FRIDAY ORAL SESSION

OP1 SPORTS AND EXERCISE PHYSIOLOGY

OP1-1 KEYNOTE
Arterial blood gas analysis in breath-hold divers at the breaking-point

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Purpose: This project aimed to investigate human blood gases at BHD breaking point after a dive at 40 m.
Methods: Six well trained, healthy breath-hold divers regularly completed this study (41.67 ± 8.78 years, 72.83 ± 7.88 kg and 1.79 ± 0.08 m). Prior to submersion, an arterial cannula was inserted in the radial artery of the non-dominant limb. In the post conditions, blood samples were drawn before the breaking point, with face still submerged. Blood samples were drawn in four different time-points: Blood sampling out of water before diving (PRE). Moreover, blood sampling after breath-holding at surface (POST SUR), at depth (POST DP) and at depth with muscular exercise (POST DP-EXE). Withdrawals took place measuring PH, pCO_2 (mmHg) pO_2 (mmHg) HCO_3 (mmol/L), so2 (%), tco2 (mmol/L) and lactate.
Results: Levels of paO_2 progressively and significantly decrease between the PRE and POST DP-EXE condition. In particular, the PRE value (96.17 ± 7.03) is significantly higher with respect to POST SUR (64.50 ± 4.72, $p < 0.001$), POST DP (39.83 ± 8.66, $p < 0.001$) and POST DP-EXE (31.6 ± 16.95, $p < 0.001$) values. Furthermore, values registered in the POST SUR condition are significantly higher compared with those observed in POST DP ($p < 0.01$) and POST DP-EXE, ($p < 0.001$). Values of $paCO_2$ did not show a regular behavior with a significance registered. In particular, $paCO_2$ was significantly higher in the POST SUR (42.75 ± 6.03) condition with respect to POST DP (31.38 ± 3.70, $p < 0.01$) condition. There were variable changes in arterial lactate after the descent, with a growing tendency between the four progressive conditions. In detail, the POST DP-EXE value (2.09 ± 0.35) is significantly higher with respect to POST SUR (0.79 ± 0.17, $p < 0.001$), POST DP (1.18 ± 0.17, $p < 0.001$), and PRE (0.64 ± 0.38, $p < 0.001$).
Conclusions: We have demonstrated that hypoxia and lactate at surface are increased by exercise, hypercapnia exists to a lesser degree than would be expected from calculation of alveolar $paCO_2$, presumably due to pulmonary gas exchange abnormalities caused by lung compression and because of carbon dioxide uptake and storage in the blood and tissues.
Reference
1. Bosco G et al. (2018) Arterial Blood Gas Analysis in Breath-Hold Divers at Depth. Frontiers in Physiology. 9: 1558

OP1-2
Acute muscle stretching does not alter balance control ability: the compensative role of neuromuscular activation

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Purpose: Balance control (BC) is the resultant of an integrative network involving sight, hearing, vestibular function, and proprioceptive feedback[1]. Perturbations of one of these contributors could turn into a worsening of BC regulation[2]. Passive stretching (PS) has been reported to affect proprioceptive feedback[3], thus possibly decreasing BC ability. This study evaluated the acute effects of PS and active stretching (AS) of the lower limbs on static and dynamic BC parameters.
Methods: Thirty-eight participants (age: 26 ± 3 yrs; stature: 1.72 ± 0.10 m; body mass: 69 ± 17 kg, mean ± SD) underwent PS, AS and control sessions randomly on different days. Stretching routines had similar durations and involved bilaterally the muscles acting around the knee and ankle. Before and after the intervention, hip, knee and ankle range of motion (ROM), maximum voluntary isometric contraction (MVC), and maximum muscle activation [surface electromyography, sEMG, root mean square (RMS) from the investigated muscles] were measured. Static and dynamic BC parameters were determined by stabilometry in bipedal and monopedal conditions (with both open and close eyes). sEMG was recorded during the balance test and normalized to MVC.
Results: After the intervention, ROM increased in all the joints ($p < 0.001$) and MVC decreased (PS: $p < 0.001$; AS $p = 0.03$) together with sEMG RMS (PS: $p = 0.01$; AS $p = 0.02$) in all the investigated muscles. BC was unaffected. However, an overall significant increment in sEMG RMS was found in all the tested muscles during balance tests (p from 0.02 to < 0.001).
Conclusions: These findings suggest that muscles directly involved in BC were more activated to maintain a similar performance, likely as a possible compensation in response to altered proprioceptive feedback from the stretched muscles.
References
1. Lima BN et al. (2014) The acute effects of unilateral ankle plantar flexors static-stretching on postural sway and gastrocnemius muscle activity during single-leg balance tasks. Journal of Sports Science and Medicine 13: 564–570
2. Chatzopoulos D et al. (2015) Acute effects of different stretching methods on balance, agility, reaction time and movement time. Journal of Sports Science and Medicine 13: 403–409
3. Trajano GS et al. (2017) Neurophysiological Mechanisms Underpinning Stretch-Induced Force Loss. Sports Medicine 47: 1531–1541