

# Exercise-Induced Asthma

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## Introduction

It feels like a 200-pound person sitting on your chest. It feels as though you're trying to breathe through a thick sweatshirt that has been pulled up tight over your nose and mouth. It makes you wonder how small your lungs are—you picture the shriveled-up raisins that your lungs feel like and compare them with the typical image of a plump round healthy set of lungs. You try to breathe as deeply as you can, but only a gasp of air enters. It makes you wonder, after months of training, if you're still out of shape. The following day, your ribcage is still sore, feeling as though it had more of a workout than your arms or legs.

Call it bronchospasm, bronchoconstriction, or asthma; the disease afflicts an ever-growing number of people around the world. Some people have chronic asthma, meaning they have difficulty breathing all the time, even while at rest. What is more interesting, however, is the percentage of the population who do not have difficulty breathing until they're exercising. For people who suffer from exercise-induced asthma (EIA), when the body needs air the most, for some still unknown reason, the bronchial tubes constrict and impede the flow of air.

What is this affliction and how does it happen? How many people have exercise-induced asthma, and

how many of those people perform regular exercise anyway? What problems are associated with exercise-induced asthma, and can people die from it? What triggers it and how can one avoid an asthma episode? This paper explores these questions and relates what doctors and scientists have learned about exercise-induced asthma.

## **What is Exercise-Induced Asthma?**

First of all, what is asthma? The ancient Greeks gave asthma its name, and Merriam-Webster defines it as “a condition often of allergic origin that is marked by continuous or paroxysmal labored breathing accompanied by wheezing, by a sense of constriction in the chest, and often by attacks of coughing or gasping.” The medical definition is even simpler: “a reversible obstructive airway disorder.”<sup>1</sup> This broad definition reflects the numerous triggers and circumstances that can result in asthma, but it is important to note that it is reversible (as opposed to emphysema, a disease which causes permanent damage to the lungs that result in symptoms similar to those of asthma). Therefore, exercise-induced asthma is the difficulty of breathing that results from exertion.

Exercise-induced asthma occurs in about 90% of people who have chronic asthma and about 40% of people who only exhibit allergic rhinitis (hay fever) or atopic dermatitis.<sup>2</sup> Looking at the population as a whole, approximately 12-15% experience exercise induced asthma—this includes people who have no other symptoms related to asthma or allergies.<sup>3</sup> And before concluding that the performance of people

with exercise-induced asthma is impaired by their breathing difficulty, here is a statistic from the 1984 Summer Olympic Games in Los Angeles: 67 of the 597 members (11%) of the American team tested positive for exercise-induced asthma, and those 67 asthmatics brought home a total of 41 medals.<sup>4</sup> At the 1998 Nagano Winter Olympic Games, 17% of the U.S. Olympic team had exercise-induced asthma.<sup>5</sup> Looking strictly at the percentage of population, asthmatics have virtually the same chances of getting to the Olympics than asymptomatic athletes.

Asthma occurs in the bronchial tubes—the airways that lead to the lungs. The scientific synonyms of asthma—bronchospasm and bronchoconstriction—precisely define what is happening during an asthma episode; the muscles around the bronchial tubes constrict or spasm, the lining of the bronchial tubes swell up, and excess mucus is excreted. All three combine to constrict airflow to the lungs. (Constriction happens at the early stages of asthma, while excess mucus is a sign of a prolonged asthma episode.)<sup>6</sup>

Asthma is also known as the hyperreaction of the airways. In asymptomatic people, things like smoke or exercise naturally cause the bronchial tubes to constrict. The Midlands Asthma and Allergy Research Association of Leicester, England lists a dozen common triggers for asthma on their exercise-induced asthma web page.<sup>7</sup> But in asthmatics, the same triggers can cause an overreaction—over-constriction of the airways.

Returning to the Merriam-Webster definition, asthma is often of allergic origin. Some triggers of asthma (which will be explored in more depth later in

the paper) such as smoke, pollen, foods, and dust are understandably allergy based. Exercise-induced asthma happens, obviously, as a result of exercise. How can something so removed from allergies be a trigger for asthma? Can people be allergic to exercise? Clearly, the answer is no, and researchers have been studying this subset of asthma for years with no concrete conclusions.

What makes the matters more confusing is that there is exercise-induced asthma and then there is chronic asthma with an exercise exacerbation. For those suffering only from exercise-induced asthma, pretreatment is only required before exercise, but for the latter group, their asthma needs to be considered as an always-present problem in addition to one that requires pretreatment before exercise.

