

## The Relationship Between Heart Rate Variability and Skeletal Muscle Damage in Female Collegiate Athletes

BRETT CROSSLAND, MATTHEW SOKOLOSKI, and B. RHETT RIGBY

Exercise Physiology Laboratory; Kinesiology; Texas Woman's University; Denton, TX

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*Advisor / Mentor: Rigby, Rhett (brigby@twu.edu)*

### ABSTRACT

Heart rate variability (HRV) is an accurate indicator of sympathetic and parasympathetic nervous system activity. With athletes, HRV analysis can be a useful tool in analyzing the readiness to train, recovery status, and chronic adaptations to training, and overtraining. Skeletal muscle damage, which can be an outcome of overtraining, may be assessed using biomarkers in the blood, including creatine kinase (CK). The relationship between skeletal muscle damage and measures of HRV with regards to performance is not known. **PURPOSE:** The purpose of this study was to determine the relationships between HRV measures and serum CK concentrations. A secondary purpose of this study was to determine what lifestyle factors, other than physical activity levels, may affect HRV measures and serum CK concentrations in the same population. **METHODS:** Six Female NCAA Division II Volleyball athletes completed the 14-day study. Participants recorded HRV with the use of the Cardiomood smartphone application daily, upon waking, throughout the study. Time domain (i.e., RMSSD) and frequency domain (i.e., low, high, total power) variables were recorded to characterize HRV. Blood samples were collected in an unfasted state at 7 time points throughout the study and analyzed for total CK level (U/L). In addition, a wellness questionnaire completed daily included questions pertaining to fatigue (F), mood (M), stress (ST), soreness (MS), sleep duration (S), sleep quality (SQ), and hydration (H). During structured practice and workout sessions, energy expenditure (EE) was measured using a chest worn monitor. A Pearson product-moment correlation was performed to investigate the relationships among variables with significance set at 0.05. **RESULTS:** Total CK levels were found to have a significant negative relationship with RMSSD ( $p = 0.035$ ), and a positive relationship with EE ( $p < 0.01$ ) and MS ( $p < 0.01$ ). A significant negative relationship with RMSD and SQ ( $p = 0.01$ ), and a significant positive relationship with RMSSD and M ( $p = 0.008$ ) was also found. Within the wellness questionnaire, MS and H had a significant negative relationship ( $p = 0.021$ ) and M had a significant positive relationship with S ( $p = 0.038$ ). **CONCLUSION:** The use of HRV may serve as an accurate monitor of total circulating CK levels in the blood. With regards to the wellness questionnaire, it was found that sleep quality had the largest influence on HRV, reinforcing the importance of sleep and recovery. These results could prove beneficial for coaches in assessing an athlete's readiness to train and recovery status.