Home-Based High-Intensity Interval Training Improves Muscle Capillarisation and eNOS/NAD(P)Hoxidase Protein Ratio in Obese Individuals with Elevated Cardiovascular Disease Risk

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Objective Obesity and inactivity lead to structural and functional muscle microvascular impairments associated with development of chronic disease. This study is the first to investigate the effect of a novel home-based high-intensity interval training (HIT) (Home-HT) intervention in obese individuals with elevated cardiovascular disease (CVD) risk on capillarisation and muscle microvascular eNOS/NAD(P)Hoxidase ratio. Comparisons were made with home-based moderate-intensity continuous training (Home-MICT) and supervised laboratory-based low-volume HIT (Lab-HIT) as control groups.

Methods Thirty-two sedentary obese adults (age 36±2 years; BMI 34.3±0.8 kg·m⁻²; O₂peak 24.6±1.0 ml·kg⁻¹·min⁻¹) were allocated to 12 weeks of Home-HT (n=9), Home-MICT (n=13) or Lab-HIT (n=10). Muscle biopsies were taken pre- and post-training to assess specifically in the endothelial layer of muscle arterioles and capillaries the protein content of eNOS, serine1177 phosphorylated eNOS, NOX2 and p47phox, and various capillarisation measures using quantitative immunofluorescence microscopy.

Results All interventions induced comparable increases in total eNOS content in terminal arterioles and capillaries (P<0.001). There was no change in ser1177 phosphorylated eNOS (arterioles P=0.802; capillaries P=0.311), but eNOS ser1177/eNOS ratio significantly decreased following training in arterioles and capillaries (P<0.001). Training decreased NOX2 content (arterioles P<0.001; capillaries P<0.001), but there was no change in p47phox content (arterioles P=0.101; capillaries P=0.345). All measures of capillarisation increased (P<0.05). These adaptations occurred alongside increased O₂peak (P<0.001) and whole-body insulin sensitivity (P=0.033). There were no significant differences between training programmes.

Conclusions The training effects of Home-HIT on skeletal muscle microvascular adaptations are comparable to those of traditional training methods, with the advantage that Home-HIT reduces barriers to exercise in obese individuals with elevated CVD risk.