### **Why Does EIA Happen?**

No one truly knows what *causes* exercise-induced asthma. Causes, as opposed to “triggers,” are thus speculative. What exactly happens in the body is not completely understood either. Those studying exercise-induced asthma have proposed two theories: the water loss theory and the heat-exchange theory.

The water loss theory is based on the fact that air inhaled through the nose has more time to be conditioned by the upper respiratory tract than air inhaled through the mouth. In the process of conditioning, the upper airway—which includes the nose, pharynx, and the first seven generations of bronchi<sup>8</sup>—adds moisture and warms up the air to a comfortable 98.6°F. This conditioning is, as the theory goes, important for the protection of the delicate

alveolar membranes within the lungs.

With a basic understanding of the relationship between air temperature and humidity, and given the fact that the air sacs would rather accept warm moist air, it is easy to understand why the conditioning process is important, especially on cool crisp days. Essentially, the cooler the air, the less moisture it is able to hold. The warmer the air, the more moisture it is able keep in vapor form. Therefore, cold air is typically drier. Nevertheless, in the range of air temperature and humidity that is comfortable to exercise, the air is still too cool and much too dry for the alveoli's liking. (Imagine jogging in 98.6°F, 100% humidity conditions!) The warm moist surfaces in the upper airway are essential to keeping the alveoli safe from damage.

However, inherent with exercise is the need for more air. All athletes, regardless of age or physical condition, need to inhale more air when they're exerting themselves. "With exercise, the ventilation rate increases markedly and can exceed 200 L per minute."<sup>9</sup> In the pursuit for more air, most people supplement their air intake by breathing through their mouths. (This assumes that the sinuses of the athlete are not clogged or inflamed, as is often the case for people with allergies. More on the link between allergies and asthma later.) By letting the air bypass the upper airway conditioning, the person is introducing cool dry air to the lungs.

Fortunately, the human body has a backup conditioning system—the upper parts of the lungs also add moisture to the inhaled air, if necessary. Naturally, the surface of this part of the lungs, along with most surfaces within the human body, is

protected by surface liquid. As the dry inhaled-through-the-mouth air passes the bronchial tubes, this surface liquid is drawn into the breath, thus leaving the respiratory epithelium (the membrane that lines the bronchial tubes) dehydrated and changing the osmolarity, pH, and temperature of the protective fluid. Researchers have not been able to determine how these changes occur, nor have they been able to figure out how hyperosmolarity of the surface liquid leads to bronchoconstriction (asthma), but previous studies suggest that this theory is viable.<sup>10</sup>

According to the water loss theory, those suffering from exercise-induced asthma, suffer from problems with the conditioning backup system. Essentially, the bronchial tubes, as a secondary conditioning system, can only do so much to humidify the incoming air—thus, they dry up and constrict as a last effort to protect the delicate alveoli.

The second theory, the heat-exchange theory, is based on an understanding of the blood vessels that line the airways. Surrounding the bronchial tubes is a net of capillaries. This theory assumes that the inhaled air still remains too cool for the lungs to handle, so the body's quickest way of warming up the air in the bronchial tubes is to dilate those capillaries by engorging them with warm blood. In this theory, the swelling blood vessels cause constriction of the bronchial airways. The supporters of this theory also suggest that, with all this additional blood in the area, the resulting minor capillary leakage would trigger mediator release, leading to bronchospasm.<sup>11</sup>

The heat-exchange theory explains why people who suffer from exercise-induced asthma often don't feel difficulty breathing until after they've stopped

exercising.<sup>12</sup> At that point, the ventilating flow of cool air has decreased, but the body is still pumping blood to the bronchial tubes. The blood vessels remain engorged, and the passage of air becomes restricted.

## Other Triggers

It is important to establish that *triggers* of asthma are not *causes* of asthma. By thinking of the following factors as triggers rather than causes, people can remind themselves that asthma is, unfortunately, something that will not go away, but it is something whose occurrences can be minimized. According to asthma experts, the danger of thinking that asthma will just go away is the risk of letting the disease go untreated.<sup>13</sup> A related issue is that if the triggers are thought of as causes, people with asthma may try to treat those causes directly, rather than treating the asthma while moderating exposure to the triggers.

Of the population that suffers from exercise-induced asthma, exercise is seldom the only trigger. In other words, a combination of exercise and any of the triggers described below may lead to an asthma attack. Fortunately, the other triggers may be easier to mitigate than exercise.

