

Abstract

Purpose: Advanced vascular ageing (VA) has been found in children with cardiovascular disease risk factors. Limited studies have examined the association between sedentary behavior, physical activity and carotid intima media thickness (cIMT) in adolescents. The purpose of this study was to examine the associations of daily total sedentary time (ST), steps and breaks in ST with cIMT in apparently healthy male adolescents, and to determine if total ST, the number of breaks in ST or steps could identify adolescents with VA.

Methods: A total of 54 apparently healthy male adolescents (mean \pm SD: age 15.6 \pm 0.7 yr.; BMI 23.0 \pm 4.8) wore a tri-axial ActivPAL accelerometer for 7 consecutive days. Daily total ST during waking hours, the number of breaks in ST and total daily steps were calculated. High-resolution ultrasonography was used to measure left and right far wall intima media thickness (IMT) of the common carotid artery (CCA). Advanced VA was defined as having a mean far wall cIMT greater than or equal to the 25th percentile for race and sex matched healthy 45 year old ¹. Associations between daily total ST during waking hours, steps and cIMT were examined using univariate correlation and regression analysis. Logistic regressions were conducted to determine if daily total ST, the number of breaks in ST or steps could identify adolescents with VA.

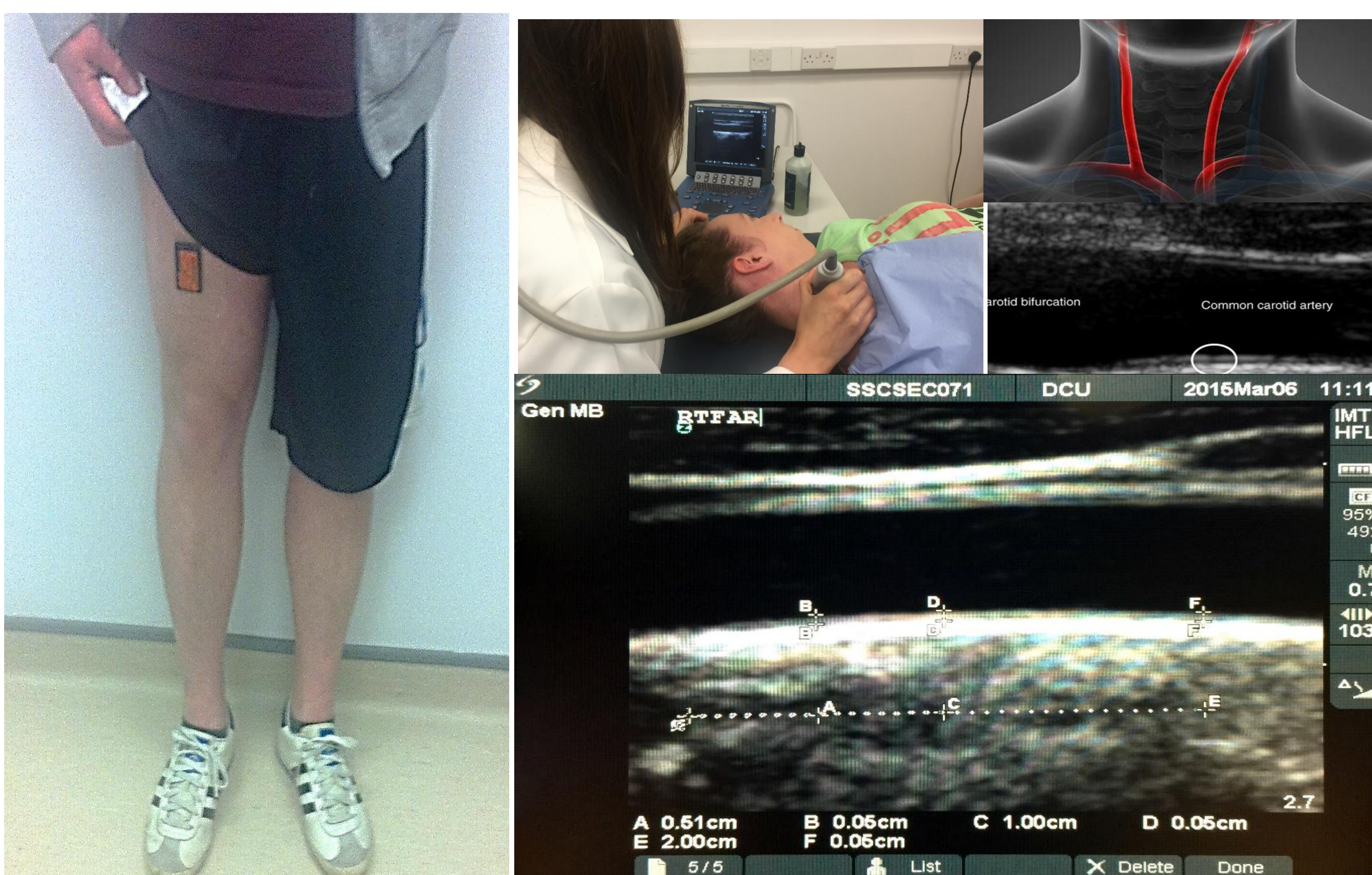
Results: Daily total ST during waking hours was positively associated with cIMT ($r=0.37$, $p=0.006$) and daily steps ($r=-0.41$, $p=0.002$) and the number of breaks in ST ($r=-0.28$, $p=0.045$) were inversely related to cIMT. After adjustment for the number of breaks in ST, total ST during waking hours and steps were significantly related to cIMT ($\beta=0.02$, $p=0.032$ and $\beta=8.89 \times 10^{-6}$, $p=0.018$) when regressed using separate models against cIMT. The number of breaks in ST had significant odds ratio (OR=1.0745, $p=0.035$) when identifying adolescents with VA.

