The Science of the Hum: How Sound, Breath, and Nitric Oxide Connect

An ancient breathing practice meets modern science in the pursuit of cardiovascular health, longevity, and healthy aging.

By Dr. Mike Van Thielen, PhD.

What if one of the simplest ways to support your cardiovascular health, improve circulation, and promote healthy aging requires nothing more than your breath and a gentle hum?

Inside your body, a remarkable molecule called **nitric oxide (NO)** works continuously to keep your blood vessels functioning properly, regulate blood pressure, and support the delivery of oxygen and nutrients to your tissues. Although most people have never heard of it, nitric oxide plays a central role in cardiovascular health and longevity.

As we age, however, our ability to produce and utilize nitric oxide effectively often declines. The consequences can extend far beyond our arteries, influencing circulation, physical performance, and overall vascular health.

The exciting part? Our bodies possess several natural pathways for producing nitric oxide, and breathing practices may help us engage some of them.

Nitric Oxide: The Molecule of Healthy Aging

Nitric oxide is a short-lived gaseous signaling molecule that helps blood vessels relax and widen, a process called *vasodilation*. This allows blood to flow more easily, reduces vascular resistance, and helps regulate blood pressure.

Its functions extend beyond circulation. Nitric oxide participates in immune defense, platelet regulation, cellular communication, and the matching of blood flow to oxygen needs. It also plays a role in exercise performance and sexual function.

One of the hallmarks of cardiovascular aging is **endothelial dysfunction**, a condition in which the inner lining of blood vessels becomes less capable of

producing or responding to nitric oxide. Increased oxidative stress can further reduce NO availability.

When this happens, arteries may become stiffer, blood pressure may rise, and the risk of atherosclerosis and cardiovascular disease increases. Reduced endothelial NO signaling can also contribute to impaired circulation, diminished exercise tolerance, and erectile dysfunction. These effects become particularly important with advancing age, when cardiovascular disease remains a leading cause of illness and mortality.

Nitric oxide is not the only factor governing cardiovascular aging, but preserving its normal signaling is an important component of maintaining vascular health. In fact, the discovery of nitric oxide as a signaling molecule in the cardiovascular system was so significant that it earned the 1998 Nobel Prize in Physiology or Medicine.

Three Important Sites of Nitric Oxide Production

Our bodies produce nitric oxide through several interconnected pathways. Three locations are particularly relevant to cardiovascular health and breathing.

1. The vascular endothelium — our circulatory system. The endothelial cells lining our blood vessels produce nitric oxide primarily through an enzyme called endothelial nitric oxide synthase (eNOS). This NO helps arteries relax, supports healthy circulation, and protects against excessive platelet activation and vascular inflammation. Regular physical activity is one of the best-established ways to support endothelial NO signaling. When endothelial function deteriorates with age, the resulting reduction in NO bioavailability contributes to arterial stiffness, hypertension, and increased cardiovascular risk.

