

# Heart Rate Variability As Psychophysiological Stress Indicator In Mexican College Volleyball Players

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## ABSTRACT:

**PURPOSE:** To compare the response of Heart Rate Variability (HRV) during induced stress as psychophysiological stress indicator in Mexican college volleyball players.

**METHODS:** 16 male college volleyball players (18 to 26 yrs) were evaluated. Psychophysiological assessment of stress consisted of 7 stages lasting 2 min each (baseline, exposed to physiological stressor (unpleasant sounds), 1st rest, exposed to cognitive stressor (mathematical task), 2nd rest, exposed to stressor emotional (talk about a stressful memory) and 3rd rest) and was done by a ProComp™ Infiniti Biofeedback System. Short-term HRV was obtained by a Blood Volume Pulse (BVP) Sensor and analyzed using time-domain: SDRR (standard deviation of RR intervals) and pNN50 (percentage of successive RR intervals that differ by more than 50 ms); and frequency-domain: HRV peak frequency, Very Low Frequency (VLF) total power, Low Frequency (LF) total power, High Frequency (HF) total power, VLF % power, LF % power and HF % power measurements. A statistical analysis was made by repeated measures ANOVA and Non-parametric statistical Friedman test.

**RESULTS:** Significant differences in HRV were found when compared the 7 stages of the assessment (with stress stimulus and without stress stimulus). During the COGNITIVE stage there was a difference with the BASE LINE ( $p = .01$ ) and PHYSIOLOGICAL ( $p = .004$ ) stage in HRV peak frequency; in VLF% between PHYSIOLOGICAL and 1st REST ( $p = .01$ ) stage; among the BASE LINE and the EMOTIONAL ( $p = .04$ ) stage on SDRR; and with pNN50 on COGNITIVE and 3rd REST ( $p = .02$ ) stage.

**CONCLUSIONS:** The results show significant changes in the variables associated with sympathetic activity in stages that had stressors compared to baseline and rests, which may indicate psychophysiological response to stress. These results support the idea of HRV is a useful psychophysiological stress indicator and may be a helpful tool to identify and have better stress management in Mexican college athletes.

# INTRODUCTION

Athletes are often exposed to numerous stressors in both training and competition environments (1); and the demands increase even more being a student (2).

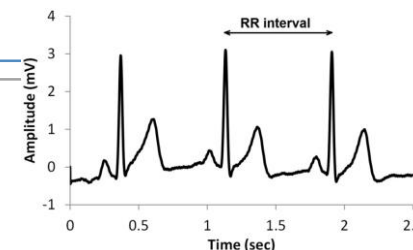
Stress was defined like “a relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being” (3), which results in physiological, cognitive and behavioral responses.

The main stress-activated pathways are the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal axis, which cause the fight-flight response (4,5,6).

