

Exercise and Asthma: A Review

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Abstract

The most prevalent respiratory condition, asthma is characterised by airway inflammation that eventually blocks the airways. Asthma cases are growing unceasingly, as seen by the global ongoing rise in cases and the mounting strain on the healthcare system. Breathing difficulties and wheezing are closely associated with asthma attacks. Asthma is brought on by allergies, dust, pollution, and physical activity or exercise. Although exercise may trigger asthma attack also known as exercise-induced asthma or exercise-induced bronchoconstriction, but poor engagement in exercise may deteriorate the asthma condition. Thus, along with taking medication to control asthma attack, participating in exercise helps in asthma control as well as improving quality of life of the asthma population. This review offers a glance analysis of the exercise recommendations made for those who have asthma. It offers explanations of the underlying mechanisms along with a thorough review of how exercise affects asthma. In addition, the analysis highlights the possible hazards that come with exercise for people who have asthma and looks into options of exercise regimens that can be helpful for this particular group of people.

Keywords: Asthma, Asthma Attack, Asthma Control, Exercise, Exercise-Induced Bronchoconstriction.

Introduction

Asthma is a common chronic respiratory disease that nevertheless presents a major worldwide health challenge for individuals of all ages. Asthma is characterised by inflammation of the airways and can severely impaired breathing. Symptoms of the asthma are varies including shortness of breath, wheezing, coughing and tightness of chest. Underdiagnosis and undertreatment of asthma are common, especially in low- and middle-income nations (WHO, 2023).

The prevalence of asthma is still on the rise, which emphasises how serious a public health issue it is. Globally, an estimated 262 million people in 2019 suffer from asthma and caused 455 000 death (Abbafati et al, 2020; WHO, 2023). The dynamic interaction between environmental and genetic factors, suggesting that environmental triggers are crucial in initiating and intensifying asthma symptoms, even while hereditary factors also contribute to an individual's susceptibility.

In Malaysia, the prevalence of asthma among children is much higher than adults which is around 8.9% to 13%, whereas the prevalence among adults is 6.3% (Hussein et al, 2023). Overall, 6.4% of the Malaysian population were formally diagnosed by a doctor to have asthma (NHMS, 2011). Comparing between ethnic groups, Chinese population has the least percentage of having asthma with only 4.0% compared to Malay, Indian and other Bumiputera with 7.2%, 7.6% and 7.8% respectively (NHMS, 2011).

People with asthma have an inadequate quality of life as a result of ineffective asthma management. They are unable to lead normal lives, particularly when it comes to sports or physically demanding hobbies as the asthma symptoms further can be deteriorating and worsening (NHMS 2008, ACSM 2018). In the pursuit of better symptom control and minimizing the risk of asthma exacerbations, incorporating non-pharmacological strategies can also be highlighted. Embracing practices such as quitting smoking, prioritizing vaccinations, and actively managing weight as well as engaging in exercise not only enhances overall well-being but also plays a pivotal role in the comprehensive management of asthma (Ban et al., 2018).

Thus, this article will be focusing on safe and effective exercise recommendations for asthmatic population as well as its physiology behind helps in managing the condition. Moreover, exercise-related risk and innovative exercise approaches also will be delved into and explored.

Discussion

Exercise Recommendation for asthmatic population

Aerobic exercise takes center stage as it proves effective in enhancing cardiovascular fitness and functional capacity. Suitable forms of aerobic exercise for this category include walking, running, cycling, swimming, or water aerobics. According to ACSM (2018), asthmatic patients should aim for 3-4 days of exercise per week, gradually progressing to 5 days a week with moderate intensity. The moderate intensity should be around 40% - 59% of heart rate reserve (HRR) and oxygen consumption reserve (VO_2R). Talk test or rating perceive exertion (RPE) scale can be used to monitor the difficulty of the intensity level which is within scale of 5-6 out of 10 on Borg scale. The duration of the aerobic exercise program should be around 30-60 minutes per day.

