. While the program included aerobic components, these findings reinforce that strength-focused sessions specifically contribute to enhanced muscular function and exercise tolerance.

Billany et al., (2020) reviewed home-based RT programs for adults with chronic diseases, including asthma, concluding that progressive resistance exercises targeting major muscle groups consistently improve strength and functional capacity. The authors emphasized the importance of proper supervision, progressive loading, and adherence monitoring to maximize outcomes.

Together, these studies support the inclusion of RT as a safe and effective strategy to enhance muscle strength and functional capacity in adults with asthma, facilitating greater independence and better tolerance of physical activity (Olenich et al., 2018; Billany et al., 2020; Hong et al., 2025; Lo Bello1 et al., 2025)

2.1.3. Effects on quality of life and psychological outcomes

Resistance training (RT) interventions in adults with asthma can improve perceived quality of life by enhancing functional independence and confidence in daily activities. Olenich et al., (2018) observed that participants completing an eight-week, twice-weekly RT program reported improved tolerance to physical activity and reduced anxiety related to exertion. These changes in subjective experience may reinforce adherence to regular exercise and contribute to long-term improvements in physical and mental health.

Hong et al., (2025) reported that higher handgrip strength in adults with asthma was associated with better scores in both physical and psychosocial domains of quality of life questionnaires, highlighting a close link between muscle strength and perceived well-being in this population.

Billany et al., (2020) highlighted that home-based RT programs with appropriate supervision or remote guidance not only support adherence but also translate muscular improvements into meaningful benefits for daily living. Participants reported greater confidence in performing everyday tasks and maintaining independence, emphasizing the role of practical implementation in enhancing quality of life in adults with asthma.

Overall, RT in adults supports greater confidence and independence in daily activities. When appropriately structured and progressively implemented, these interventions can translate physical improvements into meaningful benefits for overall quality of life.

2.1.4. Safety and tolerability of resistance training

Resistance training (RT) appears safe and well-tolerated in adults with asthma when programs are properly supervised and tailored to individual capabilities. Evidence from randomized trials and pilot studies indicates that structured strength interventions, including both standalone resistance training (Olenich et al., 2018) and combined strength-aerobic programs (Lo Bello et al., 2025), improve muscle strength and functional capacity without increasing asthma exacerbations or causing exercise-induced bronchoconstriction, particularly when warm-up routines, proper technique instruction, symptom monitoring, and gradual progression of intensity are applied (Billany et al., 2020; Guarnieri et al., 2025). These findings support the inclusion of RT as a safe component of exercise programs for adults with asthma, emphasizing tolerable workloads, individualized supervision, and careful progression to maintain respiratory safety while optimizing functional benefits.

Indirect evidence from exercise physiology also suggests that RT can be safely performed in individuals using inhaled bronchodilators. In a controlled study, Merlini et al., (2019) demonstrated improved sprint performance when resistance exercise was combined with inhaled long-acting β2-agonists, without adverse respiratory effects, supporting the compatibility of strength-based exercise with standard asthma pharmacotherapy.

2.2. Aerobic training – current evidence

Aerobic training (AT) is one of the most commonly applied exercise modalities in adults with asthma and represents the most established form of exercise intervention in this population.

In a randomized controlled trial, Jaakkola et al., (2019) demonstrated that adults with asthma participating in a structured AT program achieved significantly better asthma control scores compared with non-exercising controls. These findings highlight the safety and clinical relevance of aerobic exercise when appropriately prescribed and supervised.

Systematic reviews and meta-analyses provide further support for these effects. Hansen et al., (2020) reported that aerobic interventions led to significant improvements in maximal and submaximal exercise capacity, including peak oxygen uptake and endurance performance, alongside consistent gains in asthma-related quality of life. Importantly, these functional

improvements occurred largely independently of baseline lung function, suggesting that adaptations to AT are predominantly peripheral rather than airway-specific.

The applicability of aerobic training across different asthma severity levels has also been investigated. McLoughlin et al., (2022) found that increasing physical activity in individuals with severe asthma improved exercise tolerance and quality of life without a consistent increase in asthma exacerbations or adverse respiratory events. Similarly, Liu et al., (2025) confirmed in an overview of systematic reviews that regular AT enhances asthma control, symptom perception, and functional capacity across moderate and severe asthma populations, although heterogeneity in protocols limits precise recommendations for intensity or duration.

Aerobic training also benefits patients with comorbidities. Freitas et al., (2018) reported that obese adults with asthma participating in a 12-week aerobic program experienced improvements in physical activity levels, cardiovascular fitness, and associated comorbid conditions. De Lima et al., (2023) highlighted physiological mechanisms underlying these benefits, including enhanced cardiorespiratory function, reductions in systemic inflammation, and improved perception of exertional dyspnoea.

Overall, AT is a safe and effective strategy for adults with asthma, improving functional capacity, exercise tolerance, and quality of life.

2.3. Combined aerobic and resistance training

Combining aerobic and resistance training integrates the complementary benefits of both modalities, addressing cardiovascular fitness, muscular strength, and overall functional capacity in adults with asthma. Evidence suggests that multi-modal programs may provide more comprehensive functional benefits than either aerobic or resistance training alone.

