E-Poster

EP-668

The Effects of 12-Week Exercise Interventions on Cardiovascular Fitness and fMRI-Assessed Cerebrovascular Reactivity (CVR) in Healthy Older Adults

Topic: Neuroscience

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BACKGROUND

Aging and cardiorespiratory fitness are known to exert powerful effects on vascular, neurological, cognitive, and sensorimotor function. With respect to the cerebrovascular health, studies using Transcranial Doppler Ultrasound have shown that greater hypercapnic cerebrovascular reactivity (CVR) at the major cerebral arteries is associated with higher peak VO2 outcomes in older adults. Nevertheless, this work is primarily cross-sectional in nature and does not characterize fitness effects on cerebrovascular function across the entire brain. As such, the current study aimed to examine the effects of exercise, as an intervention, on changes to cardiovascular fitness and regional cerebrovascular reactivity using functional MRI (fMRI).

METHODS

We report on data from 20 healthy older participants (65-80) who completed 12-weeks of either aerobic cycling (n=15), or a balance-based active control intervention (n = 5). Before and after interventions, participants performed a submaximal graded-exercise test (GXT) up to 90% of their estimated heart-rate max. The cardiovascular fitness outcomes derived from GXT included peak VO2, VE/VO2 slope, GXT duration, and HR/VO2 slope. Participants also underwent fMRI scanning while breathing a hypercapnic gas mixture (5% CO2, 21% O2, balanced N2) to examine CVR outcomes before and after exercise. Cortical atlas segmentation and voxel-wise CVR analyses were performed to examine the effects of exercise type on CVR change at the whole-brain level, and in the frontal, parietal, temporal, and occipital cortices.

RESULTS

Analysis of variance (ANOVA) demonstrated that the aerobic exercise significantly increased GXT duration and significantly decreased HR/VO2 slope parameters after the 12-week intervention. Peak VO2 and CVR did not exhibit any significant change as a function of exercise group of session (pre *vs.* post). Step-wise regression was also performed across our participant sample to examine the sensitivity of change in individual fitness to change in cerebrovascular reactivity after exercise. HR/VO2 slope parameters were sensitive to change in whole-brain CVR, with those exhibiting an increase in HR/VO2 slope demonstrated greater increases to CVR after exercise (R2 = .38; p = 0.01). Separate regressions found that this relationship was consistent across both hemispheres of the frontal, temporal, parietal, and occipital cortices (all $p < 0.05$)

CONCLUSION

Our findings lend support for aerobic exercise as a viable intervention to improve cardiovascular health in aging adults. Nevertheless, our regression analyses also that individual differences in fitness response may help to explain differential adaptations in cerebrovascular function after exercise.

Statement of Disclosures

None

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Doi: 10.5606/archisprm.2026.EP-668