

Physiology of Long Pranayamic Breathing: Neural Respiratory Elements may Provide a Mechanism that Explains How Slow Deep Breathing Shifts the Autonomic Nervous System

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Introduction

Pranayama is a breathing technique that has been shown to be beneficial in treating many disorders such as hypertension, asthma, autonomic nervous system imbalances, stress-related disorders, post traumatic stress disorder, depression, and can decrease symptoms of irritable bowel syndrome (along with yogic techniques) by enhancing parasympathetic activity of the GI tract and reducing the effects of stress [1-10].

Lesson 1: *Pranayamic* breathing can activate the autonomic nervous system through oxygen consumption, metabolism, and skin resistance, and the focus on slow deep breathing has been shown to improve autonomic nervous system functioning through enhanced activation of the parasympathetic nervous system [11-13].

Lesson 2: In the brain, *Pranayama* increases theta waves during breath holding, and delta waves are elicited by decreased breathing frequency indicating parasympathetic dominance [14,15]. *Pranayama* increases melatonin production creating an experience of relaxation and well-being and has been shown to increase neural plasticity and alter information processing [3,9,16].

Conclusion

Our paper not only presents evidence showing how *Pranayama* works, but also presents a hypothesis as to why *Pranayama* works. We suggest this breathing technique induces inhibition through impulses generated by slowly adapting stretch receptors (SARS), which are derived from the central nervous system during embryonic development [17-21]. The inhibitory impulses and the hyperpolarization current shift the autonomic balance toward parasympathetic dominance through initiation of synchronization between the lungs and the central nervous system, along with synchronization of neural elements in the peripheral nervous system, and surrounding non-neural tissues [8,9,22-24].

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Received June 20, 2016; Accepted July 05, 2016; Published July 12, 2016

Citation: Jerath R (2016) Physiology of Long Pranayamic Breathing: Neural Respiratory Elements may Provide a Mechanism that Explains How Slow Deep Breathing Shifts the Autonomic Nervous System. *J Yoga Phys Ther* 6: 252. doi:10.4172/2157-7595.1000252

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