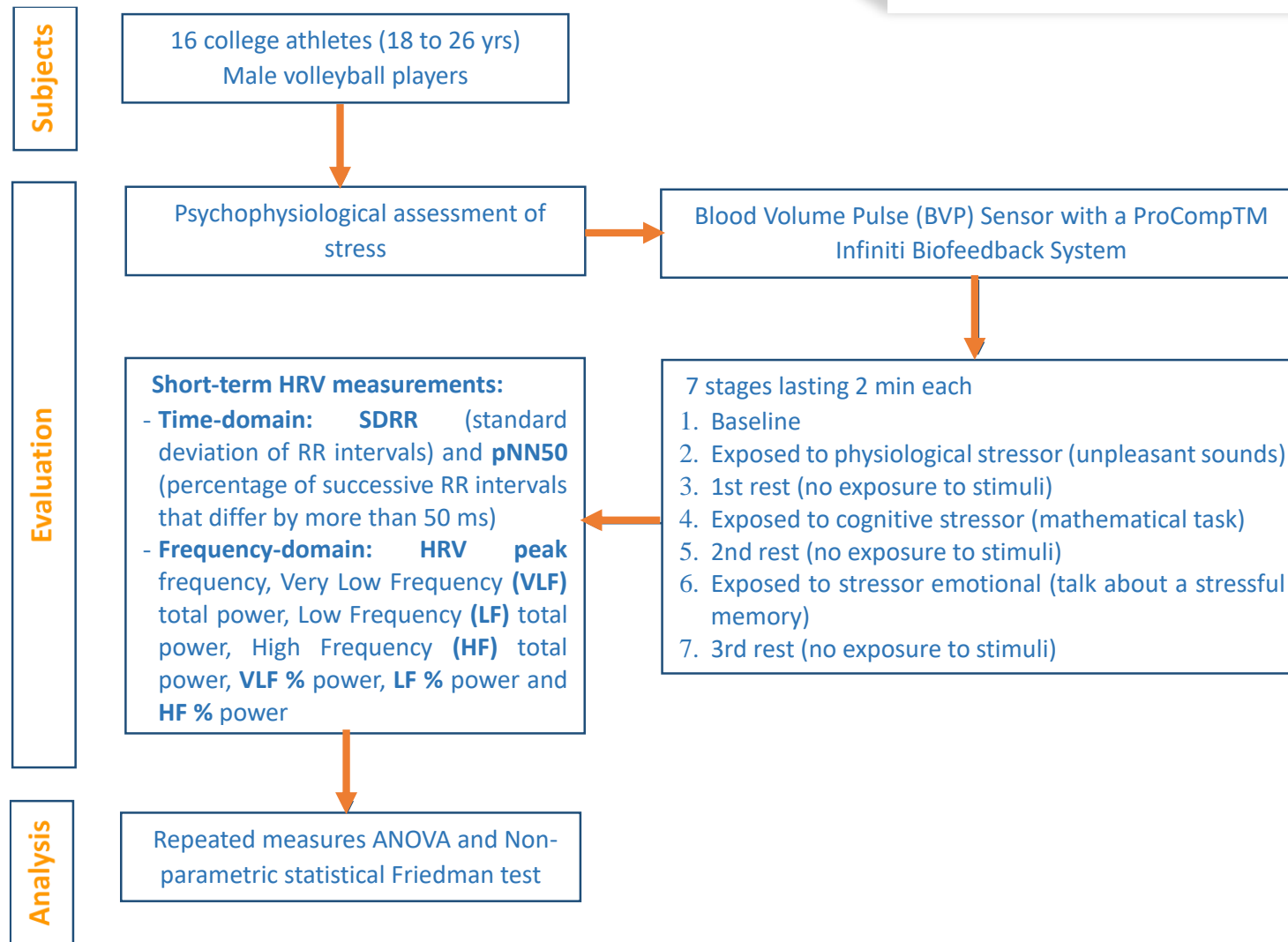
One noninvasive tool to monitor SNS activity is through heart rate variability (HRV). HRV is the fluctuation in the time intervals between heartbeats <RR intervals> (7).

HRV has been considered as a potential marker of stress (8).

The aim of this study is to compare the response of HRV during induced stress as psychophysiological stress indicator.



