RISE RESEARCH INNOVATION SCHOLARSHIP ENTREPRENEURSHIP

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Mentor Name: Lauren B. Raine
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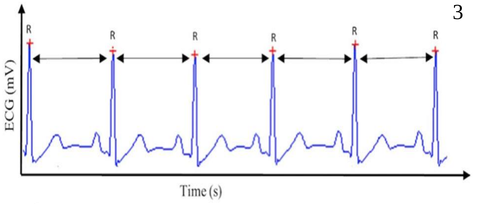
Exploring the Relationship Between Heart Rate Variability, Sleep, Fitness, and BMI

Suhani Rathi, Bianca Braun; Lauren B. Raine
Center for Cognitive & Brain Health, Northeastern University, Boston, MA, USA

Purpose

- Heart Rate Variability (HRV) has recently gained interest as an indicator of autonomic nervous system function & HRV has been linked to cardiovascular health[1]
- However, the relationship of HRV with sleep, fitness, and BMI remains unclear, which this analysis aims to investigate in young adults
- When sympathetic nervous system (fight-or-flight response) is activated, HRV is lowered[2], whereas HRV increases when the parasympathetic nervous system (rest-and-digest response) is activated, indicating recovery[2]

Measures



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Heart Rate Variability

- Measured using Garmin HR monitor & Elite HRV app for 1 minute
- Analyzed using Kubios HRV Scientific Software
- Calculated by finding the root mean square of successive differences[3]

Sleep

- Sleep Duration and Sleep Quality were measured via questionnaire
  - During the past month, how many hours of actual sleep did you get at night?
  - Over the past month, how would you rate your sleep quality overall?

Fitness

- VO_2 Max test to measure maximal oxygen consumption

Body Mass Index

- Calculated using height and weight

Results

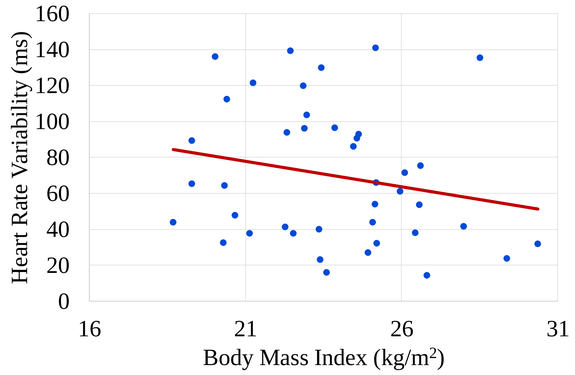

Figure 1. HRV x BMI
(r = -.186, p = 0.257)

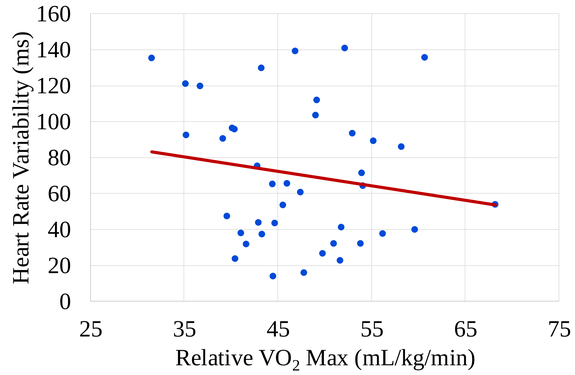

Figure 2. HRV x Relative VO_2 Max
(r = -0.110, p = 0.505)

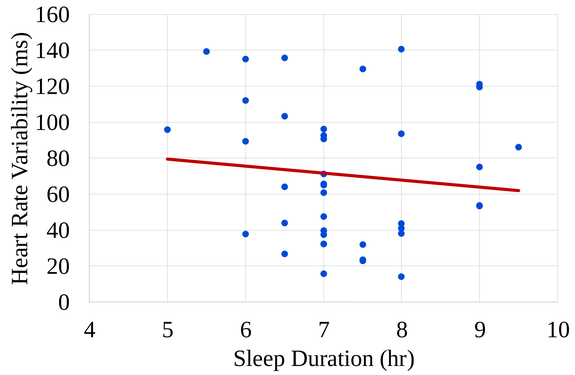

Figure 3. HRV x Sleep Duration
(r = -.128, p = 0.438)

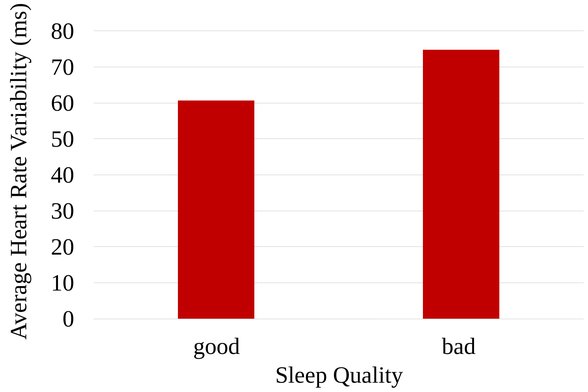

Figure 4. Independent Samples t-test of Average HRV by Sleep Quality
(t(36) = -1.125, p = 0.268)

Demographics

Variables	Mean (SD)
n	41
Age, years	20.63 (1.98)
Sex, Female (%)	20 (48.78%)
Race, Non-White (%)	16 (39.02%)
Mother's Education (≥ advanced degree)	23 (56.10%)
BMI class (≥ overweight)	16 (39.02%)
Average VO2 percentile	62.45%

Conclusions

- Preliminary results show no significant correlation between HRV, sleep, aerobic fitness (VO_2 max), or BMI ($p > 0.05$)
- Findings suggest that HRV may not be directly influenced by these factors in this healthy, young, well-educated population; other physiological or behavioral variables (e.g, stress, genetics, lifestyle) may play a more significant role in HRV regulation
- Future research should consider larger sample sizes and longitudinal studies to further analyze potential determinants of HRV. Identifying additional biomarkers could also improve our understanding of HRV and its relationship to overall health

References

1. Yugar, L. B. T., et al. (2023). The role of Heart Rate Variability (HRV) in different hypertensive syndromes. *Diagnostics*, *13*(4).
2. Tiwari R, et al. (2021). Analysis of Heart Rate Variability and Implication of Different Factors on Heart Rate Variability. *Curr Cardiol Rev.*17(5).
3. Laborde S, et al. (2017). Heart rate variability and cardiac vagal tone in psychophysiological research -- recommendations for experiment planning, data analysis, and data reporting. *Front Psychol*, *8*(213).

Lab Website