

Sistema

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THE HEART AS A COMPLEX ADAPTIVE SYSTEM AND THE IMPLICATIONS FOR RESPIRATORY INTERVENTIONS: DOES OUR HEART LIKE DEEP BREATHING? . ¹ Perakakis, P. **; ² Taylor, M. ; ³ Muñoz, M.A. **; ⁴ Vila, J. ; ^{1, 3, 4} Psicologia, Universidad de Granada; ² FÍSICA E MATEMÁTICA, Universidad Autónoma de Madrid, Espanha; .

Objetivo:

Current research indicates that the heart is a complex adaptive system whose dynamics are driven by nonlinearly coupled oscillators. Respiration is one of those oscillators contributing to heart rate fluctuations through central (respiratory sinus arrhythmia) and peripheral (arterial CO₂ concentrations) mechanisms. In this study we tested the effects of a shallow breathing pattern known as the Buteyko Breathing Method (BBM) on heart rate dynamics. The BBM is a respiratory training that since 1985 has been the standard treatment for asthma and many of the other hyperventilation related disorders in Russia. Its theoretical premises, however, have not been sufficiently investigated by western scientists.

Métodos e Resultados:

We conducted an experiment where thirty-five university students (7 male) underwent a physiological monitoring of respiratory parameters, end-tidal CO₂ (Pet CO₂) and continuous electrocardiogram during two breathing conditions: normal and shallow breathing. Compared to normal breathing (mean PetCO₂=38.09mmHg), the BBM was shown to significantly increase PetCO₂ levels (mean PetCO₂=40.75mmHg) and also increase the long term correlations in the heart rate signal, as measured by the detrended fluctuation analysis ($a(\text{normal})=0.81$; $a(\text{BBM})=0.88$). In addition, the results from the spectral analysis revealed that during shallow breathing heart rate fluctuations follow a power law distribution, the hallmark of scale-invariant systems self-organized in a critical state of optimal adaptability. Finally, our results suggest a dissociation between linear and nonlinear indices of heart rate variability (HRV), especially in deep breathing conditions where the phasic changes in respiration generate a major gating influence on cardiac dynamics.

Conclusões:

In the light of these findings, new questions arise concerning (a) the clinical utility of relaxation techniques based on deep breathing exercises and (b) the positive correlation frequently reported in the literature between linear indices of HRV (RMSSD and HF HRV) and indices of physical and mental health.

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