

HRV-BIOFEEDBACK: the effects of session count on psychophysiological functioning – preliminary results



Ratajczak E.^{1,2}, Szczęsny P.³, Fojutowska J.³, Dreszer-Drogorób J.^{2,3}, Duch W.^{1,2}



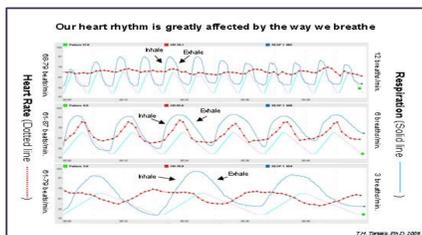
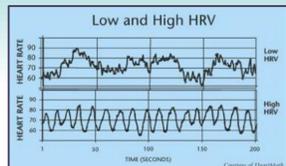
1 - Department of Physics, Astronomy and Applied Informatics, Nicolaus Copernicus University, Toruń, Poland

2 - Centre for Modern Interdisciplinary Technologies, Nicolaus Copernicus University, Toruń, Poland

3 – Faculty of Humanities, Nicolaus Copernicus University, Toruń, Poland

Introduction

- **Biofeedback:** control of unconscious physiology with the help of biosensors and computers
- **Heart rate variability (HRV):** beat-to-beat variations in heart rate¹
- A measure of **neurocardiac function** that reflects sympathovagal balance, psychological resiliency and behavioral flexibility¹
- **High HRV** associated with
 - ✓ good physical and psychological health,
 - ✓ well-being and
 - ✓ improved performance¹
- **HRV-biofeedback:** paced breathing at ~ 0.1 Hz creates resonance (coherence) between heart rate fluctuations resulting from:



- ✓ baroreflex (BRX) and
- ✓ respiratory sinus arrhythmia (RSA)²

Aim of the Study/Hypothesis

- Experimentally establish an efficient HRV-BFB training protocol.
- 20 HRV-BFB sessions (in 4 weeks) should provide additional increase in HRV above 10 sessions (in 2 weeks).

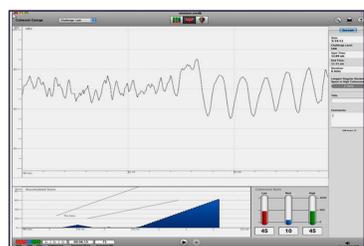
HRV-BFB Methodology

1. Participants:

- Experimental group: 18 (13 completed, 15 female), age M = 20,4, SD = 2,1
- Control group: 9 (8 completed, 4 female), age M = 23.20, SD = 2,5)

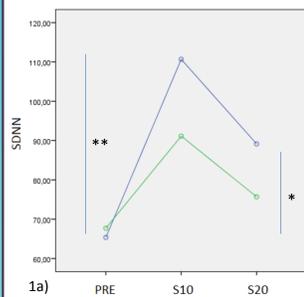
2. HRV-BFB training protocol:

- Slow breathing at individual resonant frequency: av. 6 breaths/min (0.1 Hz)
- Abdominal (diaphragmatic) breathing, inhalation through the nose, prolonged pursed-lips exhalation²
- 20-min sessions with emWave® (Institute of HeartMath)
- 2 blocks of 10 sessions
- Each block completed within 2 weeks
- Positive emotions facilitate coherence¹



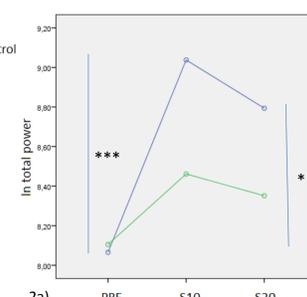
Results

1. Linear indices: time-domain



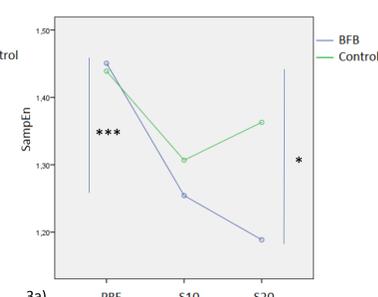
1a)