One trigger often mislabeled as a cause is emotional stress. According to Nancy Hogshead, blaming the asthma on psychological factors is one of the most destructive things one can do. Imagine the chain reaction that results when a sufferer has trouble breathing and then decides, because it feels like the precursor to an asthma attack, that an asthma attack is about to occur. While it is true that asthma attacks can be triggered because of psychological reasons,

people must be careful about trying to solve their breathing problems by focusing solely on the psychological causes. “In all cases, asthma begins with a physical disorder in the lungs, not with an emotion such as sorrow, anger, or laughter.”<sup>14</sup> Besides being a misguided effort, pinning the problem of breathing on psychological reasons can potentially reduce the asthmatic’s self confidence—that somehow, he or she wasn’t mentally determined enough to breathe correctly. Similarly, believing that one should be able to control their asthma at will, and then not being able to do so, can add to stress and feelings of inadequacy.

On the other hand, in both the water loss theory and the heat-exchange theory, the over-inhalation of cold dry air is sufficient to trigger an asthma episode. Furthermore, there is typically such a differential in the air temperature between the inhaled air and the body’s interior temperature that some bronchoconstriction seems inevitable. To think of cold air as a trigger means treating it as yet another factor to be mitigated. One simple way to limit exposure to cold air (besides not going outdoors during winter or not entering air-conditioned buildings) is to breath through a permeable cloth, worn over the nose and mouth. This barrier traps the warm moisture carried in each exhalation within the mouth, so that during inhalation, the same moisture can be returned back to the lungs.

Even changes in weather can trigger asthma attacks. Logically, this is related to the two aforementioned theories as well, because changes in weather correspond to changes in temperature and humidity. Respiratory infections can also trigger asthma attacks, since these increase phlegm and



cause inflammation of the airways. Hence it is wise to avoid exercising when asthma might be triggered by another illness.

Perhaps the most common trigger of asthma is allergy. The pathology of allergy-based asthma shows that mast cells in the body are partially responsible for the inflammation and mucus. When a mast cell comes in contact with allergens, the mast cells become active and start to release pre-formed mediators like histamine.<sup>15</sup> As mentioned before, 40% of people with allergies also experience exercise-induced asthma. (As a side note, research shows that allergies, eczema, and asthma are all inter-related, and these problems run in families. In my case, both my parents suffered from hay fever, and my siblings from hay fever and eczema, but I was the lucky one who got all three.) Allergies can be triggered by a multitude of factors, including smog, cigarette smoke, pollen, animal dander, dust, foods, mold, fungus, and chemicals like sulfur dioxide (a preservative that is commonly used in many prepared foods, especially dried fruits). Allergic reactions can range from excessive mucus and hay fever, to coughing and wheezing, to even vomiting or asphyxiation as a result of internal swelling. Because of the correlation between allergic reactions and asthma, it is important to identify a patient's sensitivities to assorted allergens as part of an asthma control regimen.

### **Who Gets EIA?**

Statistics show that exercise-induced asthma is one of the most prevalent conditions among active children, adolescents, and young adults.<sup>16</sup> One cannot

assume it is something that will “just go away.” People concerned with the increasing pollutants in our air and water and the chemicals in our foods like to question whether the prevalence of diseases in children these days is a direct result of the increasingly poisoned environment we inhabit. According to HealAsthma, an Internet company selling herbal asthma remedies, the global incidence of asthma has risen 50% in the last 10 years. Ignoring this population-wide increase, another explanation—perhaps more logical—of the prevalence of exercise-induced asthma in younger people, is that younger people tend to exercise more than adults. And because there is more of a chance to observe exercise-induced asthma in a larger group of active people, exercise-induced asthma is found more often among children.

Physical activity is not limited to children, however, and adults are subject to exercise-induced asthma too. Most asthmatic adults, if given the choice between gasping for air while exercising or relaxing in front of the TV, would choose to not experience that shortness of breath. Some adult asthmatics exercise anyway because they enjoy it. Meanwhile, the same adults may or may not know that their breathing difficulty is due to asthma. It is easy to ascribe shortness of breath to getting older or getting out of shape (which may be partially true). But if the cause is exercise-induced asthma, these adults need to know the difference!

Chronic asthmatics are also prone to get exercise-induced asthma. Some organizations like the American Academy of Allergy Asthma & Immunology advise coaches and teachers to assume that “exercise-induced symptoms should be anticipated in ALL

patients with asthma."<sup>17</sup> This safety precaution is based on the fact that 90% of those with chronic allergies also experience exercise-induced asthma. For people whose asthma is an around-the-clock ordeal, exercise is simply just another of the many triggers.