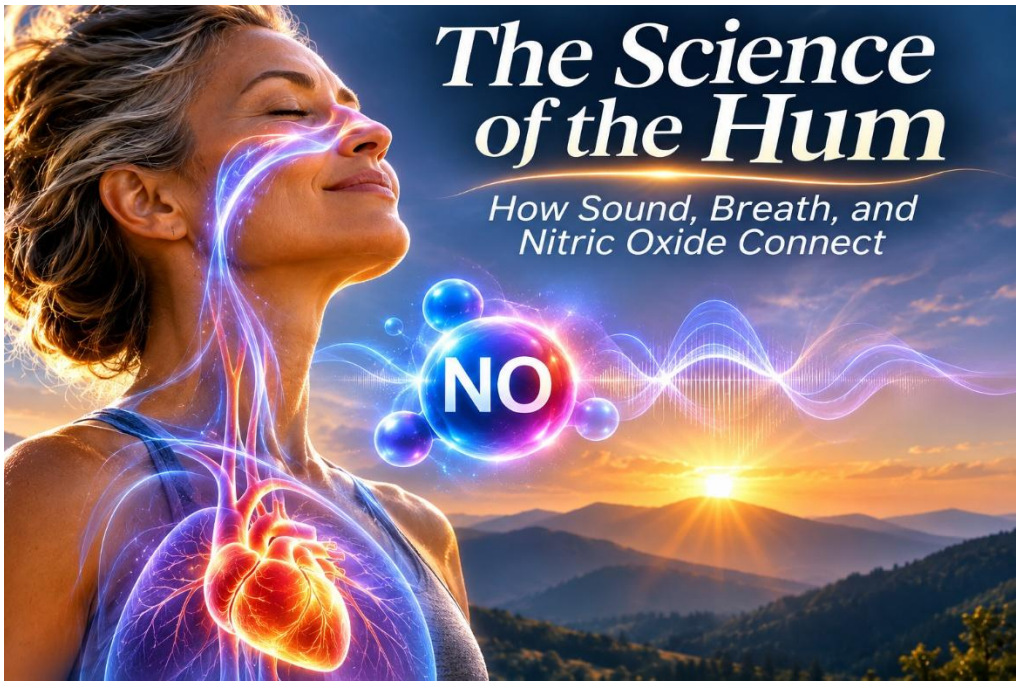
2. The nasal passages and paranasal sinuses — our natural NO reservoirs. The nasal and sinus tissues produce nitric oxide, with the paranasal sinuses serving as an important source of the NO measured in nasal air. During nasal breathing, some of this nitric oxide travels with inhaled air toward the lungs, where it may contribute to local pulmonary physiology. This provides an additional reason to appreciate the biological importance of breathing through the nose rather than exclusively through the mouth.

3. The pulmonary system — where breathing meets circulation. Nitric oxide is also produced within the lungs, including airway and vascular tissues. It participates in regulating pulmonary blood vessel tone and the distribution of blood flow relative to ventilation. In other words, NO helps coordinate the relationship between the air entering our lungs and the blood circulating through them. However, the lungs are not simply a third storage reservoir waiting to receive nasal NO; their nitric oxide biology is more complex.

These three systems illustrate how extensively nitric oxide participates in human physiology. The vascular endothelium produces NO to regulate circulation, the nasal sinuses release NO-rich air during breathing, and the pulmonary system uses NO signaling to help regulate local blood flow. Although these processes are related, they are not one continuous production-and-delivery mechanism.

The Remarkable Science of Humming

Ancient yogic traditions incorporated humming into a breathing practice known as *Bhramari Pranayama*, often called the humming bee breath. Practitioners used this technique to cultivate calmness, concentration, and greater awareness of the breath. They did not know about nitric oxide, endothelial cells, or respiratory biochemistry, yet their observations led to practices that modern researchers are now examining through a scientific lens.



In a landmark study published in the *American Journal of Respiratory and Critical Care Medicine* in 2002, researchers found that humming increased measured nasal nitric oxide approximately **15-fold compared with quiet exhalation**.

Why does something so simple produce such a remarkable effect?

When we hum with our mouths closed, the vibration creates oscillating pressure changes in the nasal cavity and surrounding sinuses. These oscillations enhance gas exchange between the paranasal sinuses and nasal passages, allowing nitric oxide-rich air to move out of the sinuses more efficiently. The result is a substantial increase in the amount of NO measured during exhalation.

Importantly, this does not mean the body suddenly produces 15 times more nitric oxide or that circulating NO levels increase by the same amount. The observed increase primarily reflects enhanced release of NO-rich gas already present within the sinuses. Nevertheless, the finding demonstrates a fascinating relationship between sound, respiratory mechanics, and an important biological signaling molecule.

Humming also naturally encourages prolonged exhalation. Slow, comfortable breathing can influence respiratory sinus arrhythmia, baroreflex activity, and autonomic regulation, potentially contributing to a calmer physiological state. These effects provide an additional reason to explore humming as part of a daily wellness practice.

The Seven-Minute Nitric Oxide Breathing Protocol

Three simple techniques. Seven minutes. One powerful daily habit.

One of the most fascinating aspects of nitric oxide biology is that we can influence certain aspects of its production and release through something as natural as breathing. Ancient yogic traditions developed breathing techniques thousands of years ago, long before scientists discovered nitric oxide or understood its role in cardiovascular health.

