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Abstract

Acute effect of 4 different exercise techniques on heart rate, lower limb muscle oxygen saturation and perceived exertion responses in elderly

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During the ageing process, there is a reduction of physiological conditions such as loss of muscle mass, strength and cardiovascular capacity. Analysing muscle oxygen saturation (SmO_2) combined with heart rate (HR) enables us to understand both local and global responses to exercise. The aim was to evaluate the acute effect of 4 cardiovascular exercises on the response of SmO_2 in *vastus lateralis* (VL) and *gastrocnemius medialis* (GM) muscles, on HR, and on perceived exertion (RPE) in an elderly population.

Thirteen elderly volunteers (age = 74.4 ± 6.2 years; height = 160.8 ± 7.1 cm; body mass = 72.5 ± 8.8 kg) performed a session consisting of four exercises: body-weight squat, stepping up and down, cycle ergometer, and stationary walking. These exercises are widely used due to their characteristics: they focus on the lower limbs, three are weight-

bearing exercises that are very important for balance support, and all are easily applied in this population. The squat-exercise was performed for 2 minutes, and the other exercises for 4 minutes in random order. The intensity was based on the self-perceived moderate intensity exertion, and the cadence was predefined (between 60 and 96 bpm). The HR (H10, Polar Electro, Kempele, Finland), the RPE (Modified Borg Scale 0-10) and SmO_2 (Moxy 3, Fortiori Design LLC, Hutchinson, USA) were measured.

Differences were found in $HR_{average\ last\ 30"}$ $F(1.2, 11.66)=1011.1$, $p=0.016$, $\eta^2=0.444$, and in $HR_{peak10"}$, $F(1.34, 10.75)=917.1$, $p=0.025$, $\eta^2=0.433$, with higher values in $HR_{average\ last\ 30"}$ in stepping vs. stationary walking (97.4±5.8 vs. 90.7±9.4 bpm). In $HR_{peak10"}$, higher values were found in stepping vs. cycle ergometer (99.1±7.5 vs. 94.2±10.2 bpm). In SmO_2 at VL, $F(2, 24.2)=1357.4$, $p=0.009$, $\eta^2=0.180$, no differences were found. Also, an exercise effect was found in the GM SmO_2, $F(1.6, 16.8)=2827.4$, $p=0.009$, $\eta^2=0.402$, in the stepping up-and-down vs. cycle ergometer (29.6±21.3 vs. 54±26.3%) and stationary walking vs. stepping (53.3±25 vs. 29.6±21.3%) Differences were found in VL $SmO_{2deoxygenation}$ $F(1.8, 14.4)=1667.1$, $p=0.002$, $\eta^2=0.558$, in stepping vs. cycle ergometer (31.5±18.7 vs. 5.3±3.7%), and in $SmO_{2deoxygenation}$ GM $X^2(3)=16.5$, $p=0.001$, in the stepping vs. cycle ergometer (18(12.6-26.5) vs. 4.3(1.1-8.2)%). The RPE was different $X^2(3)=11.16$, $p=0.011$, with higher values in stationary walking vs. body-weight squat (5(3.5-5.5) vs. 4(4-6) AU).

The body-weight squat exercise promoted an important cardiovascular stimulus, probably because of the large amount of active muscle mass. The stepping exercise showed a large SmO_2 variation, revealing a suitable muscle recruitment. And the stationary walking promotes higher perceived exertion. These results help professionals to adjust the exercise prescription in this specific population.