

Challenges with Nose Breathing During Exercise & Competition

The Interaction of Nasal Congestion With Athlete Performance



Over 85 million consumers over the age of 18 experience inflammation-related symptoms related to allergies, congestion, head pain, and sinus issues. 69% of them experience exercise-related nasal issues: post-nasal drip after exercise or running (59%) or unable to get enough air through my nose during exercise or exertion (44%). But 58% of these same consumers try to avoid medication, if at all possible, to address their symptoms. There are proven benefits of exercise, and this study with over 2,000 consumers by Intellego Insights commissioned by Tivic Health found that Athletes (a self-defined group of 20% of the sample) have fewer symptoms overall and sleep better, but they may also snore more. This whitepaper highlights some of the very interesting unmet needs related to exercise, nasal congestion, and nose breathing.

59%

Experience
post-nasal drip

44%

Experience nose
breathing
challenges

58%

Try to avoid
medication if at
all possible

When you exercise and have trouble breathing through your nose, what is your first course of action? What dissatisfactions and pain points do you have, and what workarounds or homemade solutions do you try? What are the benefits of nose breathing for athletic performance?



INCIDENCE

Incidence of Exercise or Physical Activity

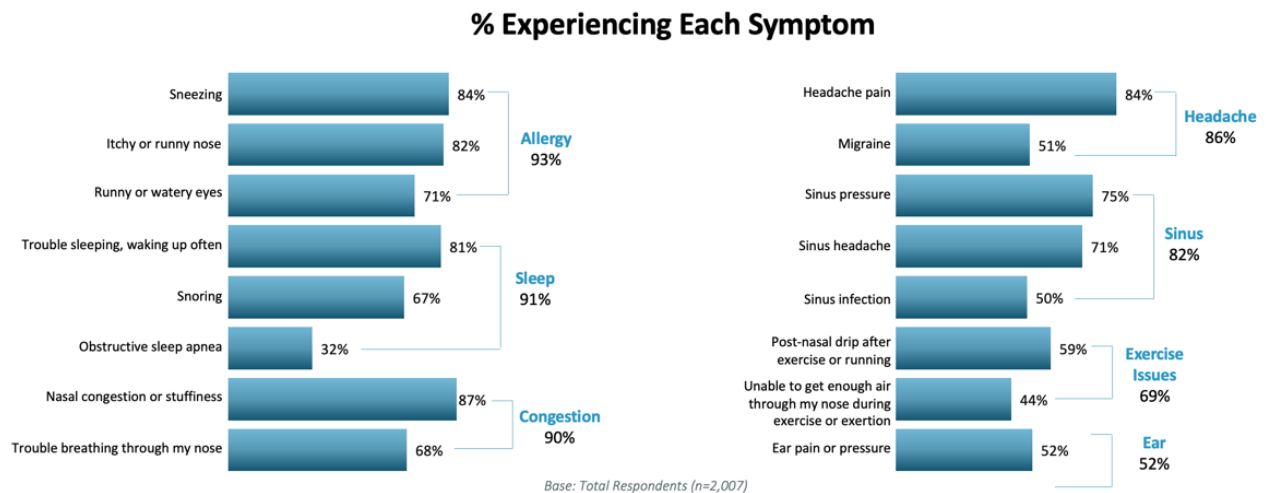
The CDC cited that 46.9% of U.S. adults aged 18 and over met the Physical Activity Guidelines for aerobic physical activity in 2020.¹

As sub-set of those consider themselves Athletes. In the Intellego Insights research, 20% of the consumers (405 out of the 2,007 total U.S. adult sample) self-described themselves as having played athletics in college, currently participate in competitive events, run 5K or more, or play in an adult sports league.