The following seven-minute routine combines three traditional techniques: alternate nostril breathing, humming breath, and gentle breath retention. Each interacts with our respiratory physiology in a different way. Together, they provide a simple daily practice designed to encourage nasal breathing, relaxation, and awareness of the connection between breath and body.

For best results, practice in the morning, preferably before breakfast, in a quiet environment. Sit comfortably in a chair with your feet on the floor or cross-legged on a cushion. Keep your spine upright, shoulders relaxed, and jaw unclenched. Breathe gently rather than forcefully. No previous breathwork experience is required.

Step 1: Nadi Shodhana — Alternate Nostril Breathing (3 Minutes)

Purpose: Encourage nasal airflow, establish a slow breathing rhythm, and support nervous system regulation.

Nadi Shodhana is a traditional yogic breathing technique in which we alternate airflow between the left and right nostrils. The nasal passages are closely connected to the paranasal sinuses, which contain nitric oxide-rich air. Although research has not established that alternating nostrils directly increases nitric oxide production, nasal breathing allows naturally occurring nasal NO to accompany inhaled air toward the lungs.

How to practice:

1. Sit upright and relax your shoulders. Bring your right hand toward your nose.
2. Gently close your right nostril with your right thumb.
3. Inhale slowly through your left nostril for **4 seconds**.
4. Close your left nostril with your ring finger, release your thumb, and exhale through your right nostril for **6 seconds**.
5. Keeping the left nostril closed, inhale through the right nostril for **4 seconds**.
6. Close the right nostril, release the left, and exhale through the left nostril for **6 seconds**.
7. Continue this alternating pattern for **3 minutes**, maintaining a comfortable, relaxed rhythm.

One complete cycle takes approximately 20 seconds. You will complete about nine cycles during the three-minute practice.

What happens inside your body?

Slowing your breathing to approximately six breaths per minute can influence respiratory sinus arrhythmia and baroreflex function, two important mechanisms involved in cardiovascular and autonomic regulation. This rhythm may encourage relaxation and improve short-term cardiovascular regulation.

Meanwhile, breathing through the nose allows air to pass through nasal structures where nitric oxide is naturally present. The exact effect of alternate nostril breathing on NO bioavailability remains an area for further research.

What you may notice: A calmer mind, slower breathing, greater awareness of airflow, and a gradual reduction in physical tension.

Step 2: Bhramari — The Humming Breath (2 Minutes)

Purpose: Increase the release of nitric oxide-rich air from the paranasal sinuses through sound-induced vibration.

This is perhaps the most scientifically fascinating part of the protocol.

Bhramari, commonly called the humming bee breath, involves producing a gentle humming sound during exhalation. The vibration travels through the nasal passages and surrounding air spaces, creating oscillating pressure changes that enhance gas exchange between the sinuses and nasal cavities.

In the 2002 study by Weitzberg and Lundberg, researchers demonstrated that humming increased measured nasal nitric oxide approximately **15-fold compared with quiet exhalation**. This dramatic increase is thought to result primarily from improved sinus ventilation and release of stored NO-rich gas rather than a sudden increase in NO synthesis.

How to practice:

1. Relax both hands onto your knees or thighs and gently close your eyes.
2. Inhale slowly and comfortably through your nose for approximately **4 seconds**.
3. Keep your lips closed, teeth slightly separated, and jaw relaxed.
4. As you exhale, produce a soft, continuous humming sound, similar to a gentle "mmmmmm."

5. Allow the humming exhalation to last approximately **6–8 seconds**, without forcing or straining.
6. Notice the vibration around your nose, cheeks, lips, and facial bones.
7. Inhale naturally through your nose and repeat for **2 minutes**.

Aim for approximately 10–12 comfortable humming breaths. The sound does not need to be loud or particularly deep. A gentle, sustained hum is sufficient.

What happens inside your body?

The vibration generated by humming creates rapid oscillations in airflow and pressure that facilitate the exchange of gases between the paranasal sinuses and nasal cavity. As nitric oxide-rich air moves out of the sinuses, measured nasal NO output increases significantly.