As mentioned previously, elite athletes are not immune from exhibiting exercise-induced asthma. Nor are sufferers of exercise-induced asthma barred from becoming elite athletes. To repeat the statistic, 12-15% of the general public has exercise-induced asthma, and asthmatics represent roughly 11-17% of the athletes on American Olympic teams.<sup>18</sup> Besides Olympians, professional athletes of all sports have exercise-induced asthma too. Depending on the sport, the prevalence of exercise-induced asthma in elite athletes may vary between 10% and 50%, which is much higher than people once thought.<sup>19</sup>

Nancy Hogshead, who won three gold medals and one silver in swimming at the 1984 Summer Olympics, suffers from exercise-induced asthma, and wrote a book *Asthma and Exercise*, as a response to what she found to be the popular misunderstanding that exercise-induced asthma prevents exercise. Her book gives the layperson a clear understanding of how breathing works, what asthma is, why education of asthma is important, and how to deal with it. In *Asthma and Exercise*, Hogshead draws from her own experiences and the experiences of other asthmatic athletes (several of them Olympic-caliber athletes) to explain the issues related to exercise-induced asthma. In her own case, she had won Olympic gold medals with no treatment for her asthma. In fact, Hogshead did not even know she had asthma—she had always assumed that her shortness of breath was just due to

being out of shape. And after workouts, she often passed out at the side of the pool, thinking that it was a normal part of pushing oneself to the limit.<sup>20</sup>

Because she was so well conditioned from all her training, Hogshead's exercise-induced asthma did not kick in until the final grueling race. Despite being in tip-top physical shape, her training was not enough to prevent the constricting effects of asthma, and sadly, she finished 0.07 seconds behind the bronze medallist in the 1984 Olympics at Los Angeles.<sup>21</sup> As it turns out, the reason why Hogshead didn't earn a medal in the 200-meter butterfly, her fifth and most difficult Olympic event, was because she simply could not get enough oxygen to her arms.

Hogshead always felt that her lungs were not big enough, but a clinical test at the 1984 Olympics revealed that she had greater lung capacity and about one third more lung strength than any of her competitors. The reason why her exercise-induced asthma was never detected before was because these breathing tests were done while she was at rest.<sup>22</sup> Her asthma only kicked in upon vigorous exercise. She encourages asthmatics who want to exercise to take their inhalers or medications faithfully and to keep in shape. In general, her book is very pro-medicine, but also acknowledges the benefits of following more holistic approaches, like breathing exercises. Throughout her book, Hogshead encourages everyone to exercise, but also encourages everyone to find a doctor who will perform the appropriate tests and prescribe the appropriate drugs.

## **Problems and Risks Associated with EIA**

Exercise-induced asthma may be enough to dissuade some people from exerting themselves. For someone who experiences constricted breathing as a direct result of exercise, what is the incentive to go out and burn a few calories when the payback may be a lingering and painful death? For these people in this mindset, the logical way to avoid getting an asthma attack is to avoid exercising altogether.

This fear of exercise leads to a sedentary lifestyle and to all the other health risks associated with such an inactive disposition. Among these are obesity, heart disease, diabetes, and high blood pressure to name a few. Not as fearsome or life threatening on a moment-by-moment basis, but surely no less deadly in the long run. Perhaps more immediately obnoxious is the lack of energy, strength and flexibility that accompanies the sedentary lifestyle. For children, undiagnosed exercise-induced asthma may keep them from participating in sports and other playtime activities. And because asthmatic children are not able to or do not want to join in on these strenuous exertions, they may develop poor self-esteem and their peers may label them as outcasts.<sup>23</sup> Obviously, exercise-induced asthma can result in poor self-image among both children and adults.

To belabor the point yet again, asthma should not become an excuse for not exercising. In an article under the "Exercise is Medicine" section of *The Physician and Sports Medicine* compilation called "Exercise for Asthma Patients: Little Risk, Big Rewards," Vincent Disabella and his colleagues share conclusions from their research efforts that regular

exercise is good for the asthmatic patient.<sup>24</sup> Nonetheless, the advice to keep in shape does not mean that asthmatics can discount their affliction. Left untreated or ignored, asthma can lead to death. Nancy Hogshead relates the atypical stories of two well-conditioned athletes who died as a result of irreversible episodes of their exercise-induced asthma. Further, she prefaces these warning anecdotes with an astounding statistic: "In 1985 more than three thousand people died from asthma."<sup>25</sup> (Note that this number includes all cases of asthma, not just exercise-induced asthma.) As a footnote, the majority of asthmatic people who die from asthma complications are over 55 years old, and fatal asthma in the young is now very uncommon.<sup>26</sup> Hogshead's message is not to scare asthmatics away from exercise but to encourage asthmatics to approach their disease seriously by following a regular treatment regimen. Disabella agrees with this, noting that the capacity to exercise requires some initial control of asthma symptoms.