Besides, the resistance training also one of the essential parts in the exercise program for asthmatic patients which can improve the muscle strength and endurance, prevent physical deconditioning, improves ability to function and promotes a good health. Based on the frequency, intensity, time and type (FITT) principal from ACSM (2018), the resistance training should be done at least 2 days per week at moderate intensity which is around 60% - 70% of one repetition maximum (1RM) for 8-12 repetitions. The strengthening exercise should be done for 2-4 sets and it is recommended to begin with small repetitions before progressively build up the repetitions level. The types of exercise recommended are by using body weight exercise or weight machines. There is a finding showed an intervention of the combination of strength and flexibility exercise recommended for asthmatic patients which

used Resistance Flexibility and Strength Training (RFST) could improve the muscle activation and neuromuscular adaptation which involved with respiration ability, that enable the patients to breathe efficiently (Olenich et al., 2018).

Another part that also important in improving the activity daily livings (ADLs) of asthmatic patients is flexibility exercise, which can be performed daily or 2-3 days per week. It is best to hold for 10-30 seconds for static stretching, and 2-4 repetitions for each exercise (ACSM, 2018). The goal in practicing the flexibility exercise is to improve balance and increase the range of motion. Commonly stretching can be performed as a cool down session after the aerobic and resistance exercise. There is a study that found RFST helps in stretching of tissues which had anti-inflammatory effects (Olenich et al., 2018). The summary of exercise recommendation from ACSM (2018) are as in Table 1.0 below.

Table 1.0
Exercise recommendation for asthmatic patients.

	Aerobic	Resistance	Flexibility
Frequency	Should be performed 3 to 5 days per week	Should be performed 2 to 3 nonconsecutive days per week	Should be performed more than 2 to 3 days per weeks with daily being more recommended. It is preferably performed during cool down period
Intensity	Always start with moderate intensity which is 40% - 59% of HRR or VO ₂ R. After period of one month and patient well tolerated with exercise, progress the intensity to 60%-70% of HRR or VO ₂ R which is vigorous.	Begin at 60% - 70% of 1RM for beginner and ≥80% of 1RM for experienced populations.	Stretch to the point of experiencing tightness or slight discomfort.
Time	Progressively increase to at least 30 to 40 minutes per day.	2-4 sets of 8-12 repetitions focusing on major muscle groups for strength. For endurance, use <50% of 1RM.	10 to 30 seconds hold for static stretching with 2 to 4 repetitions of each exercise
Type	Exercise that use large muscle groups such as cycling, swimming and running.	Variety of body weight exercise, free weight to machine weight exercises.	Perform static, dynamic and/or Proprioceptive Neuromuscular Facilitation (PNF) stretching.

Despite of recommendation from the ACSM, it is proven that exercise can improve asthma control in adults. Dogra et al (2011) in their study conclude that adults with partially managed asthma who were interested in exercising saw improvements in their quality of life and asthma control after a 12-week supervised exercise programme. Furthermore, significant

gains in aerobic fitness and perceived asthma control were obtained with supervised exercise followed by a self-administered exercise phase, which maintained the improved asthma control levels.

Moreover, a randomized controlled trial from Jaakkola et al (2019) proved that 24-weeks individualized aerobic exercise ameliorate the condition of adult asthmatic patients in term of asthma control. The aerobic exercise was done at least three times per week with the duration of 30 minutes and more. Besides, muscle training as well as stretching also was included in the 24-weeks exercise program. Muscle training was done two times per week with stretching exercise was performed before and after the training.

Mechanism of Exercise in Improving Asthmatic Patient

An increased maximum oxygen consumption indicates that cardiopulmonary fitness is improved by aerobic training. As the cardiopulmonary fitness boosting, asthmatics might manage daily life with less effort if their oxygen uptake capacity were enhanced and their threshold for being dyspneic was raised. By doing exercise, the effort-benefit ratio would increase, and more breathing room would be left (Heikkinen et al., 2012).

Furthermore, exercise training appears to lower inflammation and airway responsiveness in mice, according to animal models. A 12-week aerobic exercise programme decreased bronchioles responsiveness (BHR), the proinflammatory cytokines interleukin-6 (IL-6) and monocyte chemoattractant-1 (MCP-1), as well as the fractional exhaled nitric oxide (FeNO) and sputum eosinophils in asthmatic patients with higher levels of inflammation. It is possible that aerobic exercise lessens airway inflammation because of the drop in FeNO (Jaakkola et al., 2019; Moraes-Ferreira et al., 2022).