¹ [Physical Activity Among Adults Aged 18 and Over: United States, 2020, National Health Interview Survey](#)

Incidence of Symptoms

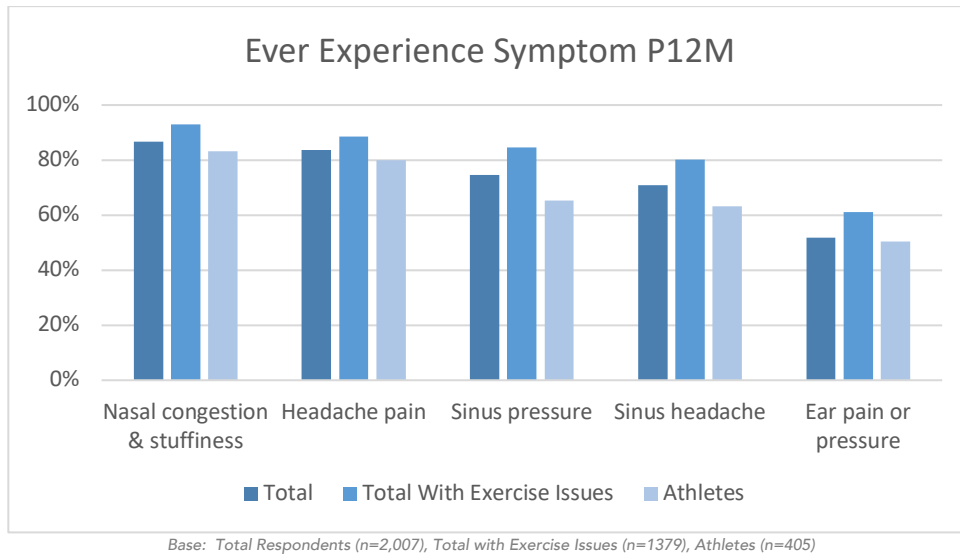
The Total sample included in the study experienced a range of inflammation-related symptoms. A larger percentage (69%) than just the competitive Athletes indicated they experienced exercise related issues: post-nasal drip after exercise or running (59%) or unable to get enough air through my nose during exercise or exertion (44%).



Incidence of Cross-Symptoms

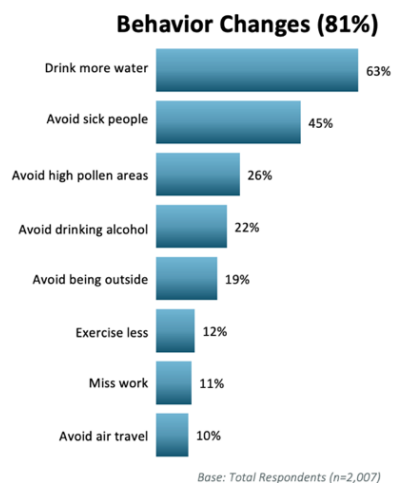
This analysis looks at three groups: the Total sample, the sub-set of those with Exercise Issues, and Athletes. Interestingly, it appears that the sub-set with Exercise Issues have a higher incidence of other symptoms than the Total or Athletes.

Those with Exercise Issues have significantly higher incidence of nasal congestion & stuffiness (93%), headache pain (89%), sinus pressure (85%), sinus headache (80%), and ear pain or pressure (61%) than both the Total and the Athlete sub group.



This study did not evaluate causation versus correlation, but this data suggests there is learning to further understand how some underlying sinus inflammation-related symptoms may be impacting one's engagement and experience with exercise and physical activity.

The Intellego study showed that consumers make many behavioral changes to address their overall symptoms, with drinking water and avoiding sick people the most common. In addition, consumers avoided high pollen areas (26%), avoided being outside (19%), and exercised less (12%).



For Athletes, they may experience significant symptoms of allergy triggers by exposure to aeroallergen as a result of the increase in air flow during exercise. An allergic response can cause nasal and conjunctival congestion, tearing, breathing difficulties, and, fatigue, which affect athletic performance.²

The adverse relationship between inflammation and allergy-related symptoms with exercise has been seen by Dr. Annie Chern who is a board-certified Family Physician and Faculty Member of Stanford Family Medicine Residency Program. She is also a Medical Advisor to Tivic Health, creator of the ClearUP bioelectronic sinus device.

