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Reduction in post-menopausal related vascular dysfunction through exercise and Mediterranean diet

A. Alkhatib[1] and M. Klonizakis[2]

[1]*Department of Life and Sport Science, University of Greenwich, Chatham Maritime, ME4 4TB,* [2]*School of Sport and Exercise Science, Sheffield Hallam University, Collegiate Hall, Collegiate Crescent, Sheffield, S10 2BP, UK*

Menopause has been associated with reduced physical activity levels, reduced muscle and whole body metabolism, increased caloric intake and reduced cardio-respiratory exercise tolerance[(1)], which increase the risk of developing cardiovascular disease following menopause particularly in postmenopausal sedentary women[(2)]. Regular exercise has been linked with a reduction in postmenopausal-related deterioration in the vasculature, and the benefits included improvement in arterial stiffness and enhanced vascular endothelial function in post-menopausal women[(3)]. It has been recently shown that age-related deterioration in the microcirculatory endothelial function may be further reversed through combining exercise training with Mediterranean Diet (MD)[(4)]. Therefore, this study aims to extend the latter finding by testing whether and how regular aerobic exercise training, combined with MD compliance would increase microcirculatory vascular activity and cardiorespiratory exercise tolerance in postmenopausal women.

The study adhered to the guidelines of the Declaration of Helsinki, and gained the institutional ethical approval. Fifteen postmenopausal women (Mean $\pm$ SD, age = 53.3 ± 2.9, body mass = 74.4 ± 15.07 kg, height = 1.65 ± 5.3 m) completed a cardiorespiratory exercise tolerance test, and were assessed for their upper- and lower-limb endothelial cutaneous vascular conductance (CVC) test using Laser Doppler Fluximetry (LDF), with endothelium- dependent Acetylchloride (ACh) and –independent Sodium nitropurruside (SNP) vasodilation. Participants were then randomised into two groups, MD and non-MD, and followed eight-week intervention programme, which included discontinuous treadmill running based on each individual's exertion, twice per week. The MD group was encouraged to increase food and drink items, which were traditionally associated with a Mediterranean-style diet without any specific recommendation to restrict energy or calorie intake as previously described[(5)]. The cardiorespiratory data was analysed using repeated measures mixed ANOVA and the microcirculatory data was analysed using ANCOVA[(4)].

Exercise training improved participants' cardiorespiratory exercise tolerance as indicated by a significant increase in the ventilatory threshold (VT) (11.5 ± 2.1 *vs.* 14.0 ± 3.0 ml.kg^{-1}.min^{-1}) and the corresponding VT speed (4.4 ± 1.0 *vs.* 5.0 ± 0.8 km.h^{-1}), all are $p<0.05$, with no between group difference in VT for the MD versus exercise alone. Exercise training also improved CVC in a dose-dependent effect for both ACh and SNP in the upper limb ($p<0.001$, $d = 0.84$ and $p<0.001$, $d = 0.64$ respectively), and lower limb ($p<0.001$, $d = 0.86$ and $p = 0.004$, $d = 0.79$). However, the lower body CVC analysis of the interaction between the time-period (prior and following the intervention) and the groups (MD and non-MD), showed a stronger improvement in the MD group than the exercise group in the Ach following the intervention ($p = 0.02$, $d = 0.36$), but not for the SNP ($p = 0.22$, $d = 0.12$).

The present study suggests that regular moderate exercise improves microcirculatory vascular function and increases exercise tolerance in postmenopausal women, both are responsible for reducing cardiovascular risk in this high-risk group. Better improvement in CVC of the lower body in the MD than the non-MD group suggests that the compliance with MD may induce additional vascular microcirculatory benefits than exercise alone.

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