

Título: Incomplete parasympathetic recovery after successive bouts of maximal exercise in rowers is associated with plasma pro-inflammatory cytokine

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RESUMO

High intensity exercise causes profound alterations in the immune system that may induces changes in nervous autonomic system. The aim of this study is to compare the changes in plasma cytokine profile in response to two bouts of maximal exercise in highly trained rowers associating the results with the HRV recovery. After ethic committee approval (protocol number 19325413.3.0000.5248), competitive rowers (n= 14 males, 24±6 years) performed two 2000m maximal bouts (2k1 and 2k2) in a rowergometer (Concept2 D, USA) separated by four hours of rest. Blood samples were obtained and times series of RR intervals recorded before (Pré2K1) and immediately after 2k1 (Pós2K1), at rest four hours after Pós2K1 (Pré2K2) and after the second bout of exercise (Pós2K2). Cytokines plasma concentration were measured in those moments and 30 minutes (Pós30-2K1 and Pós30-2K2) after the end of each stimulus by immunoassay using multiplex with Luminex 100. Autonomic markers of parasympathetic modulation of heart rate (HR) were used in time and frequency domains and the spectral power for the high (0.15<HF<0.5 Hz) frequency band calculated by a Fast Fourier Transformation. Changes in the levels of plasma cytokines (pg/ml) and autonomic modulation were presented as mean and standard deviation and analyzed by repeated measures ANOVA, Newman-Keuls post test and significance level of $p > <0.05$. Despite maximal heart rate (2k1:190±7 vs 2k2:191±9 bpm) and heart rate recovery (2k1:34±12 vs 2k2:36±10 bpm) were similar for both situations, time for 2k2 was greater than in 2k1 (398±17 vs 408±24 seconds, respectively, $p < <0.05$). Successive 2k exercise bouts provoked a lower HF power in Pré2K2 as compared to Pré2K1 ($p < <0.05$) that was associated with a significant increase of IL-15 plasma levels. The rMSSD showed lower values for Pré2K2 (48±29ms) compared to Pré2K1 (68±35 ms, $p < <0.05$) and associated to TNF α , IL-1 β , IL-6 and IL-10 cytokines plasma levels [TNF α (Pré2K1:27,3±14,2; Pós2K1:55,3±26,3; Pós30-2K1:36,2±21,8; Pré2K2:38,14±17; Pós2K2:65,4±25,8; Pós30-2K2:42,9±26,4), IL-1 β (Pré2K1:3,5±1,5; Pós2K1:5,8±2,1; Pós30-2K1:4,8±1,9; Pré2K2:5,0±2,4; Pós2K2:7,9±3,5; Pós30-2K2:5,0±2,2), IL-6 (Pré2K1:7,4±3,0; Pós2K1:14,1±5,9; Pós30-2K1:10,3±4,2; Pré2K2:10±3,7; Pós2K2:15±5,0; Pós30-2K2: 10,6±3,7), IL-10 (Pré2K1:12,6±3,9; Pós2K1:19,9±6,8; Pós30-2K1:16,7±7,2; Pré2K2:15,31±2,2; Pós2K2:24,29±6,1; Pós30-2K2:17,5±7,1)]. IL-8, MIP-1 β and growth factors VEGF and PDGF involved angiogenesis adaptation, showed increases only after 2k2 suggesting that their elevations depends on overlay loads that prevents organism full recovery [MIP-1 β (Pré2K1:87,89±37; Pós2K1:121,6±59; Pós30-2K1:121,1±54,5; Pré2K2:105,7±51,5; Pós2K2:152,6±76,03; Pós30-2K2:99,1±40,1), IL-8 (Pré2K1:36±13,6; Pós2K1:199±201,3; Pós30-2K1:263,7±224,7; Pré2K2:122,8±79,3; Pós2K2:522±347,1; Pós30-2K2:106,4±92,2), VEGF (Pré2K1:131,8±81,4; Pós2K1:190±116,7; Pós30-2K1:168,9±114,1; Pré2K2:206,2±106,5; Pós2K2:252,7±138,7; Pós30-2K2:201,2±116,5) and PDGF (Pré2K1:11376±3571; Pós2K1:16139±5926; Pós30-2K1:13255±5089; Pré2K2:13562±3507; Pós2K2:16901±7173; Pós30-2K2:14244±5375)]. Autonomic modulation of resting heart rate was still modified and directly associated with increases in pro-inflammatory cytokines four hours after maximal whole body exercise, suggesting that inflammation may influence the incomplete recovery of vagal control of the heart and could be necessary to allow vascular