

# Exercise-Induced Bronchoconstriction

## Background, Prevalence, and Sport Considerations

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### KEYWORDS

• Asthma • Bronchoconstriction • Exercise • Athlete • Prevalence • Sport discipline

### KEY POINTS

- Exercise-induced bronchoconstriction (EIB) is defined as the transient airway narrowing that occurs as a result of exercise.
- Current guidelines recommend distinguishing EIB with underlying clinical asthma from the occurrence of exercise-induced bronchial obstruction in subjects without other symptoms and signs of asthma.
- EIB has been reported in up to 90% of asthmatic patients, reflecting the level of disease control, but it may develop even in subjects without clinical asthma, particularly in athletes, children, subjects with atopy or rhinitis, and following respiratory infections.
- The intensity, duration, and type of training have been associated with the occurrence of EIB with higher prevalence rates in endurance sports, winter disciplines, and swimming.
- When properly managed, EIB does not restrict exercise performance and does not prevent competition at elite level.

### BACKGROUND

Regular physical activity is strongly recommended by all principal health care systems and evidence-based guidelines as one of the most effective means to prevent chronic diseases and maintain good health.<sup>1</sup> Indeed, extensive evidence exists regarding the beneficial effect of training and rehabilitation programs in respiratory diseases, including asthma.<sup>2</sup> It has been shown that physical activity can improve symptoms, quality of life, exercise capacity, and pulmonary function, as well as reduce airway inflammation and responsiveness in asthmatic subjects.<sup>3–5</sup>

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On the other hand, vigorous physical training may trigger airway symptoms by imposing high demands on the respiratory system and by exposing subjects to increased amounts of inhalant allergens, pollutants, irritants, and adverse environmental conditions.<sup>6</sup> Furthermore, intense physical training may induce a transient status of immune downregulation with a shift toward a prevalent T-lymphocyte helper-2 response, clinically associated with an increased prevalence of atopy and viral upper respiratory tract infections, both representing relevant risk factors for the onset and worsening of asthma.<sup>7,8</sup>

The transient airway narrowing that occurs as a result of exercise is defined exercise-induced bronchoconstriction (EIB).<sup>6</sup> Already in the first century AD, Aetius the Cappadocian described respiratory symptoms induced by physical exercise: “if from running, gymnastics, or any other work, breathing becomes difficult, it is called asthma.”<sup>9</sup> However, a scientific objective interest for this phenomenon can be dated back to 1960, when Jones and coworkers<sup>10</sup> focused on the physiologic response to exercise in asthmatic children and named the airway obstruction after an exercise challenge “exercise-induced asthma” (EIA). Subsequent studies defined the different patterns of response to exercise in asthmatic patients, the effect of type, intensity, and duration of challenges, and the influence of antiasthmatic drugs on EIA.<sup>11</sup> In reviewing these findings, Godfrey<sup>12</sup> concluded that “despite of some exceptions, there has been no evidence that EIA occurs in patients other than asthmatics, and although sporadic cases have been reported where exercise appears to have been the only precipitant of asthma in a patient, careful investigation has usually revealed other clinical and physiological manifestations of bronchial asthma.” Although some investigators consider EIA a distinct asthma phenotype,<sup>13</sup> it is quite evident that exercise may trigger bronchial obstruction and clinical symptoms in almost all asthmatic patients, independently from the underlying causes and mechanisms of asthma.<sup>14</sup> However, the concept that exercise may induce bronchial obstruction only in asthmatic patients is currently under debate.<sup>15</sup> In fact, despite the physiologic response to exercise, which usually results in slight bronchodilation, EIB may develop even in subjects without clinical asthma.<sup>9</sup> To bring some clarity to this still controversial issue, a Practice Parameter, jointly developed by the American Academy/College of Allergy Asthma and Immunology,<sup>16</sup> recommended to abandon the term of EIA, and more recently, an American Thoracic Society Clinical Practice Guideline<sup>6</sup> suggests naming EIB with asthma (EIBa), the occurrence of bronchial obstruction after exercise in asthmatic patients, and EIB without asthma (EIBwa), the occurrence of EIB in subjects without other symptoms and signs of clinical asthma.

EIB typically develops within 15 minutes following at least 5 to 8 minutes of high-intensity aerobic training (>85% of maximal voluntary ventilation), although it can also occur during exercise, and spontaneously resolves within 60 minutes.<sup>17</sup> After an episode of EIB, there is often a refractory period of about 1 to 3 hours during which, if exercise is repeated, the bronchoconstriction is less accentuated.<sup>12</sup> The increase in airway osmolarity due to the respiratory water loss and the vasodilation associated with airways rewarming has been reported to be the major determinants of EIB (osmotic and thermal theories).<sup>18,19</sup> Furthermore, a direct damage of the bronchial epithelium caused by viral infections, occupational agents and exercise, as well as an autonomic dysregulation may represent alternative causal mechanisms.<sup>11</sup> Most common symptoms include cough, dyspnea, breathlessness, wheezing, and chest tightness.<sup>6</sup> A careful history taking and physical examination is always recommended.<sup>20</sup> The use of specific questionnaires for screening allergic and respiratory diseases in athletes and exercisers represents a useful and easy-to-use additional diagnostic tool.<sup>21</sup> However, research performed over the years has consistently

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