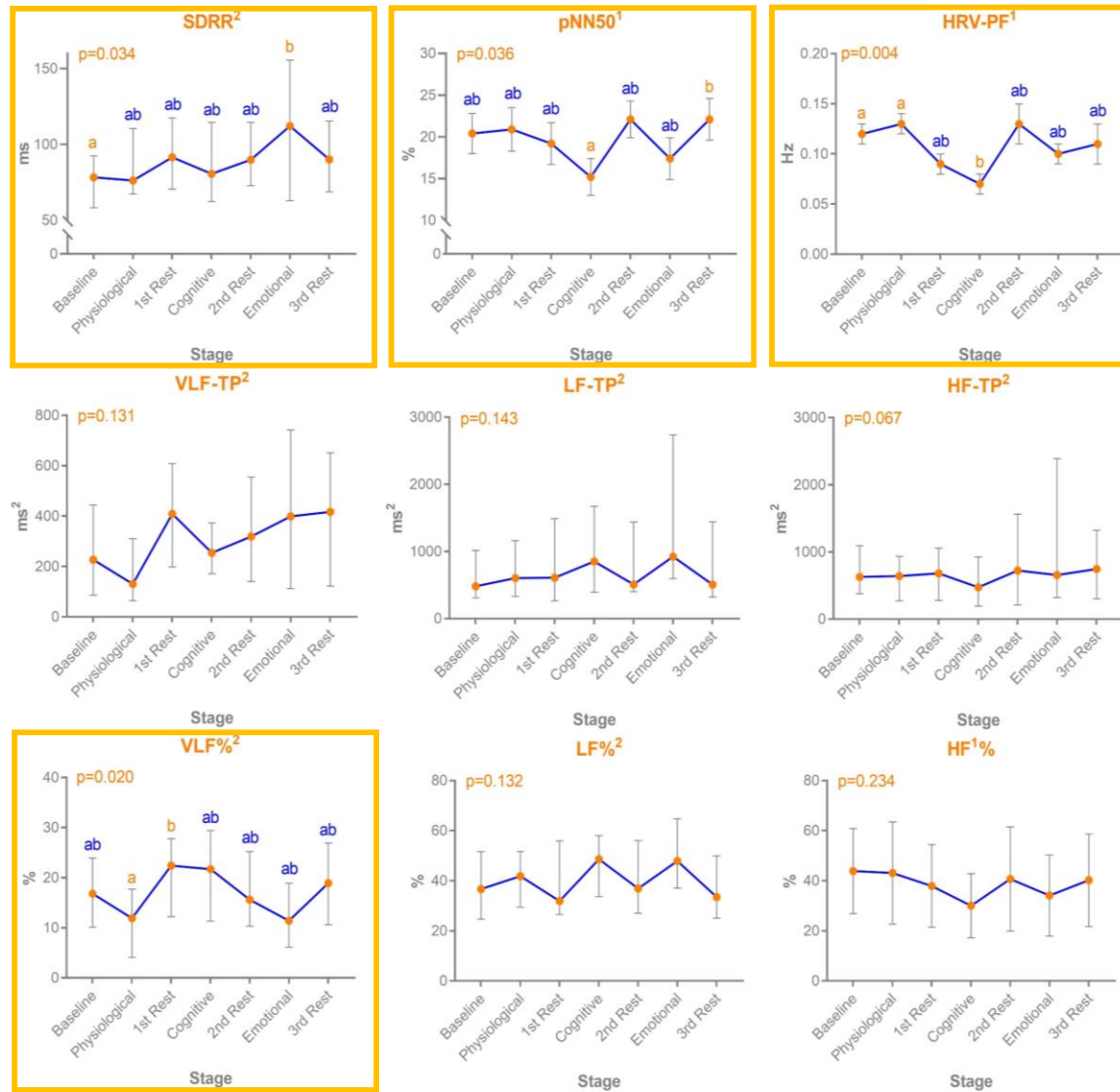
# METHODS



# RESULTS



**Figure 1.** Heart Rate Variability indicators comparison between each stage.



<sup>1</sup> Non-normal distribution is expressed with Median (P25 - P75).

<sup>2</sup> Normal distribution is expressed with Mean (SD)  
Different letters denote significant differences between the indicator of HRV during each stage ( $p < 0.05$ ).

**SDRR** standard deviation of RR intervals. **pNN50** percentage of successive RR intervals that differ by more than 50 ms. **HRV-PF** Heart Rate Variability peak frequency. **VLF-TP** Very Low Frequency total power. **LF-TP** Low Frequency total power. **HF-TP** High Frequency total power. **VLF %** Very Low Frequency power. **LF %** Low Frequency power. **HF %** High Frequency power.

# CONCLUSIONS

- Our results show some significant changes in both, time-domain and frequency-domain, measurements between stages with and without stress stimuli. These changes are related with higher SNS activity, which may indicate psychophysiological response to stress.
- These findings support the idea of HRV is a useful marker of stress. Besides, HRV might be a more practical tool to identify stress, compared with salivary cortisol measures, that currently is a stress biomarker widely studied and applied in sports environments (9,10).
- With awareness and training, college athletes could have a better stress management. This could mean a way to improve sports performance and well-being in athletes.
- We recommend continuing with this research line, expanding the sample and the evaluation variables (e.g. a comparison with cortisol measures).

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