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Effects of different practice task constraints on fluctuations of player heart rate in small-sided football games

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This paper analyzes effects of different practice task constraints on heart rate (HR) variability during 4v4 small-sided football games. Participants were sixteen football players divided into two age groups (U13, Mean age: 12.4±0.5 yrs; U15: 14.6±0.5), who performed one trial under three different practice task constraints. The task consisted of a 4v4 sub-phase without goalkeepers, on a 25x15 m field, of 15 minutes duration with an active recovery period of 6 minutes between each condition. We recorded players' heart rates using heart rate monitors (Polar Team System, Polar Electro, Kempele, Finland) as scoring mode was manipulated (line goal: scoring by dribbling past an extended line; double goal: scoring in either of two lateral goals; and central goal: scoring only in one goal). Subsequently, %HR reserve was calculated with the Karvonen formula. Data showed that HR during the break after the initial warm-up was similar to the other two rest periods ($P \geq 0.05$). After confirmation of mean differences between active breaks and exercise bouts ($P < 0.05$), rest periods were excluded from analysis. We next performed a time-series analysis of HR for each individual in each condition. To analyze intra-participant variability we used an autocorrelation technique. To examine inter-participant variability we used percentage of coefficient of variation (%CV) and percentage of root mean square difference (%RMSD).

Mean data showed that autocorrelation function was associated with more short-range dependence processes in the "line goal" condition, compared to other conditions, demonstrating that the "line goal" constraint induced more randomness in HR response. Relative to inter-individual variability, line goal constraints demonstrated lower %CV and %RMSD (U13: 9% and 19%; U15: 10% and 19%) compared with double goal (U13: 12% and 21%; U15: 12% and 21%) and central goal (U13: 14% and 24%; U15: 13% and 24%) task constraints, respectively. Results suggested that line goal constraints imposed more randomness on cardiovascular stimulation of each individual and lower inter-individual variability than double goal and central goal constraints. Quantifying variability in human movement can lead us to understand how different practice task constraints affect the dynamics of the performer-environment interactions

Key words: task constraints, time-series analysis, fluctuations