“I have patients that don’t want to go outside because of their allergies,” said Dr. Chern, “Decreasing any barrier to get movement or activity by having a solution like Tivic ClearUP could be very beneficial.”

2 Seasonal Allergies and Seasonal Decrements in Athletic Performance, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7119062/>



DEMOGRAPHICS & HABITS

Athletes

Younger. Those who defined themselves as Athletes tended to be younger, average age 44, compared to the total base average 49. 63% of Athletes were aged 45 or younger.

Male. 71% of those who defined themselves as Athletes were male, 28% female. The total was 46% male, 54% female.

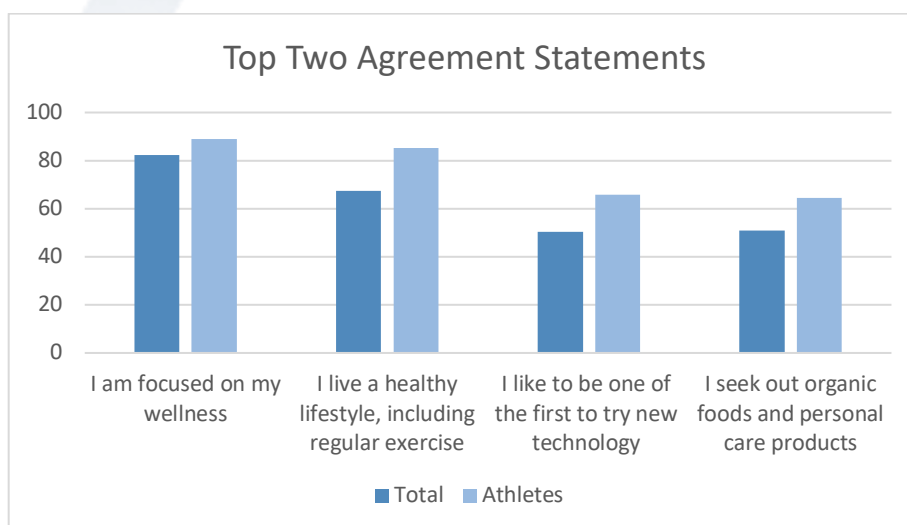
Educated. 82% of those who define themselves as Athletes completed college or higher level of education, compared to 74% of the total.

The other variables of income and race were not statistically different between Athletes and Total.

Current Behaviors

There are a few expected and one surprising behavior identified from this research.

As expected, the Athlete population is focused on wellness (88.9%), they live a healthy lifestyle (85.2%), are early adopters (65.9%), and seek organic foods (64.4%).



Base: Total Respondents (n=2,007) Athletes (n=405)

Contrary to common notions of a healthy lifestyle, however, smoking was a higher behavior among Athletes than the Total. Among Athletes, 26.4% indicated they are a regular smoker. This compares to the Total 19%. It was not specified if this is tobacco, cannabis, or forms of vaping, which are common among younger adults.

According to the CDC, men (4.3%) were almost twice as likely as women (2.3%) to be current e-cigarette users. The percentage of adults who were current e-cigarette users decreased with age, from 7.6% among those aged 18–24, 4.3% among those aged 25–44, 2.1% among those 45–64, to 0.8% among those aged 65 and over.³

The Intellego study did not ask about alcohol consumption, but an article in Runner’s World shared the results of a study that found moderate and highly fit people were significantly more likely to be moderate or heavy drinkers. Highly fit men were 63% more likely to be moderate or heavy drinkers; for women, being highly fit more than doubled the chances of being a moderate or heavy drinker. The study author suggests this may be caused by a “licensing effect,” which means when you have done something good for you (e.g. a run), you are more inclined to feel entitled to reward yourself with something bad for you (e.g. a drink).⁴

³ CDC, *Electronic Cigarette Use Among U.S. Adults, 2018*, NCHS Data Brief No. 365, April 2020

⁴ Nov 2021 <https://www.runnersworld.com/uk/news/a38277274/alcohol-fitness/>

The Benefits of Nose Breathing for Sports Competition

Among Athletes specifically, 49.1% are unable to get enough air through their nose during exercise or exertion, and 64.9% have post-nasal drip.

