

# ECG-based Indices of Poincaré Plot Asymmetry Differ between Different Types of Athletic Training

Hans Esperer\*, Martin Oehler, Chris Esperer and René Schwesig

Internal Medicine - Cardiology, Otto-von-Guericke University  
Magdeburg, Germany

Heart rate variability (HRV) is a promising technique to evaluate the effects of physical training (PT) on the cardiac autonomic nervous system. However, traditional HRV methods have produced contradictory results. We hypothesized that, at the elite level, novel ECG-based indices of Poincaré plot (PoP) asymmetry would significantly differ between different PT types. 36 male elite athletes aged  $23 \pm 5$  years with a training history of 2 years of running (R, n=12), or triathlon (T, n=12), or cycling (C, n=12), and 12 age-matched untrained controls (Co), underwent 24-hour ECG monitoring. The following PoP asymmetry indices were determined: (1) relative frequency of episodes of sudden increases in cycle length (SIC); (2) relative frequency of episodes of sudden decreases in cycle length (SDC); (3) decay rate of SIC duration ( $\lambda_{SIC}$ ), and (4) decay rate of SDC duration ( $\lambda_{SDC}$ ). The SIC-related indices served as measures of left-sided, and the SDC-related indices of right-sided asymmetry regarding the PoPs bisector. SIC(%) was smallest in C differing significantly ( $p < 0.01$ ) with both R and T. SDC(%) did not differ between PT groups. Whereas  $\lambda_{SIC}$  differed significantly ( $p < 0.01$ ) between R and C,  $\lambda_{SDC}$  differed significantly ( $p < 0.05$ ) between R and T. Of note, each PT group differed significantly ( $p < 0.001$ ) with controls regarding all the asymmetry indices investigated. In conclusion, different types of PT induce different effects on heart rate dynamics, and the novel PoP asymmetry indices allow for differentiation of PT types. This may be important as to the design of high performance PT.