Conclusion: The lower the number of breaks in ST, the higher the odds of advanced VA in apparently healthy male adolescents. Total ST and steps were significantly related to cIMT independent of the number of breaks in ST.

Introduction

Carotid Intima Media thickness (cIMT) is a structural marker of cardiovascular disease (CVD). Vascular aging (VA) evaluates cIMT measurements against race and gender matched adult cIMT data and can stratify adolescents at risk of developing premature CVD. Advanced VA has been found in children with cardiovascular disease risk factors including obesity and familial dyslipidemia ². Sedentary behavior is an independent risk factor for CVD. Limited studies have examined the association between sedentary behavior, physical activity and cIMT in adolescents. The purpose of this study was to examine the associations of daily total sedentary time (ST), steps and breaks in ST with cIMT in apparently healthy male adolescents, and to determine if total ST, the number of breaks in ST or steps could identify adolescents with VA.

Methods



7 day Accelerometry

- Tri-axial ActivPAL
- 7 days
- ST during waking hours
- Steps per day
- Number of breaks in ST

cIMT measurement

- B mode ultrasonography
- Far wall IMT of left and right common carotid artery
- Advanced VA = mean far wall cIMT \geq or equal to the 25th percentile for race and sex matched healthy 45 year old ¹

Results

Table. Participant characteristics, cIMT measurement, daily total ST, steps, and breaks in ST

	(n=54)
Age (y)	15.6 \pm 0.7
Height (cm)	174.6 \pm 6.5
Weight (kg)	70.0 \pm 15.9
BMI (kg·m ⁻²)	23.0 \pm 4.8
cIMT (mm)	0.5 \pm 0.1
Total Sitting Time (h)	9.5 \pm 1.4
Breaks in Sitting Time (n)	53.0 \pm 10.1
Steps per day	11373.8 \pm 3401.6