## **Diagnosing EIA**

Is the patient's asthma chronic, allergy-triggered, severe or mild? When does the asthma appear: at night, with exercise, after being outdoors, or being near animals? There are many subsets of asthma, and within EIA there are subclasses as well. Diagnosing exactly what kind of asthma one has involves several tests. As mentioned earlier, asthma associated with exercise could be exercise-induced or it could be chronic asthma that is aggravated by exercise. For treatment reasons, it is important to determine what kind of asthma it is and what triggers it. Following are

common tests.

One way to determine whether the asthma is chronic is to take some simple tests conducted by the family doctor or an allergist. Several gadgets are used. The Wright's peak flow meter is a gauge attached to a tube into which people exhale. After taking as deep a breath as possible, the patient is asked to exhale as forcefully and as quickly as possible into the peak flow meter. The instrument registers the maximum flow (peak expiratory flow, or PEF) sustained for 10 milliseconds. The process is repeated two more times. Besides measuring the rate at which the lungs can move air in one breath, repeating the process also checks if the person has asthma. In asthma patients, the deep breaths may trigger airway narrowing, resulting in a decreased peak flow with each breath.<sup>27</sup> A reduced PEF reflects proportionately the amount of obstruction of the airways.

The spirometry test is similar, except that the gadget plots a graph of the volume of air expelled as a function of time. Once again, the patient is asked to inhale deeply, and then to exhale as quickly and as long as she can. This machine measures the total forced vital capacity (FVC) and provides the value of forced expiratory volume in the first second ( $FEV_1$ ). Typically, a normal patient would be able to expel more air in one second than someone with asthma, plus, the non-asthmatic would typically be able to move a greater volume of air overall.<sup>28</sup> Reduced FVC values are generally seen only in moderate to severe asthma sufferers.

The results from these tests are usually compared against standardized norms, indexed according to variations in gender, age, height, weight and

ethnicity.<sup>29</sup> Many other asthma tests exist, but the two most common ones are the peak flow test and spirometry. For reference, following are a few other tests and their associated asthma indications as compared to normal patients:<sup>30</sup>

- Relaxed vital capacity (RVC) is decreased in patients suffering moderate to severe asthma.
- Total lung capacity (TLC) may show a mild increase in people suffering from moderate to severe asthma, perhaps as a physiological accommodation to chronic shortages of air.
- Residual volume (RV) and functional residual capacity (FRC) may increase as well if there is moderate to severe asthma.
- Maximum expiratory flow at lower lung volumes (e.g. MEF<sub>50</sub>) shows an early reduction in asthmatic patients.
- Airway resistance (Raw) and Specific conductance (sGaw) both increase when asthma is present.

Keep in mind that most of these tests are taken when the patient is at rest. But many tests can easily be modified to check for exercise-induced asthma simply by adding several minutes of exertion between measurements.

## **Treatment of Asthma**

Once the type, duration, and severity of asthma are determined, several pharmacological and naturopathic treatments can be used to control the asthma. Each medication or herbal treatment targets only specific symptoms or triggers of asthma. None of them claim to be or are effective in curing asthma. Following FDA



standards, the medications have been rigorously proven to provide beneficial effects. Naturopathic treatments may contain similar chemicals to those found in prescription medications, but because these supplements have not gone through the same rigorous testing that prescribed medications have gone through, most doctors will not endorse their usage.

In the pharmacological category, the most popular pre-exercise medications are inhaled beta-2 agonists like albuterol, terbutaline sulfate, and salmeterol. All athletes with exercise-induced asthma are recommended to carry these fast-acting inhalers as a precaution.<sup>31</sup> By affecting the increase of intracellular concentrations of cyclic adenosine monophosphate (AMP), these drugs help control contraction and relaxation of the smooth muscles around the bronchial tubes.<sup>32</sup> It is important to note that both albuterol and terbutaline sulfate interact with alpha- and beta-1 adrenergic receptors (also targeted in medication used by patients with high blood pressure and heart problems), sometimes causing side effects like heart palpitations and tremors.<sup>33</sup> When two puffs of metered dosage are taken 30 minutes before exercise, these medications prevent asthma symptoms in 90% of patients.<sup>34</sup>

Another set of pre-exercise medications are the mast cell stabilizers including cromolyn sodium and nedocromil sodium. These drugs do nothing to prevent the constriction of the airways, but instead inhibit inflammation. People who cannot handle the side effects of the beta-2 agonists typically take these medications instead. These mast cell medications, when inhaled about 20 minutes before exercise, can

prevent asthma symptoms in 70-85% of patients with exercise-induced asthma.<sup>35</sup>

Long-term medications like inhaled corticosteroids,<sup>36</sup> (including beclomethasone dipropionate, budesonide, flunisolide, fluticasone propionate, and triamcinolone acetonide) are typically used by people who have chronic asthma, but may be used in conjunction with the beta-2 agonist inhalers. These reduce hyper-responsiveness caused by allergies or exercise. Leukotriene modifiers include montelukast and zafirlukast, and are used to control exercise-induced asthma in people with chronic asthma.<sup>37</sup> For people whose asthma is also associated with allergies, there are multitudes of drugs and treatments for the control of allergies too, however, that topic will not be addressed here.