Nitric oxide inhaled through the nose may participate in local pulmonary physiology, including regulation of blood vessel tone and ventilation-perfusion matching. However, researchers have not established that the increased nasal NO measured during humming produces a corresponding increase in systemic NO levels or long-term cardiovascular benefits.

Prolonged exhalation may also contribute to relaxation by influencing breathing rhythm and autonomic activity.

What you may notice: Pleasant vibration throughout the face, a feeling of relaxation, greater mental quiet, or improved awareness of your nasal passages. Some people experience a soothing sensation similar to meditation.

Step 3: Kumbhaka — Gentle Breath Retention (2 Minutes)

Purpose: Develop respiratory awareness and comfortable breath control while maintaining a relaxed breathing pattern.

Kumbhaka is the traditional yogic practice of temporarily pausing the breath. In some traditions, breath retention is believed to help conserve and direct vital energy, or *prana*. Modern physiology offers a different explanation: holding the breath temporarily changes oxygen and carbon dioxide levels and influences respiratory and cardiovascular responses.

Some proponents suggest that breath retention drives nitric oxide accumulated in the nasal passages deeper into the lungs. Although intriguing, this specific mechanism has not been demonstrated in clinical studies.

Therefore, breath retention should be viewed as an optional breathing-control exercise rather than a proven method of increasing NO absorption.

How to practice:

1. Remain seated comfortably with your spine upright and shoulders relaxed.
2. Take a slow, natural breath in through your nose for approximately **4 seconds**, without filling your lungs to maximum capacity.
3. At the end of the inhalation, gently pause your breathing for **8–12 seconds**, or less if that is more comfortable. Do not strain, bear down, or tighten your throat.
4. Slowly exhale through your nose for approximately **6 seconds**.
5. Take one or two relaxed, normal breaths before repeating.
6. Continue for **2 minutes**, allowing approximately four to six gentle breath-retention cycles, depending on your natural breathing rhythm.

If you are new to breath retention, begin with just 3–5 seconds. The objective is not to see how long you can hold your breath, but to develop comfort and control without creating stress.

What happens inside your body?

During breath retention, oxygen consumption continues while carbon dioxide gradually accumulates. These changes stimulate respiratory control mechanisms and can affect heart rate and vascular responses. The magnitude of these effects depends on the duration and intensity of the hold.

Short, comfortable pauses may help develop respiratory awareness, but longer or forceful breath holds can produce undesirable cardiovascular responses. There is currently insufficient evidence that this two-minute retention sequence improves nitric oxide bioavailability or slows aging.

What you may notice: greater awareness of your breathing, improved comfort with brief pauses, and a sense of calm when the practice is performed gently.

Breath retention is optional. Anyone with cardiovascular or respiratory disease, uncontrolled blood pressure, a history of fainting, or pregnancy should seek appropriate medical guidance before practicing breath holds. If

you experience dizziness, chest discomfort, or unusual breathlessness, stop immediately and return to normal breathing. Never practice breath retention in water or while driving.

Making Seven Minutes a Daily Habit

The greatest potential benefit of this routine may come from consistency rather than intensity. Choose a comfortable time each morning and practice without distractions. There is no need to breathe harder, hum louder, or hold your breath longer to make the practice more effective.

During the first week, simply pay attention to how you feel before and after exercise. Notice your breathing rhythm, mental clarity, stress level, and general sense of relaxation. If you use a wearable device, you may also observe changes in resting heart rate or heart rate variability over time, remembering that HRV is influenced by many factors and does not directly measure nitric oxide production.

The three techniques are complementary, but the complete sequence has not been clinically validated as a nitric oxide-enhancing or anti-aging treatment. The strongest direct NO evidence relates to humming, while slow breathing has a separate body of research supporting certain autonomic and cardiovascular effects.

The Bigger Picture: Breath, Longevity, and Human Potential

Healthy aging is not simply about adding years to our lives but preserving the physiological capacity to enjoy those years. Nitric oxide is one important piece of that puzzle. Its availability influences vascular flexibility, circulation, and cardiovascular resilience, all of which become increasingly important as we grow older.