Values are means \pm SD

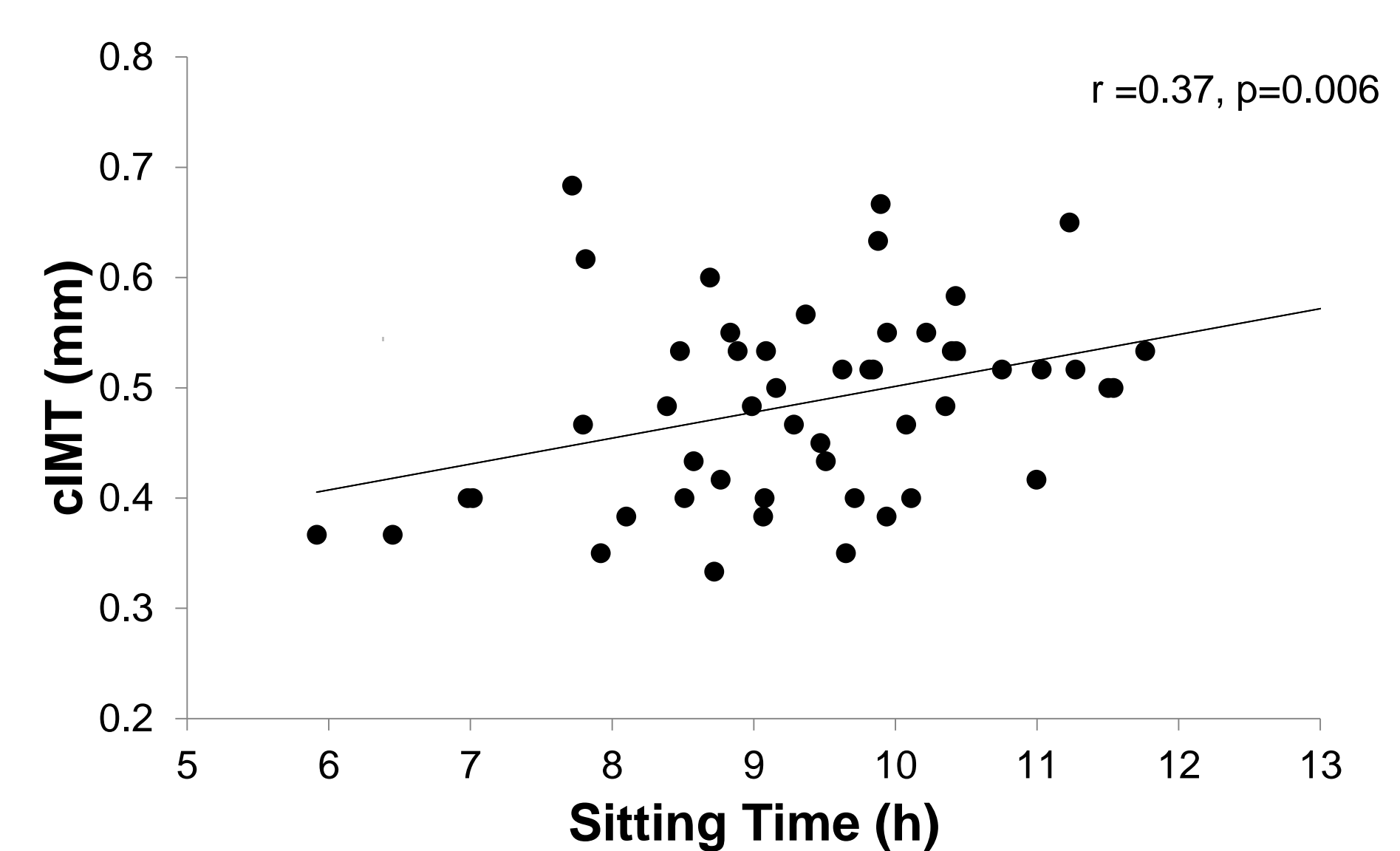


Figure 1. Relation between total sitting time during waking hours and carotid intima media thickness