Another potential mechanism proposed by Freeman et al (2020) include modifications to the glucocorticoid receptor's redox state. The function of the receptor can be impacted by increased oxidation. Children who have asthma tend to have greater levels of oxidative stress, which is linked to the development of asthma. It has been demonstrated that an 8-week exercise regimen lowers these stress levels, boosts antioxidant activity, and enhances lung function in kids with asthma. Exercise's effect on reactive oxygen species in healthy individuals has been studied, but its effects on adults with asthma have not yet been investigated. Interestingly to note that results in adolescents do not support the participation of the glucocorticoid receptor (Freeman et al., 2020).

Limitations and Associated Risk of Exercise

Prescription of exercise should be made on the basis of guidelines that is suitable for asthmatic patients incorporated with the careful guidance in introducing the exercises or physical activities. Some limitations and associated risk of exercise that can induces asthma is exercise-induced bronchoconstriction (EIB) or exercise-induced asthma (EIA) phenomenon that can cause airway narrowing which can be occur during or after the exercise (Del Giacco et al., 2015). Some study explained that children and adolescents are more susceptible to be affected than adults (Van Leeuwen et al., 2013).

According to ACSM (2018), the EIB is more likely to occur not only in asthmatic patients, those who are without diagnosis of asthmatic symptoms also may experience the EIB. Some elite athletes also may get the EIB which can be worsened by the presence of series of environmental factors such as air pollution, surrounded with dry or cold air, allergens and chlorine in swimming pool areas that can limit their participation to any sport activities. This happened when these athletes constantly exposed to the environmental agents that could

further worsened their symptoms due to their heavily increased ventilation during their daily repeated training routine and competition (Moreira et al., 2011).

In order to prevent the EIB, pharmacological approach need to be administered by using a short-acting bronchodilator before or after the exercise. For those who are experienced asthma exacerbation, they are advised to not doing any exercise until their symptoms are well controlled (ACSM, 2018). There is a limitation to exercise in a cold environments or exercise in the surrounding that openly exposed to airborne allergen or air pollution in order to avoid from getting EIB. Other than that, high intensity of exercise and prolong exercise session duration also can induce bronchoconstriction in susceptible individuals. This is supported by van Leeuwen et al (2013) that at least 5-8 minutes continuous high intensity exercise can provoke the EIB response which usually can be observed after heavy exercise in 2-10 minutes.

Supporting Exercise Approaches

According to Thomas and Bruton (2014), there is a special technique suggested in improvising breathing retraining technique and their mechanism through a breathing exercise program especially for asthmatic patients. In order to achieve the effectiveness of the breathing exercises for asthma, this exercise is divided into three types with different goals that aimed in manipulating the pattern of breathing (breathing retraining), improve the strength and endurance of the respiratory muscles (respiratory muscle training) and also increase the flexibility of the thoracic cage and improving posture (musculoskeletal training). The rationale for introducing this exercise is based on the presumption that asthmatic people have a dysfunctional and abnormal breathing patterns. However, the evidence behind that was not reliable when compared breathing patterns in non-asthmatic with asthmatic people. People with asthma usually do have end-tidal carbon dioxide tension and average lower arterial which indicating a tendency to over-breathe or hyperventilate (Thomas and Bruton, 2014). Other than that, high intensity interval training (HIIT) is one of the trending exercise option for asthmatic populations. According to recent studies by da Silva et al (2022), 12 weeks HIIT program was successfully improving dyspnea level, physical activity level and reduce lower limb fatigue in moderate-to-severe asthma patient. The exercise training was done twice a week with every session last fo 40 minutes. The HIIT protocol was done using cycle ergometer with the exercise bout of 80% maximal exercise intensity (W_{max}) to 140% W_{max} . The increment was done fortnightly. Each HIIT session was made up of 30 seconds exercise bout of 80% to 140% maximal exercise intensity and interspersed with 30 seconds of active recovery at 40% of W_{max} . Despite that, the evidence of HIIT protocol specifically for asthmatic population is still not conclusive. As HIIT can possibly cause distress to asthmatic patients, additional research is needed to develop a safe and effective HIIT prescription for the management of asthma (Kahwash & Nyenhuis, 2022)

Conclusion

Exercise is important to be practiced as it can helps to improve lungs capacity, cardiorespiratory fitness and reduce physical deconditioning effectively. Some of the exercise has been proved their efficacy in reducing incidence of exacerbations and delay the risk of developing other chronic diseases which is can be beneficial for the improvement of quality of life and long-term health. However, some of the exercise may not recommended to be practiced due to certain limitation to the lung that might worsened and provoked the asthma symptoms. It is important to focus on light to moderate intensity of exercise, warm-up before and cold down after the exercise, identify and alert with any exercise-induced asthma

triggers, make sure use premedication properly before start the exercise and always seek for advice and help from health care provider in order to provide the confidence to exercise and lead a good quality of life.