Lo Bello et al., (2025) evaluated a 12-week combined RT and AT program in adults with asthma. Compared with standard care, participants in the combined program achieved meaningful enhancements in overall physical performance and functional independence. These results indicate that integrating resistance exercises into aerobic routines can amplify the benefits of pulmonary rehabilitation, particularly in supporting everyday activities that require both muscular strength and endurance.

Sanz-Santiago et al., (2020) examined a combined exercise intervention in adults with controlled asthma and found improvements in cardiorespiratory fitness, muscular endurance, and health-related quality of life (HRQoL). The program was well tolerated, with no significant adverse events, supporting the feasibility and safety of combined exercise modalities in asthma management.

Overall, combining AT and RT offers a holistic approach to physical fitness in adults with asthma. Programs can be tailored to individual capabilities and preferences, maximizing adherence and long-term functional benefits (Sanz-Santiago et al., 2020; Lo Bello et al., 2025).

2.4. Respiratory muscle training

Respiratory muscle training (RMT), particularly inspiratory muscle training, targets the strength and endurance of the inspiratory muscles, which can be compromised in adults with asthma. Evidence indicates that RMT improves inspiratory muscle function, reduces exertional dyspnoea, and enhances exercise tolerance, complementing aerobic and resistance training interventions.

Lage et al., (2021) demonstrated in a randomized controlled trial that adults with asthma engaging in a structured inspiratory muscle training program achieved significant improvements in inspiratory muscle strength, six-minute walk distance, and health-related quality of life (HRQoL) compared with controls, with no adverse respiratory events reported.

A systematic review by Lista-Paz et al., (2023) confirmed these findings, showing consistent enhancements in respiratory muscle performance and functional outcomes across multiple studies. The review highlighted the safety of RMT, with minimal side effects and a low risk of exercise-induced bronchoconstriction under supervised conditions.

Orooj et al., (2020) studied pulmonary rehabilitation including respiratory muscle exercises in patients with asthma-COPD overlap, reporting improvements in exercise capacity and

functional performance without adverse events. This supports the applicability of RMT even in populations with overlapping chronic respiratory conditions.

Overall, RMT is a safe and effective adjunct to conventional exercise programs. By improving inspiratory muscle strength and functional capacity, RMT can be integrated with aerobic and resistance training to provide a comprehensive approach to physical rehabilitation in adults with asthma (Lage et al., 2021; Orooj et al., 2020; Lista-Paz et al., 2023).

3. Practical recommendations for exercise prescription

Exercise prescription in adults with asthma should be individualized, taking into account disease severity, baseline fitness, comorbidities, and the risk of exercise-induced bronchoconstriction (Billany et al., 2020; GINA, 2025). Structured programs using the FITT principle (Frequency, Intensity, Time, Type) can help optimize both safety and effectiveness for aerobic, resistance, and respiratory muscle interventions.

Moderate-intensity aerobic exercise, such as brisk walking, cycling, or swimming, can be performed three to five times per week, with sessions lasting approximately 20–40 minutes. Training progression should be gradual and guided by patient tolerance and symptom monitoring (Hansen et al., 2020; de Lima et al., 2023;). RT targeting major muscle groups should be implemented two to three times per week, starting with low to moderate loads and progressing as tolerated, with attention to proper technique and supervised instruction to minimize the risk of injury (Olenich et al., 2018; Billany et al., 2020; Lo Bello et al., 2025;). RMT can be incorporated, particularly for individuals experiencing persistent exertional dyspnoea or limitations in whole-body exercise, typically with sessions of 15–20 minutes several times per week depending on the protocol and device used (Lage et al., 2021; Lista-Paz et al., 2023).

Structured warm-up and cool-down phases remain essential to reduce the likelihood of exercise-induced bronchoconstriction and optimize performance, while ongoing symptom monitoring allows adjustments to intensity or duration in real time. In selected cases, pre-exercise pharmacological prophylaxis may be considered according to guideline recommendations and individual risk profiles (GINA, 2025; Guarnieri et al., 2025). Table 1. summarizes recommended exercise modalities, frequency, duration, intensity, example exercises, and key safety or monitoring considerations, providing a practical framework for implementing individualized programs.

Table 1. Exercise recommendations for adults with asthma.

Exercise Type	Frequency	Intensity	Duration	Examples	Safety / Monitoring
Aerobic	3–5 times/week	Moderate	20–40 min/session	Brisk walking, stationary cycling, water aerobics	Include warm-up and cool-down, monitor symptoms, consider pre-exercise pharmacological prophylaxis if indicated
Resistance (Strength)	2–3 times/week	Low–moderate, progressive	20–30 min/session	Squats, lunges, leg press, bench press, seated row, shoulder press, bicep curls, tricep extensions	Ensure proper technique, supervised sessions, gradual progression of load, monitor for discomfort or exertional dyspnoea
Respiratory Muscle Training (RMT)	3–5 times/week	Low–moderate	15–20 min/session	Inspiratory muscle trainer exercises, diaphragmatic breathing, threshold loading devices	Supervised initially, monitor perceived exertion, stop if severe dyspnoea or adverse symptoms occur

References: (Freitas et al., 2018; Olenich et al., 2018; Billany et al., 2020; Hansen et al., 2020; Orooj et al., 2020; Lage et al., 2021; de Lima et al., 2023; Lista-Paz et al., 2023; GINA, 2025; Guarnieri et al., 2025; Lo Bello et al., 2025;)

Overall, combining RT, AT and RMT offers a safe and effective strategy to improve fitness, muscle strength, and functional capacity in adults with asthma, while minimizing respiratory risk and supporting long-term adherence.