On the naturopathic front, many combinations of supposedly 'natural' remedies are available on the market; as could be expected, their effectiveness is varied. The primary argument for them is that because these remedies contain chemicals created in plants and other natural objects rather than being formulated in a sterile pharmaceutical lab, they are somehow a healthier alternative. The argument against them rests on two objections. First is the question of their effectiveness in alleviating asthma,<sup>38</sup> and second is the fact that herbal remedies generally contain a multitude of other chemicals that may interact in unanticipated ways.

Among the long list of herbs alleged to be effective at asthma control are lobelia and ginger root. Lobelia stimulates respiration, reduces inflammation, and is an expectorant.<sup>39</sup> Ginger root is a powerful natural expectorant and is used widely in Chinese formulas

for coughs, colds, diarrhea, vomiting, abdominal pains associated with colds, edema (stagnation of fluids in the lungs), and chronic bronchitis.<sup>40</sup> Other natural treatments like Mormon Tea<sup>41</sup> contain herbs with chemical precursors to ephedrine (a stimulant). Note that in response to a number of deaths, the FDA has initiated steps to ban ephedra-containing nutritional supplements.<sup>42</sup>

For competitive athletes, the issue of banned substances is one for consideration, especially because many of the more effective chemicals in the fight against asthma are also considered performance enhancers. Different sports organizations (IOC, USOC, NCAA, etc.) have different lists of what drugs are allowed and disallowed. As far as the typical asthma drugs are concerned, the ones that contain ephedrine, pseudophedrine (commonly known as Sudafed), phenylpropanolamine, and phenylephrine are banned by the USOC. Oral (as opposed to inhaled) beta-2 agonists are similarly banned. Intravenous, intramuscular, and oral (not inhaled) corticosteroids are banned as well. The list is long and varied, so athletes wanting to compete need to double check that their asthma medication is allowed, and consult with a physician about the possible alternatives.

## **Controlling EIA**

Aside from relying on drugs or herbs, there are several ways an asthmatic can help keep exercise-induced asthma at bay. Although some asthmatics might forego all medication and just rely on tracking their peak flow, keeping in shape, warming up and down properly, or practicing breathing exercises, most

doctors advise a combination treatment of both preventative medicines as well as regular exercise.

As mentioned before, a very effective way of controlling exercise-induced asthma is to keep in shape. The theory behind this is that physically fit people use their inhaled air more efficiently, and therefore do not need as high a heart rate, nor do they need to breathe as hard. And simply by not needing to breathe as hard, physically fit asthmatics can avoid asthma episodes. Interestingly, encouraging asthmatics to exercise is a relatively new idea. "Not so many years ago, to prescribe exercise for people with asthma would have been regarded as imprudent, if not irresponsible."<sup>43</sup> Since then, several studies have been conducted to support the notion that athletes with exercise-induced asthma should continue to exercise.

One clinical study from the mid-1990's investigated the effects of three months of physical training on 36 asthmatics. At the outset of the study, the patients first performed several exercises, and then measurements of lung function were recorded. The group was then randomly split in two: half the people were to participate in a three-month training program, and the other group would be the control group. At the end of the study period, all remaining participants perform the same submaximal exercises as given at the start of the study. Those who participated in the medically supervised physical training program saw a significantly greater increase in their oxygen uptake, oxygen pulse, and anaerobic threshold as compared with the control group. As a bonus, those who went through physical training also saw a drop in breathlessness, blood lactate levels, carbon dioxide

output, and minute ventilation. The researcher's conclusion was that the physical training brought the level of fitness and cardio-respiratory performance up to a level that is beneficial to asthmatic people who want to exercise.<sup>44</sup>