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References

- American College of Sport Medicine. (2018). ACSM'S Guidelines for Exercise Testing and Prescription (10th Ed). *Wolters Kluwer*.
- Da Silva, R. A., Rocco, P. G. L., Stelmach, R., Oliveira, L. M. S., Sato, M. N., Cukier A., & Carvalho, C. R. F. (2022). Constant-load exercise versus high-intensity interval training on aerobic fitness in moderate-to-severe asthma: a randomized controlled trial. *The Journal of Allergy and Clinical Immunology: in Practice*, 10(10), 2596-2604.
- Del Giacco, S. R., Firinu, D., Bjermer, L. & Carlsen, K. H. (2015). Exercise and asthma: an overview. *European Clinical Respiratory Journal*, 2, 27984.
- Dogra, S., Kuk, J. L., Baker, J. & Jamnik, V. (2011). Exercise is associated with improved asthma control in adults. *European Respiratory Journal*, 37, 318-323.
- Freeman, A. T., Staples, K. J. & Wilkinson, T. M.A. (2020). Defining a role for exercise training in the management of asthma. *European Respiratory Review*, 29, 190106.
- Jaakkola, J. J. K., Aalto, S. A. M., Hernberg, S., Kiihamäki, S. P. & Jaakkola, M. S. (2019). Regular exercise improves asthma control in adults: A randomized controlled trial. *Scientific Reports*, 9(1), 12088.
- Kahwash, B. M. & Nyenhuis, S. M. (2022). Exercising with Asthma: A Slow Burn or a Quick HIIT? *The Journal of Allergy and Clinical Immunology: in Practice*, 10(10), 2605-2606.
- Heikkinen, S. A., Quansah, R., Jaakkola, J. J., & Jaakkola, M. S. (2012). Effects of regular exercise on adult asthma. *European Journal of Epidemiology*, 27(6), 397-407.
- Hussein, N., Ramli, R., Liew, S. M., Hanafi, N. S., Lee, P. Y., Cheong, A. T., Sazlina, S. G., Ahad, M. A., Patel, J., Schwarze, J., Pinnock, H. & Khoo, E. M. (2023). Healthcare resources, organisational support and practice in asthma in six public health clinics in Malaysia. *NPJ Primary Care Respiratory Medicine*, 33(1), 13.
- Moraes-Ferreira, R., Brandao-Rangel, M. A. R., Gibson-Alves, T. G., Silva-Reis, A., Souza-Palmeira, V. H., Aquino-Santos, H. C., Frison, C. R., Oliveira, L. V. F., Albertini, R. & Vieira, R. P. (2022). Physical Training Reduces Chronic Airway Inflammation and Mediators of Remodeling in Asthma. *Oxidative Medicine and Cellular Longevity*, 2022, 5037553.
- Moreira, A., Delgado, L., & Carlsen, K-H. (2011). Exercise-induced asthma: why is it so frequent in Olympic athletes? *Expert review of respiratory medicine*, 5(1), 1-3.

- National Health Morbidity Survey (NHMS). (2011). Healthcare Demand and Out-of-Pocket Health Expenditure. Volume III. *Institut Kesihatan Umum, Kementerian Kesihatan Malaysia*, 7.
- National Health Morbidity Survey (NHMS III). (2008). Asthma. *Institute for Public Health, National Institutes of Health, Ministry of Health, Malaysia*, 1-110.
- Olenich, S., Waterworth, G., Badger, G. J., Levy, B., Israel, E. & Langevin, H. M. (2018). Flexibility and strength training in asthma: A pilot study. *Journal of Asthma*, 55(12), 1376-83.
- Van Leeuwen, J. C., Driessen, J. M., Kersten, E. T., & Thio, B. J. (2013). Assessment of exercise-induced bronchoconstriction in adolescents and young children. *Immunology and Allergy Clinics*, 33(3), 381-94.
- World Health Organization. (2023). Asthma. <https://www.who.int/news-room/fact-sheets/detail/asthma> (assessed on 3rd January 2024)