Discussion

This narrative review synthesizes current evidence on exercise interventions in adults with asthma, with particular emphasis on resistance training (RT) as a complementary modality. Aerobic exercise, the most extensively studied intervention, consistently improves cardiorespiratory fitness, exercise tolerance, and quality of life across moderate and severe disease (Jaakkola et al., 2019; Hansen et al., 2020; McLoughlin et al., 2022; Liu et al., 2025;). RT complements aerobic training (AT) by specifically targeting peripheral muscle weakness, enhancing muscle strength, functional capacity, and tolerance to exertion while maintaining a favourable safety profile (Olenich et al., 2018; Billany et al., 2020; Lo Bello et al., 2025). Respiratory muscle training (RMT) provides additional benefits, particularly for patients with persistent exertional dyspnoea, by improving inspiratory muscle function and exercise capacity (Orooj et al., 2020; Lage et al., 2021; Lista-Paz et al., 2023)

When comparing AT and RT, aerobic interventions primarily induce cardiovascular and ventilatory adaptations, resulting in improved endurance and overall exercise capacity. RT, in contrast, directly targets skeletal muscle strength and functional performance, which are

frequently compromised in adults with asthma due to deconditioning, activity avoidance, and the systemic effects of chronic inflammation or corticosteroid use (Vermeulen et al., 2016; Visser et al., 2023; Xiong et al., 2023; Hong et al., 2025). While AT may indirectly support daily activities through enhanced endurance, RT provides more specific gains in the muscular support required for tasks such as stair climbing, lifting, or carrying. Combined exercise approaches may therefore yield additive benefits by improving both cardiorespiratory fitness and muscular performance; however, current evidence is limited by small sample sizes, heterogeneous training protocols, and relatively short intervention durations (Sanz-Santiago et al., 2020, Lo Bello et al., 2025).

Despite encouraging findings, several research gaps remain. High-quality randomized controlled trials isolating RT are scarce, limiting the ability to quantify its independent effects relative to aerobic or combined exercise programs. Optimal training parameters, including frequency, intensity, volume, and progression, remain poorly defined, particularly for older adults, individuals with severe or uncontrolled asthma, and patients with comorbidities. In addition, mechanistic evidence regarding the effects of RT or RMT on airway inflammation, bronchial hyperresponsiveness, or systemic inflammatory markers is limited. Long-term adherence, sustainability, and the effectiveness of home-based or community-based exercise programs also remain largely unexplored, as most existing studies are short-term and conducted under supervised conditions (Freitas et al., 2018; Billany et al., 2020).

Evidence from paediatric asthma populations suggests that combined AT and RT can improve physical fitness, muscular strength, and quality of life. Although these findings cannot be directly extrapolated to adults due to differences in physiology, disease progression, and lifestyle, they highlight potential directions for adult-focused research, particularly regarding the adaptation of combined exercise protocols to enhance adherence, safety, and functional outcomes (Hansen et al., 2020; Sanz-Santiago et al., 2020).

Current international guidelines reflect these evidence gaps. The Global Initiative for Asthma (GINA, 2025) emphasizes the importance of regular physical activity as part of comprehensive asthma management but does not recommend a specific exercise modality, citing insufficient evidence to favour aerobic, resistance, or combined training approaches. This underscores the need for individualized exercise prescriptions guided by patient tolerance, functional limitations, and preferences rather than rigid modality-based recommendations.

Conclusion

Resistance training is a safe and effective intervention for adults with asthma, complementing aerobic exercise by specifically improving muscle strength, functional capacity, and tolerance to exertion. Aerobic exercise remains essential for enhancing cardiorespiratory fitness and overall exercise capacity, while respiratory muscle training can provide additional benefits for individuals with persistent dyspnoea or inspiratory limitations.

Individually tailored programs that integrate aerobic, resistance, and respiratory muscle training offer the greatest potential for improving physical function, symptom control, and quality of life. Despite promising evidence, further research is needed to determine optimal training parameters, clarify mechanistic pathways, and evaluate long-term adherence and sustainability. Incorporating resistance and combined exercise interventions into routine asthma management represents a valuable step toward holistic, non-pharmacological care and supports the development of more comprehensive exercise guidelines for this population.

Disclosure

Author's contribution

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The authors declare no conflict of interest.

Declaration of AI Use

Artificial intelligence (AI) was used only for language enhancement purposes, such as grammar correction and stylistic refinement.

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