Besides being in shape, it is imperative that people with asthma properly warm up and cool down when exercising. In another clinical study, a group of 12 athletes with exercise-induced asthma were separated into three separate warm-up groups. The first group jogged on a treadmill for 15 minutes at 60%  $VO_{2max}$  (ie., 60% of their individual maximal oxygen consumption rate). The second group performed eight 30-second runs at 100%  $VO_{2max}$  (with 90 seconds rest between each run). And finally, the control group had no chance to warm-up. All three groups were then subjected to an exercise challenge test where they ran at 90%  $VO_{2max}$  for six minutes. The result was that the people who warmed up for 15 minutes at 60%  $VO_{2max}$  (compared with the control group) saw a significantly lower rate in each of the following: forced expiratory volume of air, maximal mid-expiratory flow rate, and forced vital capacity. The second, more intense warm up group did not experience as much benefit as the first. The study conclusion was that a continuous warm up at around 60%  $VO_{2max}$  can significantly decrease post-exercise bronchoconstriction in moderately trained athletes.<sup>45</sup>

For people who do not suffer from asthma, the idea of making a conscious effort to breathe may be a foreign notion. Exercise regimens that include martial arts or yoga, however, commonly include breathing exercises as an important part of the routine workout. This fact is good for asthmatics, who should, by the

way, find it second nature to breathe consciously. Rather than waiting for an asthma episode to occur, people who suffer from exercise-induced asthma can train their lungs and their minds to breathe in a controlled and deep way, even when the bronchial tubes are constricting. In fact, breathing exercises are, as their name suggests, exercises in themselves—they result in more toned bronchial muscles and better breathing technique.

Most people use up only two-thirds to three-quarters of their total lung capacity to breathe—and for most daily activities, this amount of lung function is beyond adequate. Because a quarter or more of the lung capacity is typically not used, it remains underdeveloped. Asthmatic athletes, through breathing exercises, can tap that underused percentage of the lungs and potentially train themselves to draw in more air in each breath. Further, when an asthma attack does occur, breathing exercises offer a conscious way to relax and “ride out the worst episode”<sup>46</sup> rather than giving in to fear or panic.

Beneficial breathing exercises can range from simple diaphragmatic deep breathing, to those involving the entire body, to movements drawn from yoga or tai chi. In fact, the exercises singers must do to expand their lungs and control their breath are analogous to these breathing exercises. Opera singer and practitioner of Chi Yi (literally, the art of air) Nancy Zi wrote a book titled *The Art of Breathing*. Zi draws from both her voice training and from an understanding of chi to conclude “controlled deep breathing helps the body to transform the air we breathe into energy. The stream of energized air

produced by properly executed and controlled deep breathing produces a current of inner energy which radiates throughout the entire body and can be channeled to the body areas that need it the most, on demand."<sup>47</sup> Even if an asthmatic athlete has not mastered the art of channeling chi, that person can utilize these breathing techniques to calm the lungs and to make breathing a non-passive activity.

## **EIA and Sports**

Several publications recommend lists of similar exercises and sports that seem less likely to trigger an asthma attack. What are these lists based on? Researchers have learned that sports that give an asthmatic person several seconds to rest between periods of moderate to high levels of exertion are best at keeping the asthma at bay.<sup>48</sup> Also, sports that require only short bursts of energy seem to fit well into the exercise regimen of someone with exercise-induced asthma. Not only is the list based on when and how much energy is required, the environment in which the sport takes place is also given consideration.

Recommended sports are those which keep the participant's ventilation rate well below maximum or are located where the air is moist and warm enough for comfortable inhalation. Swimming typically involves shorter bursts of energy and is naturally located in an environment of high humidity. By contrast, walking is continuous, but usually does not push the threshold of maximum exertion. The same can be said about the activities of leisure biking, hiking, and free downhill skiing.<sup>49</sup> Team sports that

require short bursts of activity are recommended too, including baseball, golf, sprinting events in track, football, tennis, racquetball, and volleyball.<sup>50</sup> Martial arts are also recommended for asthmatics, because of their intrinsic rhythm of high levels of exertion mediated by periods of rest.

On the other hand, sports that tend to trigger exercise-induced asthma are those that require continuous high minute ventilation<sup>51</sup> or those that are associated with cool, dry air. Such sports include basketball, long-distance or mountain biking, long-distance running, and soccer. Cold air exacerbates the breathing difficulties faced by asthmatic athletes, and those who participate in sports like ice hockey, ice-skating, and especially cross-country skiing are more likely to experience exercise-induced asthma. In fact, a study of Swedish cross-country skiers found that 55% of them experienced some kinds of exercise-induced asthma symptoms.<sup>52</sup> No one writes that these sports are *not* recommended, but they do label them as more likely to induce an asthma attack than the recommended activities.

## **Summary**

The primary lesson about EIA that many athletes, researchers, and physicians want to emphasize is that exercise, along with appropriate supervised medical treatments, is an excellent way to get a handle on exercise-induced asthma. In some ways, to continue to exercise is to continually increase the level of fitness, which directly correlates to a decrease in the occurrence of asthma attacks.