2. Linear indices: frequency-domain

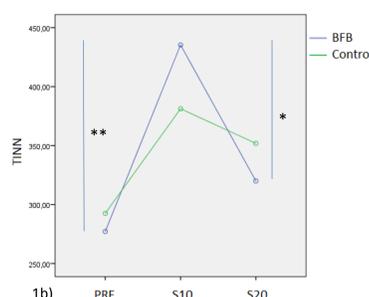


2a)

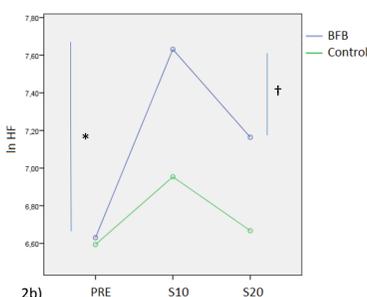
3. Non-linear indices



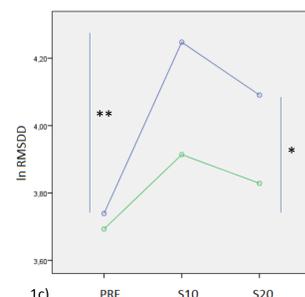
3a)



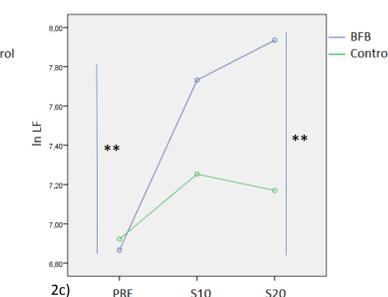
1b)



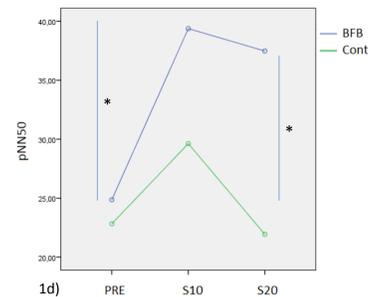
2b)



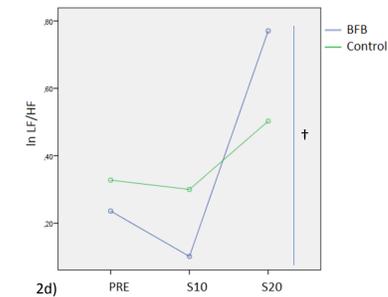
1c)



2c)



1d)



2d)

Fig. Difference in HRV indices following HRV-BFB (blue) and control condition (green) measured at pretest baseline (PRE), after 10 sessions (S10) and 20 sessions (S20). T-test analysis, skewed data ln transformed.

Conclusions

- HRV-biofeedback training successfully alters HRV
- Change of most parameters was observed already after 10 sessions (2 weeks)
- Additional 10 sessions (2 weeks) of the intervention improvement parameters related to the BRX, while other values slightly dropped, however, remained still significantly elevated from baseline (except for TINN).

Acknowledgements

I would like to thank dr hab. Jerzy Łukaszewicz, prof. UMK, director of CMIT, NCU for enabling the execution of this project. Many thanks to all the Students who took part in data acquisition and analysis.

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ECG Signal

1. Signal acquisition: EQ02 LifeMonitor Sensor Electronics Module (Equivital Inc.)

- ✓ sampling 200 Hz

1. Signal analysis: Kubios HRV (University of Eastern Finland)

- ✓ **linear methods:** time-domain (SDNN, RMSDD, pNNS50, TINN) and frequency-domain (FFT power spectrum standard frequency bands: VLF, LF and HF; LF/HF; total power)
- ✓ **non-linear methods** (SampEn)

Literature

1. McCraty, R., Ph, D., Atkinson, M., Tomasino, D., & Bradley, R. T. (2009). The Coherent Heart – Brain Interactions, Psychophysiological Coherence, and the Emergence of System-Wide Order, 5(2).
2. Lehrer, P. M., Vaschillo, E., & Vaschillo, B. (2000). Resonant frequency biofeedback training to increase cardiac variability: rationale and manual for training. Applied Psychophysiology and Biofeedback, 25(3), 177–91.