The benefits of nose breathing for cardiovascular health

When you breathe through your nose, you are filtering and humidifying the air, which helps to protect your lungs and improve your overall cardiovascular health. Nose breathing also allows you to take deeper and slower breaths, which can improve the exchange of oxygen and carbon dioxide in your body.⁵ This means that your muscles are getting the oxygen they need to perform at their best, and you are less likely to experience fatigue during exercise.

“Nasal breathing is important to sustain endurance and compete to their fullest ability while not being limited by upper respiratory issues,” says Dr. Mitesh Popat, CEO Venice Family Clinic, Board Certified Family Physician, and Medical Advisor to Tivic Health. “The air we breathe only has 21% oxygen, so it is critical to get sufficient air into the blood stream so your cells, muscle tissue, and organs of the body function well and for a longer period of time. This air movement in and out of the nose is key, and getting carbon dioxide out is just as important since carbon dioxide is what makes people fatigue faster.”

If you've ever had a cold, you know how uncomfortable nasal congestion can be. Breathing through your nose can be difficult, so you resort to breathing through your mouth instead. However, that's not ideal - breathing through your mouth compared to your nose leads to higher air resistance, making it harder for oxygen to pass into the lungs.⁶ As a result, some athletes become winded easily or experience difficulty breathing during their performance.

Nose breathing for endurance

Endurance is a crucial factor in sports competition, and nose breathing can help to improve your endurance. When you breathe through your nose, you are engaging your diaphragm and core muscles, which can help to improve your overall posture and breathing mechanics. This means that you are able to take in more oxygen with each breath, which can improve your overall endurance and help you to maintain your performance for longer periods of time.⁷



Dr. Popat describes the importance of nasal breathing and exercise as a plumbing problem. If there is blockage or restriction in one area, it affects the air flow. For high performing athletes doing strenuous exercise, when air flow is not optimal, the body sends signals to the brain via neuro pathways to tell you to stop. Over exertion without sufficient oxygen flow can even result in passing out. These are protective mechanisms of the body. “I highly recommend a product like Tivic ClearUP as a non-drug solution that addresses inflammation-related symptoms to allow more air

movement and help fuel the body," Dr. Popat states. "Your cells need a continuous flow of oxygen to move the body. This is particularly important for competitive athletes."

Nose breathing for stress reduction

Sports competition can be stressful, and nose breathing can help to reduce stress and anxiety. When you breathe through your nose, you activate your parasympathetic nervous system, which helps to calm your mind and body. This can help to reduce the stress and anxiety that can interfere with sports performance.

5 Patel, R. et al. "Nasal breathing and the science of breathlessness." *Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology*, vol. 33, no. 5, 2021, pp. 371-377.

6 McKeown, P. "The physiological effects of nasal breathing versus mouth breathing." *Journal of Oral Rehabilitation*, vol. 46, no. 6, 2019, pp. 534-543.

7 Dominelli, P. B. et al. "Nasal breathing improves ventilatory efficiency and reduces respiratory rate during exercise." *International Journal of Sports Medicine*, vol. 38, no. 13, 2017, pp. 963-969.