The second lesson is that if life has dealt you the



challenge of having to live with exercise-induced asthma, you should live your life in control of your breathing, and never let your asthma control what you do in your life. Just acknowledge its existence, take care of it, and get on with your life—sports and all.

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## Endnotes

<sup>1</sup> Hogshead, p. 25.

<sup>2</sup> Lacroix.

<sup>3</sup> Disabella, p. 79.

<sup>4</sup> See: "Exercise-Induced Asthma" at <http://www.nationaljewish.org/medfacts/induced.html>.

<sup>5</sup> Storms, p. S34.

<sup>6</sup> Hogshead, p. 29.

<sup>7</sup> Stern, Martin. "Exercise-Induced Asthma." Posted at [http://www.users.globalnet.co.uk/~aair/asthma\\_exer.htm](http://www.users.globalnet.co.uk/~aair/asthma_exer.htm). Last updated February 22, 2000. Accessed July 23, 2004.

<sup>8</sup> Lacroix.

<sup>9</sup> *Ibidem*.

<sup>10</sup> Storms. "Support for the water loss/hyperosmolarity theory of EIA comes from the fact that inhalation of hyperosmolar saline at rest will cause bronchoconstriction."

- <sup>11</sup> Storms.
- <sup>12</sup> Lacroix.
- <sup>13</sup> Hogshead, p. 36.
- <sup>14</sup> *Ibidem*.
- <sup>15</sup> Cochrane, p. 19.
- <sup>16</sup> Kaplan, p. 47.
- <sup>17</sup> "Special Considerations for Managing Asthma," Public Education Committee of the American Academy of Allergy, Asthma and Immunology, 2003. Posted online at [http://www.aaaai.org/ar/working\\_vol2/083.asp](http://www.aaaai.org/ar/working_vol2/083.asp) Content verified on July 23, 2004..
- <sup>18</sup> Storms, p. S34.
- <sup>19</sup> *Ibidem*.
- <sup>20</sup> Hogshead, p. 1.
- <sup>21</sup> *Ibidem*, p. 2.
- <sup>22</sup> *Ibidem*, p. 5-6.
- <sup>23</sup> Lacroix.
- <sup>24</sup> Disabella, p. 75.
- <sup>25</sup> Hogshead, p. 39.
- <sup>26</sup> Cochrane, p. 11.
- <sup>27</sup> *Ibidem*, p. 25.
- <sup>28</sup> *Ibidem*, p. 26.
- <sup>29</sup> *Ibidem*.
- <sup>30</sup> *Ibidem*, p. 40.
- <sup>31</sup> Lacroix.
- <sup>32</sup> *Ibidem*.

- <sup>33</sup> For more information about drugs with contraindications for asthma, see “Medications That Can Exacerbate Asthma” at [http://www.nationalasthma.org.au/publications/amh/med\\_other\\_4.htm](http://www.nationalasthma.org.au/publications/amh/med_other_4.htm).
- <sup>34</sup> *Ibidem*.
- <sup>35</sup> *Ibidem*.
- <sup>36</sup> The inhaled drugs are chemically much like the topical corticosteroid hydrocortisone, which is commonly used to relieve skin irritations, the primary difference being the means of drug delivery.
- <sup>37</sup> Lacroix.
- <sup>38</sup> “Herbal asthma remedies ‘unproven’,” *BBC News Website*, October 23, 2000. Available online at <http://news.bbc.co.uk/1/hi/health/986573.stm>. Content verified July 23, 2004.
- <sup>39</sup> From the website of Viable Herbal Solutions.
- <sup>40</sup> See: <http://www.healasthma.com/herbs.html>.
- <sup>41</sup> From the website of Viable Herbal Solutions.
- <sup>42</sup> See FDA announcements posted online at <http://www.fda.gov/oc/initiatives/ephedra/december2003/>. Content verified July 23, 2004.
- <sup>43</sup> Disabella, p.75.
- <sup>44</sup> Cochrane, p. 345.
- <sup>45</sup> McKenzie, p. 951.
- <sup>46</sup> Hogshead, p. 139-140.
- <sup>47</sup> Zi, p. 2-3.
- <sup>48</sup> Lacroix.
- <sup>49</sup> “Tips to Remember: Exercise-Induced Asthma,” Public Education Committee of the American Academy of Allergy, Asthma and Immunology, 2003. Posted online at

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<sup>50</sup> Storms, p. S34.

<sup>51</sup> Lacroix.

<sup>52</sup> Storms, p. S34.