The relationship between EMG and either heart rate or blood pressure during a single-leg incremental isometric exercise test

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Recently Wiles et al. (2008: Journal of Sports Sciences, 24, 155-162) introduced the linear relationship between double-leg EMG and either HR or BP during incremental isometric exercise as a novel method for regulating exercise intensity during training. However, many previous training studies (eg Wiley et al., 1992: Medicine and Science in Sports and Exercise, 24, 749-754) have employed single-leg protocols. The relationship between EMG and HR or BP during an incremental single-leg protocol has not been explored. Therefore, the purpose of this study was to determine whether these relationships were evident in a single-leg protocol. Following ethical approval fifteen healthy, normotensive (mean systolic blood pressure 123.8, s = 6.8 mmHg) and physically active men (age 24.8, s = 6.7 yrs; mass 78.8, s = 9.5 kg) performed a maximum voluntary contraction (MVC) using a seated isometric single-leg extension, from which peak torque (TORpeak) and EMG (EMGpeak) were determined. Subsequently, subjects performed two incremental isometric exercise tests at 10, 15, 20, 25 and 30 %EMGpeak, using dominant and non-dominant legs, during which HR and BP were measured continuously. The slope and elevation (intercept) of the linear regression lines obtained in each leg were compared with the use of analysis of covariance (ANCOVA). The within- and between-subjects variation of the mean HR, SBP, and %EMGpeak values was assessed using a repeated measures multivariate analysis of variance (MANOVA). The group mean data for each leg showed a linear relationship between %EMGpeak and HR (dominant leg $r = 0.98$; $P<0.001$; non-dominant $r = 0.99$, $P< 0.001$) and between %EMGpeak and SBP (dominant leg $r = 0.99$; $P<0.001$; non-dominant $r = 0.96$; $P< 0.05$). However, there was evidence of a large inter-individual variation in these relationships (HR: dominant leg r value between 0.23, $P>0.05$ and 0.98, $P< 0.05$; SBP: dominant leg r value between 0.03, $P>0.05$ and 0.99, $P< 0.001$). The lack of a linear relationship in many individuals was probably due to the accumulation of local metabolites in the single-leg compared to the previously published double-leg isometric exercise. The inter-individual variation in the relationship between EMGpeak and HR or BP during the single-leg protocol, make it difficult to use the single-leg protocol, in the same way as the double-leg protocol, to prescribe isometric exercise intensity during training.