Are improvements in arterial stiffness associated with moderate physical activity and modulated by nitric oxide by-products in overweight adults?

T. M. Kearney¹, M. H. Murphy², G. W. Davison², M. J. Okane³ and A. M. Gallagher¹

¹Northern Ireland Centre for Food and Health, University of Ulster, Coleraine BT52 1SA, ²Ulster Sports Academy, University of Ulster, Newtownabbey, BT37 0QB and ³Dept of Clinical Chemistry, Altnagelvin Hospital, Western Health and Social Care Trust, Londonderry BT47 6SB, UK

Arterial stiffness, measured via pulse wave velocity (PWV) has been shown to be a strong independent predictor of cardiovascular morbidity and all-cause mortality (1). Healthy compliant brachial arteries normally have a PWV of 7–9 ms⁻¹, whereas stiffer arteries tend to be in the range of 12–15 ms⁻¹ (2,3). It has been hypothesised that regular physical activity improves endothelial function due to vascular shear stress causing an increased production of the vasodilator nitric oxide (NO) (4). We previously reported that six months of brisk walking was associated with a decrease in PWV⁵,⁵. Here we investigated whether the observed beneficial changes in PWV following regular brisk walking were associated with changes in serum nitrate and nitrite (NOₓ) (a surrogate marker for the vasodilator NO) concentrations.

77 overweight sedentary individuals (19 males, 58 females; mean age 45.6 (± 6.55) years; BMI 29.18 (± 4.27) kg/m²) participated in a randomised control trial and were allocated to one of three groups: control group (n=25), walking with monthly telephone contact group (n=25) and walking with weekly telephone contact group (n=27). The walking groups were asked to incorporate 3 x 10 minute bouts of brisk walking into their daily routine on 5 days/week and were contacted over six months to provide support. The control group were given light stretching exercises to carry out on 5 days/week and were contacted on a monthly basis to control for attention effects. Percentage body fat (Tanita scales), BMI (kg/m²), and PWV were measured at baseline and repeated after six months with follow-up measurements taken four months later. PWV was measured using a sensor based device as described by McLaughlin et al. (2). For the purposes of the present investigation, both walking groups were combined (n=52) and telephone contact was included as a covariate. Time by group interactions were analysed using repeated measures two-way analysis of covariance (ANCOVA). Between subject differences were analysed using a one-way ANOVA with posteriori Tukey Honestly Significant Difference (HSD) test.

There was a significant decrease in PWV (P<0.001) coupled with significant increases in NOₓ (P<0.001) over the 6 month intervention, in the walking group as compared to control, and these beneficial effects were sustained beyond the end of the intervention period (i.e. at 4 months follow-up) (Figure 1 and 2). Furthermore a strong negative correlation between PWV and NOₓ was also observed (r = −0.65, P<0.001).

The results demonstrate that the beneficial changes in PWV observed with regular brisk walking for 3 x 10 minutes per day may be explained by concurrent increases in nitric oxide by-products in these overweight individuals.


https://doi.org/10.1017/S0029665112001528