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Heart rate variability to assess ventilatory threshold in overweight young men

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Objective The individualized training intensity is important in the prevention of overweight and obesity. Our study compared heart rate (HR), oxygen uptake (VO_2), and work load (WL) corresponded to the anaerobic threshold during an incremental cycling test between ventilatory (VT) and heart rate variability threshold (HRVT) methods. Further, we examined the validity of three heart rate variability analyses to assess VT in overweight young men.
Methods Sixteen overweight young men (age 21.1±1.7 years, height 175.3±5.5 cm, weight 84.0±6.7kg, body mass index 27.3±1.2 kg/m^2, VO_{2peak}33.6±4.3ml/min/kg) performed a gradual exercise test on a cycle ergometer (Lode Corival，Lode B.V.，Groningen，Newtherlands).The protocol started at 30 W for 2 minutes with subsequent increments of 30 W every 2 minutes until exhaustion. During test, gas exchanges (VO_2, VCO_2) and ventilation (VE) were measured by breath-by-breath using Metamax 3B portable analyzer (CORTEX, Biophysik GmbH，Leipzig，Germany). The ventilatory threshold (VT) was identified as the point at which VE for O_2 began to rise without a concomitant rise in ventilator equivalent for CO_2. The R-R intervals were continuously recorded using a Polar RS800cx HR monitor(Kempele, Finland). HRV data were further analyzed by Kubios HRV analysis software (Kuopio, Finland) based on time-domain (RMSSD) , Poincare plots(SD1) and time-varying spectral (fHF×HFP) methods. Data were analyzed using SPSS 22.0. Normal distribution of variables was verified by Kolmogorov-Smirnov test. The relationship between HRVT variables and VT was assessed using paired t-test and Pearson's production correlation. The magnitude of concordance between the methods was further evaluated by Bland-Altman plots.
Results No significant difference was witnessed in HR, VO_2, and WL related to AT between HRVT and VT methods（P<0.05）. The relationships were found between the methods to determine the AT for all variables analyzed (r=0.40-0.91). Additionally, the Bland-Altman plots revealed that findings showing narrow limits of agreement present for fHF×HFP and the VT whilst the association between RMSSD, SD1 and VT showed wider limits.
Conclusions The estimation of the HRVT, especially derived through the time-varying spectral (fHF×HFP), may be a noninvasive and more robust method to determine the VT, which could be used to adapt individualized training intensity to overweight young men for training prescription.