Sleep and Exercise

Sleep helps athletes maximize their athletic potential with recovery

When you exercise, your muscles undergo stress and micro-tears. It's during the recovery phase that your muscles rebuild and come back stronger. Sleep is a crucial aspect of this recovery process, as it is during this time that your body releases growth hormone, which aids in muscle repair, and helps to promote the growth of new tissue. Additionally, sleep also helps to reduce inflammation throughout the body, which is a contributing factor to muscle soreness and injury. It is recommended that adults aim for 7-9 hours of sleep per night and that athletes may need even more sleep during periods of intense training or competition.⁸

It might seem counterintuitive, but getting enough rest can actually help to lower your risk of injury. Aside from reducing inflammation, a well-rested body is also better equipped to deal with the stresses of training. Additionally, sleep is when your body releases cytokines, which act as modulators for immune response, meaning a lack of sleep can lead to an impaired immune response, making you more susceptible to illness and injury.⁹

Exercise can help you sleep better

Regular physical activity has been shown to improve sleep quality and duration, as well as reduce the time it takes to fall asleep. Exercise can also help regulate your body's circadian rhythm, which is the internal biological clock that controls your sleep-wake cycle.¹⁰

But too much exercise, or at late hours can impact sleep

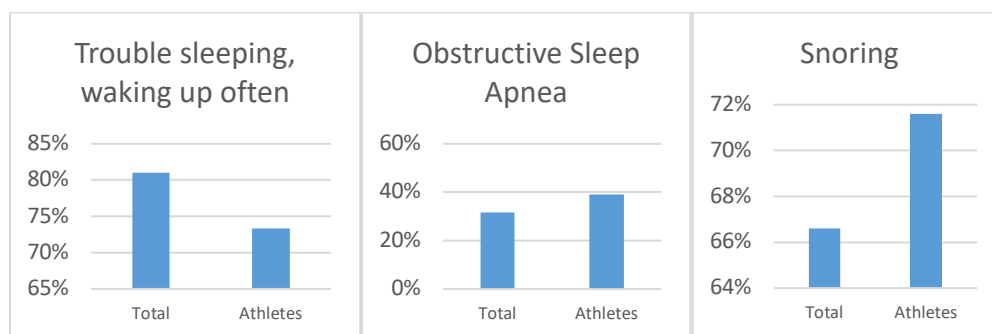
However, it's important to note that the timing and intensity of exercise can also impact sleep. Exercising too close to bedtime can increase your heart rate and body temperature, making it harder to fall asleep. It's generally recommended to finish moderate to vigorous exercise at least 3 hours before bedtime.¹¹

Some people may find that exercising too intensely or for too long can interfere with sleep, so it's important to listen to your body and adjust your exercise routine as needed. While it can get

tempting to practice around the clock, cutting into your sleep cycle can be detrimental to your athletic performance. Research has shown that sleep deprivation can lead to a decreased level of cognitive function and reaction time, which can impact overall performance.¹² When you're sleep-deprived, you're likely to make more mistakes, lose focus, and generally be less alert than if you had gotten enough rest. By making sure you're catching the recommended amount of sleep, you'll be better set up to excel during training and competition.

The sleep quality of Athletes

The data from this research indicates that self-described Athletes don't have as much trouble sleeping as the total (73.3% vs 81%), but they do directionally have higher incidence of obstructive sleep apnea (39% vs 31.7%) and they snore more (71.6% vs 66.6%).



Base: Total Respondents (n=2,007)

Q.10 In the past 12 months which of the following, if any, did you experience? (Select one on each row.)

Dr. Chern also shared a hypothesis that both the higher drinking and smoking/vaping among Athletes may be the reason for these findings. Alcohol tends to increase airway collapsibility during sleeping and make obstructive sleep apnea worse. Alcohol can also prevent people from waking themselves during periods of apnea, compared to when they have not imbibed. The Sleep Foundation also confirms that alcohol consumption may contribute to or exacerbate obstructive sleep apnea.¹³

There are many studies that explore the relationship between smoking and sleep disturbances, including smoking as well.¹⁴ Dr. Chern indicates that smoking irritates the lining of the upper airway, causing it to become inflamed. The inflammation can narrow the airway and restrict airflow, and smoking can also increase the production of extra mucus which can clog the airway and make it more difficult for air to flow. As the airway is narrowed, the movement of air in a pinched space causes vibrations, which is snoring.

