The effect of progressive heat acclimation on fatigue following intermittent-sprint exercise in the heat.

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Aim: The aims of this study were to examine central and peripheral contributions to fatigue during intermittent-sprint exercise in 33°C, 50% RH using transcranial magnetic stimulation (TMS) and electrical femoral nerve stimulation (FNS) and to investigate whether progressive heat acclimation could ameliorate fatigue following exercise of this type. **Method:** Seventeen male games players matched for peak oxygen uptake ($\dot{V}O_{2peak}$), peak power and body surface area were divided into two groups; progressive heat acclimation (PA, n = 9; 4 d, 50% $\dot{V}O_{2peak}$, 30.8 ± 0.7°C, 49 ± 5% RH, 4 d 33.2 ± 0.6°C, 50 ± 6% RH and 4 d 35.4 ± 0.6°C, 62 ± 6% RH) and training (TG, n = 8; 12 d, 50% $\dot{V}O_{2peak}$, 21.2 ± 0.9°C, 31 ± 6% RH). Pre and post acclimation or training, participants completed a 40 min cycling intermittent-sprint protocol (CISP) in 33.7 ± 0.6°C, 50 ± 3% RH, with neuromuscular fatigue assessment immediately before and after exercise. **Results:** Maximal voluntary contraction (MVC) and potentiated twitch force in both PA and TG were reduced after CISP 1 (Table 1; all P values < 0.05), whereas cortical voluntary activation was not significantly different but tended to decline. PA reduced resting T_{re} and heart rate prior to CISP 2 (37.26 ± 0.21 vs. 37.02 ± 0.24°C; 65 ± 9 vs. 55 ± 4 b.min^{-1} respectively, P < 0.05). Further, exercise heart rate was reduced by PA (168 ± 19 vs. 155 ± 19 b.min^{-1}, P < 0.05) and T_{re} tended to decline (37.9 ± 0.4 vs. 37.6 ± 0.4, P = 0.10). Despite the improved overall physiological strain, peak power output and work done were not different between CISP 1 and 2. Further, the reduction in MVC and potentiated twitch force during intermittent sprinting remained after twelve days of progressive heat acclimation (Table 1). **Conclusions:** These data indicate that during forty minutes of intermittent-sprint exercise in the heat, neuromuscular fatigue may be primarily peripheral in origin and PA or TG does not reduce the extent of fatigue despite a reduced physiological strain.

Table 1. Neuromuscular function pre-post CISP 1 and 2 in Progressive Acclimation (PA) and Training Group (TG).

	PA		TG	
	CISP 1	**CISP 2**	**CISP 1**	**CISP 2**
	Pre-Post	**Pre-Post**	**Pre-Post**	**Pre-Post**
MVC (N)	**- 101***	**- 84***	**- 99***	**- 121***
Potentiated twitch (N)	**-45***	**- 31***	**- 36***	**-33***
Cortical voluntary activation (%)	**- 3**	**- 5**	**- 9**	**-7**

Data presented are change (Δ) from pre to post CISP 1 and pre to post CISP 2 in both PA and TG. * Indicates significant difference pre to post CISP 1 or CISP 2 (within groups).