Association of Objectively Measured Physical Activity with Vascular Endothelial Function in Male Adolescents

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Abstract

Purpose: Cardiovascular disease (CVD) begins in childhood primarily due to exposure to lifestyle-mediated risk factors such as inactivity and low cardiorespiratory fitness (CRF). Endothelial dysfunction is one of the earliest events in the development of CVD. Self-reported light intensity physical activity (LIPA) is positively associated with endothelial function (EF) in adolescents. The purpose of this study was to examine the relation between objectively measured physical activity (PA) and EF in healthy male adolescents.

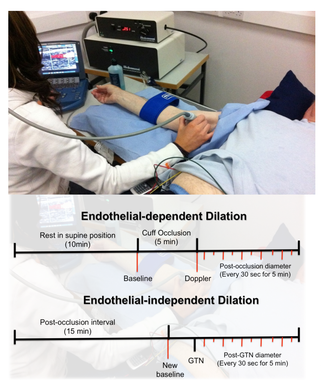
Methods: Low (n=8, VO_2max = 40.4 ± 2.3 mL.kg^{1}.min^{-1}), moderate CRF (n=12,VO_2max = 54.6 ± 3.9 mL.kg^{1}.min^{-1}) and high CRF (n=15, VO_2max = 63.7 ± 4.0 mL.kg^{1}.min^{-1}) healthy males (mean age 15.77 ± 0.4; yr) participated in the study. High-resolution ultrasonography was used to assess endothelial dependent (EDD) in response to brachial artery flow mediated dilation. Participants wore a tri-axial ActivPAL accelerometer for 6 days. Total time spent in sitting, standing, LIPA, moderate-vigorous PA (MVPA) and steps per day was calculated using previously published methodology (Dowd et al., 2012).

Results: EDD was significantly lower in low CRF than the high CRF group. Steps per day were significantly lower in low CRF (9251 ± 4113) than high CRF group (14007 ± 3176) (p<0.005). Time in sitting was significantly higher in low CRF than high CRF group (p<0.028). MVPA was significantly lower in low CRF than high CRF group (p<0.01). There was no significant difference in standing and LIPA between the groups. There was a significant positive relation between steps per day and % change (r=0.54, p<0.001) and absolute change in EDD (r= 0.60, p<0.001). Sitting was inversely related to % change (r=-0.497, p< 0.002) and absolute change in EDD (r=-0.49, p<0.003). There was a significant positive relation between MVPA and % change (r=0.47, p<0.005) and absolute change in EDD (r=0.57 p<0.000).

Conclusion: There was a significant difference in steps per day, time spent sitting and in MVPA between low CRF and high CRF. MVPA was positively associated with EF in healthy adolescent males.

