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Applied Research on Heart Rate Variability in Monitoring Sports Fatigue of Boxing Athletes

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Objective Based on the diagnosis of sports fatigue using physiological and biochemical indicators, to detect the changes of heart rate variability (HRV) index before and after heavy load training in boxing athletes, and observe the effect of heavy load training on cardiac autonomic nerves. The purpose of this study was to investigate the application of HRV to monitor boxing athletes' sports fatigue.
Methods 16 athletes from Shanghai men's boxing team were recruited. The coach organized a 4-week heavy load training, on Monday morning before and after heavy load training, to evaluate whether athletes have exercise fatigue by testing white blood cell (WBC), red blood cell (RBC), hemoglobin (Hb), blood testosterone (T), cortisol (C), testosterone/cortisol ratio (T/C), creatine kinase (CK), blood urea (BU) and morning pulse. Heart rate variability (HRV) indicators were detected simultaneously. The data were analyzed by SPSS 19.0 statistical software. Pearson correlation analysis was used to compare the correlation between HRV and physiological and biochemical indexes. The paired sample T test was used to compare the differences between the indicators, $P<0.05$, $P<0.01$ was statistically significant.
Results After heavy load training, when compared with indexes before heavy load training, T and T/C ratios decreased significantly (-38%, -52.7%, $p<0.01$), C and morning pulse increased significantly (+32.4%, +20.4%, $p<0.05$), BU and CK had an increasing trend but no statistical significance (+16.5%, +52.7%, $p>0.05$), while WBC, RBC and Hb showed no statistical significance ($p>0.05$), these changes in physiological and biochemical indexes can diagnose sports fatigue of boxing athletes after heavy load training. SDNN of HRV index was significantly correlated with morning pulse ($p<0.05$), RMSSD was significantly correlated with CK ($p<0.05$), LF was significantly correlated with Hb ($p<0.05$), and LF/HF was significantly correlated with T, C, T/C, morning pulse, CK ($p<0.05$). After heavy load training, LF and LF/HF of HRV index in boxing athletes were significantly increased than that before heavy load training (1744.7±1526.3 ms^2 vs. 1134.5±1003.3 ms^2, 2.5±1.3 vs. 1.6±1.0, $p<0.05$), the other HRV indexes showed no statistical significance ($p>0.05$).
Conclusions The LF and LF/HF changed significantly when boxing athletes appeared sports fatigue, suggesting that the sympathetic nervous system had enhanced activity and increased tension, the imbalance between Sympathetic and parasympathetic tend to predominate in sympathetic activity. LF and LF/HF are sensitive HRV indicators for monitoring sports fatigue in boxing athletes.