Furthermore, nasal congestion can impact sleep and resulting athletic performance. Good sleep is important for athletic performance, but a cold or allergies can make this challenging. When you have nasal congestion, you're more likely to experience snoring, coughing, dry mouth, and difficulty breathing at night. All of these factors can make your sleep less restful, leaving you tired and sluggish the next day. As a result, it's important to identify the causes of your nasal congestion and treat them to improve sleep and performance.

8 Fullagar, H. H. K. et al. "Sleep and recovery in team sport: current sleep-related issues facing professional team-sport athletes." Sleep Medicine Reviews, vol. 32, 2017, pp. 200-207.

9 Besedovsky et al. "Sleep and Immune Function," Sleep Medicine Reviews, 2012

10 Masahiro Banno et al "Physical activity and sleep: A systematic review and meta-analysis," Sleep Medicine Reviews, 2017

11 Hirschkowitz et al. "Sleep and Exercise: A Review of National Sleep Foundation Recommendations and Current Research," Sleep Medicine Reviews, 2013

12 The Effect of Sleep Deprivation on Choice Reaction Time and Anaerobic Power of College Student Athletes," <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3307962/> and "Sleep deprivation: Impact on cognitive performance," <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2656292/>

13 <https://www.sleepfoundation.org/sleep-apnea/alcohol-and-sleep-apnea>

14 <https://pubmed.ncbi.nlm.nih.gov/8078854/> The relationship between cigarette smoking and sleep disturbances, May 1994



ROUTINES

Current Routines & Pain Points

Most consumers take medication for their symptoms, but they try to avoid medication, if at all possible. 96% of the Athletes indicated they used medication for their symptoms, while 70% used natural remedies (e.g., humidifiers, herbal teas, nasal rinse, massage, and hot compresses), and 16% used bioelectronic devices (e.g., for migraine or sinus relief). Their use of massage, hot compresses, and bioelectronic device for sinus was statistically significant versus the Total.

While the vast majority of Athletes use medication, they want to avoid it or have experienced side effects.

- 60% try to avoid medication, if at all possible.
- 40% indicate they cannot tolerate the side effects of medication.

Athletes are keenly focused on their performance.

78% of Athletes agree *"I am willing to try any non-medicine or non-drug that improves my athletic performance"*

Future Outlook

Breathing through your nose is a critical function when exercising, and sleeping. Athletes are always looking for a competitive edge, and there are drug-free solution to relieve their congestion and improve their breathing. Whenever an industry has high unmet needs and pain points, there is room for innovation to better meet consumer needs. Drug-free relief, and solutions that don't adversely affect performance or sleep will be welcomed by the many competitive and recreational athletes.

About Tivic Health

Tivic Health Systems, Inc. is a commercial-stage bioelectronic medicine company focused on treating diseases and conditions by modulating the electrical signals carried along various nerve pathways.

Its first FDA-approved product, ClearUP® Sinus Pain Relief (“ClearUP”), is a patented handheld device that uses ultra-low electrical current to relieve sinus pain and congestion, common symptoms of sinus and nasal inflammation. These symptoms are often associated with nasal allergies, sinus infections, chronic sinusitis, cold and flu, a \$9.9 billion U.S. market currently dominated by pharmaceutical companies. ClearUP, a non-invasive bioelectronic therapy, can safely and comfortably deliver therapeutic benefits with no significant side effects.

ClearUP is a US FDA Class II and EU Class IIa medical device that has received three regulatory clearances: (US FDA 510(k) number K182025, US FDA De Novo number DEN200006 and EU CE Mark Certificate number CE 704687). ClearUP is available on Amazon, Best Buy, Walmart and other major e-commerce websites.

The Tivic Health ClearUP Sinus Pain Relief device is intended to be used for the temporary relief of sinus pain associated with Allergic Rhinitis. ClearUP Sinus Relief device is also intended to be used for the temporary relief of moderate to severe congestion.

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