Methods

PA measurement



Endothelial function

Results

Figure 1A. Relation between steps per day and endothelial dependent dilation

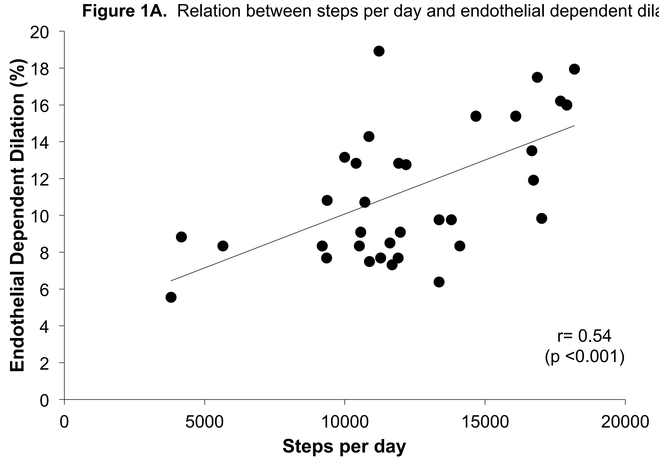


Figure 1B. Relation between MVPA and endothelial dependent dilation

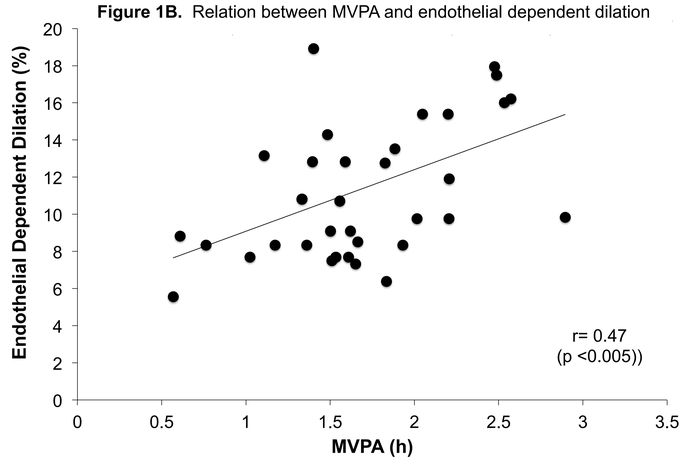


Figure 1C. Relation between sitting and endothelial dependent dilation

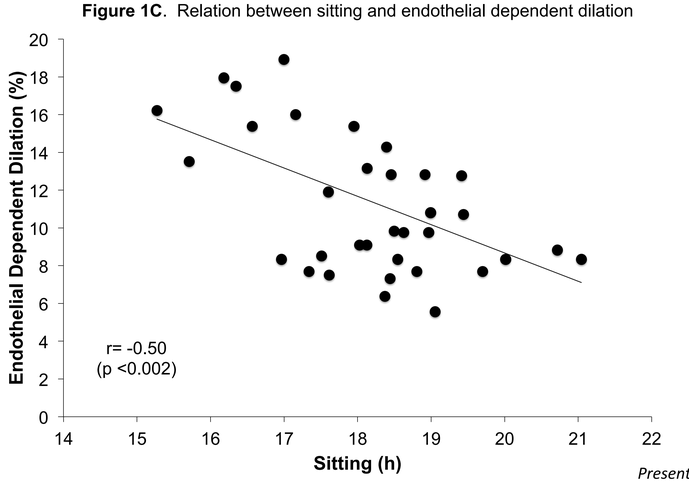


Figure 2. Endothelial dependent dilation in low, moderate and high CRF male adolescents

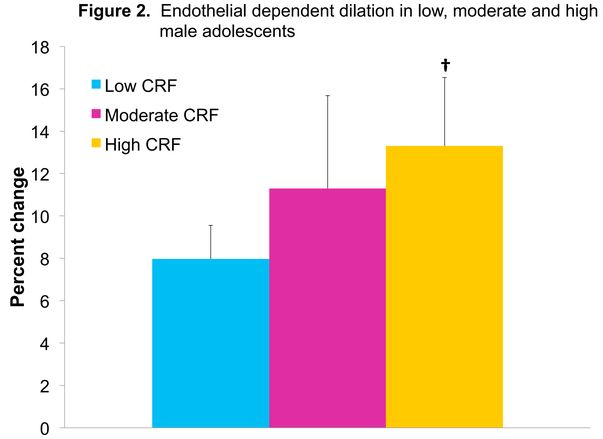
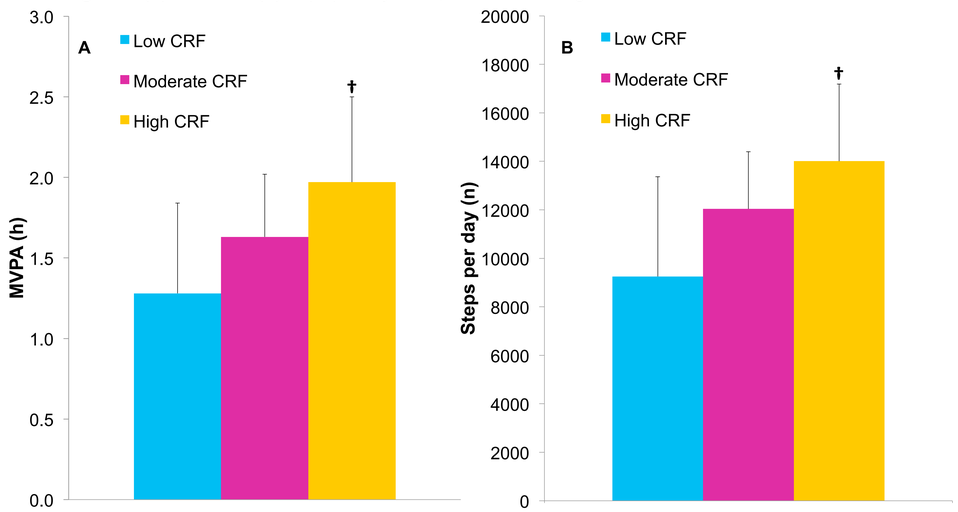


Table. Physiological and physical activity characteristics of the study participants

	Low CRF (n=8)	Moderate CRF (n=12)	High CRF (n=15)
Age (y)	15.88 ± 0.35	15.75 ± 0.45	15.73 ± 0.46
BMI (kg·m^{-2})	28.26 ± 9.37	21.67 ± 3.00 *	20.21 ± 1.27 ‡
VO_2 max (ml·kg^{-1}·min^{-1})	40.40 ± 2.3	54.60 ± 3.93 ‡	63.7 ± 4.0 ‡
Sitting (h)	19.07 ± 1.33	18.31 ± 0.89	17.62 ± 1.34 *
Standing (h)	2.65 ± 0.94	3.16 ± 0.68	3.43 ± 0.93
LIPA (h)	0.62 ± 0.30	0.79 ± 0.16	0.99 ± 0.71
MVPA (h)	1.28 ± 0.56	1.63 ± 0.39	1.97 ± 0.53 †
Steps per day	9250.79 ± 4113.54	12039.23 ± 2356.18	14007.47 ± 3175.72 †

Values are means ± SD; * p<0.05 vs. Low CRF; † p<0.01 vs. Low CRF; ‡ p<0.001 vs. Low CRF

Figure 3. (A) MVPA and (B) steps per day in low, moderate and high CRF male adolescents



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