Four Things You Should Know About Breathing

When one is firmly established in conservation of energy/prana, vitality is obtained.
– Patanjali's Yoga Sutra 2:38

As much as possible, breathing should be:

1 - Light (biochemical) - Only breathing the optimal amount of air needed
2 - Slow (cadence) - Slow respiratory rate
3 - Deep (biomechanical) - Into the low lungs with efficient use of diaphragm muscle
4 - Nasal - In and out through the nose

Light: In breathing light, we refer to breathing that provides optimal gas exchange in the lungs, improves oxygen delivery to the cells, and reduces sensitivity to carbon dioxide. We don't want to take in more air than necessary. Carbon dioxide is not just a waste gas; it is the catalyst for oxygen uptake from the bloodstream into cells from its carrier, hemoglobin. If we take in excessive oxygen via over-breathing, our blood CO2 levels drop, tightening the bond between oxygen and hemoglobin. Most people at any given time have fully oxygenated blood but do not get that oxygen efficiently delivered into cells. Bigger breathing does not help with this. It appears counterintuitive, but that is the biochemistry - more oxygen breathed in does not lead to more oxygen getting from the bloodstream into our cells where we need it. (This phenomenon, discovered by a Danish Scientist named Christain Bohr in 1904, is called the Bohr Effect). Maintaining the right balance of oxygen and carbon dioxide in the blood is essential. Low carbon dioxide in the blood also reduces oxygen delivery to the brain, leading to anxiety, brain fog, lack of concentration, and memory loss[1]. Increasing tolerance to carbon dioxide allows us to breathe less, which calms the nervous system and stimulates the vagus nerve[2].

Slow: Breathing more slowly refers to decreasing the number of breaths we take in a minute. For the most part, slower is better. Many studies show breathing at around six breaths per minute provides tremendous benefits. These include providing optimal oxygen uptake into the blood, reducing inflammation, stimulating blood pressure receptors, increasing air reaching the alveoli, and improving heart rate variability (HRV). Breathing at this rate does take practice and time. Even purposeful breathing as a practice at six (a study looking

[1] Santiago, T.V. & Edelman, N.H. (1986) Brain Blood Flow and Control of Breathing. In A.P. Fishman (ed.) Handbook of Physiology, vol. 3 part 1, The Respiratory System. Bethesda, MA: American Physiological Society. pp. 163-179
[2] Singh UP (2017) Evidence-Based Role of Hypercapnia and Exhalation Phase in Vagus Nerve Stimulation: Insights into Hypercapnic Yoga Breathing Exercises. *J Yoga Phys Ther* 7: 276

specifically at HRV, used 5.5 breaths per minute[3]) breaths per minute throughout the day provides excellent benefits. Interestingly, many yoga mantras (ex. Om Mani Padme Hum) and even the rosary prayer reduce respiration rate to about six breaths per minute[4].

Deep: Do not confuse a 'big' breath with a 'deep' breath. Often we hear the cue to take a big breath in a yoga or exercise class. While this is well-meaning, it can be counterproductive. When we are instructed to take a big breath, we may inadvertently tense and heave up the shoulders, over-engage chest and neck muscles, and potentially breathe in through the mouth. High, upper chest breathing aggravates the nervous system and results in lower amplitude of the diaphragm. This type of breathing will likely not bring more oxygen out of the bloodstream but result in too much air intake, leading to a biochemical imbalance in carbon dioxide and oxygen levels (as noted above). A proper deep breath is gentle and quiet into the lower ribs with effective diaphragm use. It is also in the lower lungs where the highest blood flow and gas exchange occurs. Upper chest breathing is less efficient than breathing deeply into the lower lungs.

Why nasal breathing? The nose is built for breathing. When we breathe through the nose, the air gets purified, warmed up, and slowed down in the nasal passages before moving into the lungs. If we take air into the lungs more slowly, we get better oxygen uptake into the blood. Nasal breathing helps ensure that we are not breathing out more air than necessary, creating more efficiency in breathing. It also helps to ensure that carbon dioxide is processed efficiently and that blood pH remains balanced.

Nasal breathing helps build up gas in the nostrils called Nitric Oxide. Nitric Oxide is a potent antiviral, antibacterial, and anti-inflammatory gas. It also has vasodilatory properties that improve the opening of blood vessels in the lungs to relax, allowing for more substantial blood flow and better oxygen uptake [5]. In yoga class, we sometimes encourage students to inhale through the nose, exhale, and sigh out the mouth. While exhaling out the mouth 3-5 times is fine and can feel relaxing (and if vibrational can stimulate the vagus nerve), we want to promote nasal breathing most of the time. A significant amount of water and heat loss - up to 42% - occurs when exhaling through the mouth, which can ultimately cause dehydration, nasal stuffiness, and inflammation[6].

**Information and reference details noted come from *Restoring Prana* by Robin Rothenberg, C-IAYT, and *The Breathing Cure* by Patrick McKeown.

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[3] Lin, I.M., L. Y. Tai, and Sheng-Yu Fan. “Breathing at a rate of 5.5 breaths per minute with equal inhalation-to-exhalation ratio increases heart rate variability.” International Journal of Psychophysiology 91, no. 3 (2014): 206-211

[4] Bernardi, Luciano, Peter Sleight, Gabriele Bandinelli, Simone Cencetti, Lamberto Fatorini, Johanna Wdowczyc-Szulc, and Alfonso Lagi. “Effect of rosary prayer and yoga mantras on autonomic cardiovascular rhythms: comparative study.” Bmj 323, no. 7327 (2001): 1446-1449

[5] Antosova, M., D. Mokra, L. Pepucha, J. Plevkova, T. Buday, M. Sterusky, and A. Bencova. “Physiology of nitric oxide in the respiratory system.” Physiological research 66 (2017).

[6] Svensson, Sophie, Anna Carin Olin, and Johan Hellgren. “Increased net water loss by oral compared to nasal expiration in healthy subjects.” *Rhinology* 44, no. 1 (2006): 74.