Maintaining healthy nitric oxide signaling involves more than breathing exercises. Regular physical activity, especially aerobic exercise, helps stimulate endothelial NO production through increased blood flow and vascular shear stress. Vegetables rich in dietary nitrates, such as beets, arugula, and spinach, can support an additional nitrate–nitrite–NO pathway. Adequate sleep, metabolic health, and the management of blood pressure and other cardiovascular risk factors also contribute to preserving endothelial function.

Conscious breathing offers a complementary opportunity to engage with our physiology. Slow nasal breathing may help regulate autonomic activity, while



The Science of the Hum

How Sound, Breath, and Nitric Oxide Connect

A 7-Minute Breathing Protocol to Support Nitric Oxide, Circulation, and Healthy Aging

Nitric Oxide (NO): A Key Molecule for Vascular Health & Longevity

- Relaxes and widens blood vessels (vasodilation)
- Helps regulate blood pressure
- Improves blood flow and oxygen delivery
- Supports endothelial health and healthy aging

The Aging Challenge

NO production naturally declines with age—

- ↓ ~30% by age 40
- ↓ ~50% by age 60

Lower NO is linked to:

- Stiffer arteries
- Higher blood pressure
- Greater cardiovascular risk
- Reduced circulation and vitality

Three Key Sites of NO Production



Nasal sinuses
Generate nitric oxide, serving as a natural reservoir for NO-rich air.



Vascular endothelium
Produces NO (via eNOS) to relax arteries and support healthy circulation.



Pulmonary system
Also makes NO, which helps regulate lung blood flow and match breathing with circulation.

The 7-Minute Nitric Oxide Breathing Protocol

Three simple techniques. Three complementary effects. Seven minutes a day.

Step 1: Nadi Shodhana (Alternate Nostril Breathing) — 3 Minutes

Purpose: Establish a slow, balanced breath, encourage nasal airflow, and support relaxation.

How to do it:

1. Close right nostril with thumb.
2. Inhale left for 4 seconds.
3. Close left, exhale right for 6 seconds.
4. Inhale right for 4 seconds.
5. Close right, exhale left for 6 seconds.
6. Continue for 3 minutes (about 9 cycles).

Step 2: Bhramari (The Humming Breath) — 2 Minutes



Purpose: Increase the release of nitric oxide–rich air from the paranasal sinuses through gentle vibration.

How to do it:

1. Inhale through your nose for ~4 seconds.
2. Keep lips closed and hum "mmmm" as you exhale for 6–8 seconds.
3. Feel the gentle vibration in your face and sinuses.
4. Repeat for 2 minutes (about 10–12 breaths).

Step 3: Kumbhaka (Gentle Breath Retention) — 2 Minutes



Purpose: Cultivate breath control and extend the effects of the previous steps.

How to do it:

1. Inhale through your nose for ~4 seconds.
2. Gently hold your breath for 8–12 seconds (no straining).
3. Exhale slowly for ~6 seconds.
4. Take 1–2 normal breaths, then repeat.
5. Continue for 2 minutes (about 4–6 cycles).

Potential Benefits with Consistent Practice

- Supports healthy blood pressure
- Improves circulation and vascular function
- Promotes deeper, more restorative sleep
- Enhances mental clarity and focus
- May ease joint stiffness and support mobility
- Supports healthier, more resilient skin

humming produces a measurable and remarkably large increase in nasal nitric oxide output. Although the long-term cardiovascular effects of this specific breathing routine remain to be established, these findings provide a compelling scientific foundation for continued investigation.

Perhaps the most remarkable lesson is that something as simple as humming can measurably change the chemistry of the air moving through our nasal passages. Ancient practices and modern science meet here—not because every traditional claim has been proven, but because curiosity about breath continues to reveal extraordinary connections between sound and biology.

Seven minutes may not reverse biological aging, but they offer an accessible opportunity to practice respiratory control, explore the remarkable science of nasal nitric oxide, and develop a daily habit of conscious breathing.

Sometimes, improving our health begins not with doing more, but with slowing down, breathing through the nose, and allowing ourselves to hum.

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Scientific note: The evidence supports humming-induced increases in measured nasal nitric oxide output, the physiological importance of NO in cardiovascular health, and certain autonomic effects of slow breathing. Long-term anti-aging benefits from this exact seven-minute protocol have not yet been established.