Heart rate, oxygen consumption and blood lactate concentration responses to repeated sprinting in youth soccer players
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Introduction
The ability to repeat sprints with limited recovery time (called repeated sprint ability [RSA]) is generally thought to be an important component of most team-sports, including Soccer (Reilly et al 2000). However, the physiological characteristics and determinants of RSA are still unclear. For example, the ability to recover between sprints appears to be partly dependent on the resynthesis of phosphocreatine (PCr) (Bogdanis et al. 1996), yet there is still debate regarding the effect of VO2max on the recovery of PCr, and therefore sprinting ability. However, recent evidence suggests that blood buffer capacity may contribute significantly to RSA (Bishop et al. 2003). Therefore, it would appear that a repeated sprint protocol aimed at training the players’ ability to repeat sprints with limited recovery should stress both the aerobic and anaerobic energy systems. Thus the aim of this study was to examine the physiological responses of a RSA protocol (RSAP) that consisted of 7x30m line sprints with 20 s active recovery between sprint-bouts (Reilly et al. 2000).

Methods
11 well-trained (age 16.9±1.3 years, VO2max 55.71±4.23 ml kg⁻¹min⁻¹) regional level soccer players (Istituto Tecnico industriale “Vito Volterra”, Ancona, Italy) volunteered to participate in this study. Players were observed for sprint performance, blood lactate concentrations (BL), heart rate (HR) and oxygen uptake (VO2) during RSAP. BL samplings were performed prior (PreBL), and 3 min (Post3BL) after RSAP (Lactate Pro, Akray, Tokyo, Japan). RSAP VO2 was measured by having players wear a portable breath-by-breath gas analyser (K4b², COSMED, Rome, Italy). HR was recorded with short-range telemetry (Polar Electro Oy, Finland). Sprint scores were assessed using photocell beams (Muscle Lab, Bosco System, Rome, Italy). RSAP fatigue index (FI) was assessed according to Fitzsimons et al (1993). Players were well motivated and instructed to give a maximal effort during each sprint and to avoid pacing. Verbal feedback and encouragements were given throughout the RSAP.

Results
There was a significant increase in sprint time across the RSAP, which resulted in sprints 3 to 7 being significantly slower than sprint 1 (p<0.05). PreBL concentration (2.1±0.8), was significantly different from Post3BL concentration (13.61±2.94 mmol l⁻¹, p<0.001). Average between sprint VO2 levelled off after sprint 2 (p<0.001) attaining 87.1±2.2% of the individual maximal. Peak RSAP-VO2 attained 96.4±3.7% of VO2max. HR leveled off from sprint 3 (p>0.05) attaining 93.4±0.7% of HRmax. Average FI was 6.0±2.4%.

Discussion/Conclusion
Results showed that sprint performance significantly deteriorated after the 2th sprint bout. Although sprint bouts time never exceeded 5s, repeated sprinting and active recovery promoted VO2 and HR responses proximal to individual maximal (94-96%). This suggests that this RSAP may elevate the oxygen uptake to levels likely to train the aerobic system. However, the BL response to the RSAP suggests that the protocol is probably intense enough to decrease muscle and blood pH, and therefore stress the buffering capacity.

References