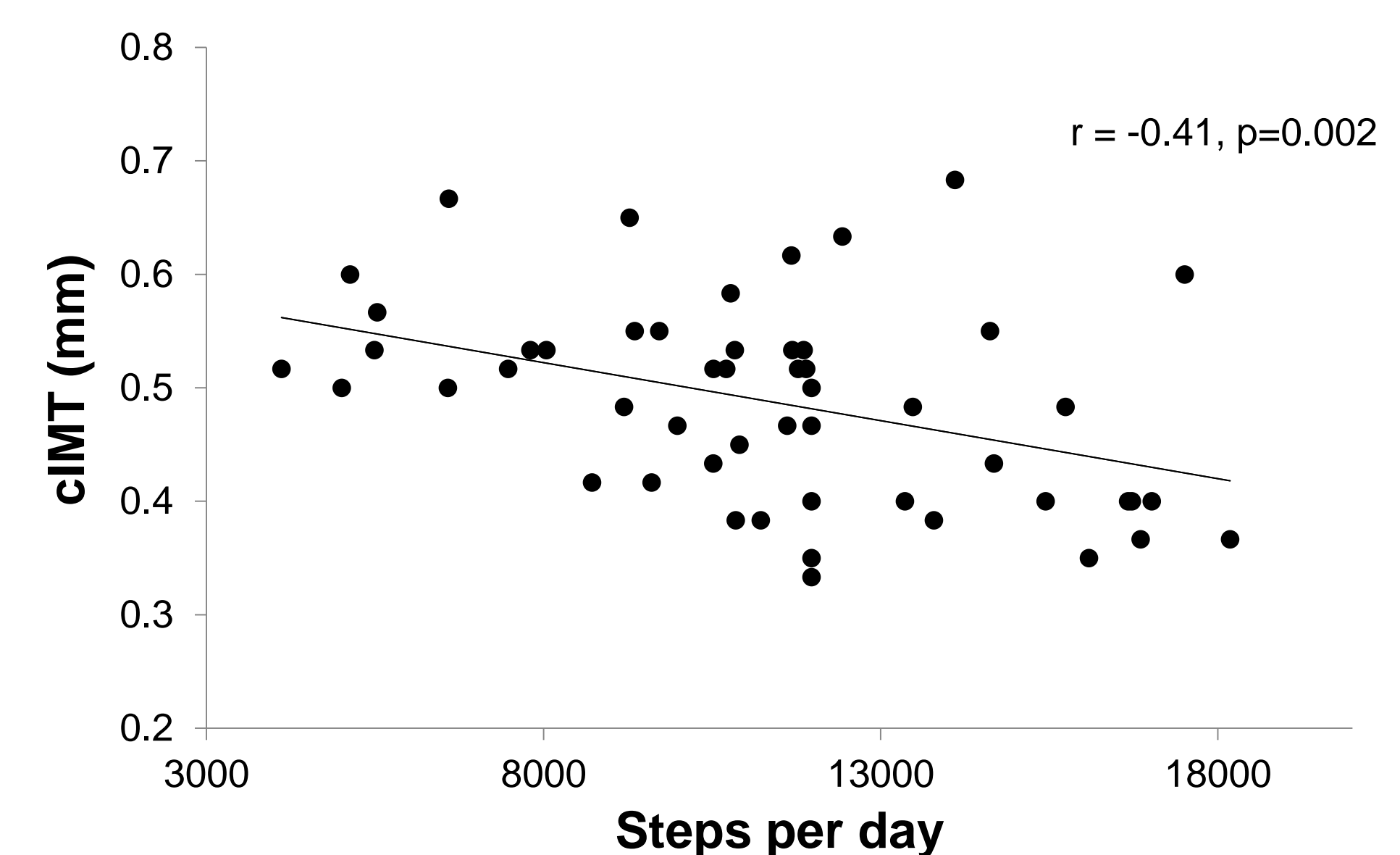


Figure 2. Relation between daily steps and carotid intima media thickness

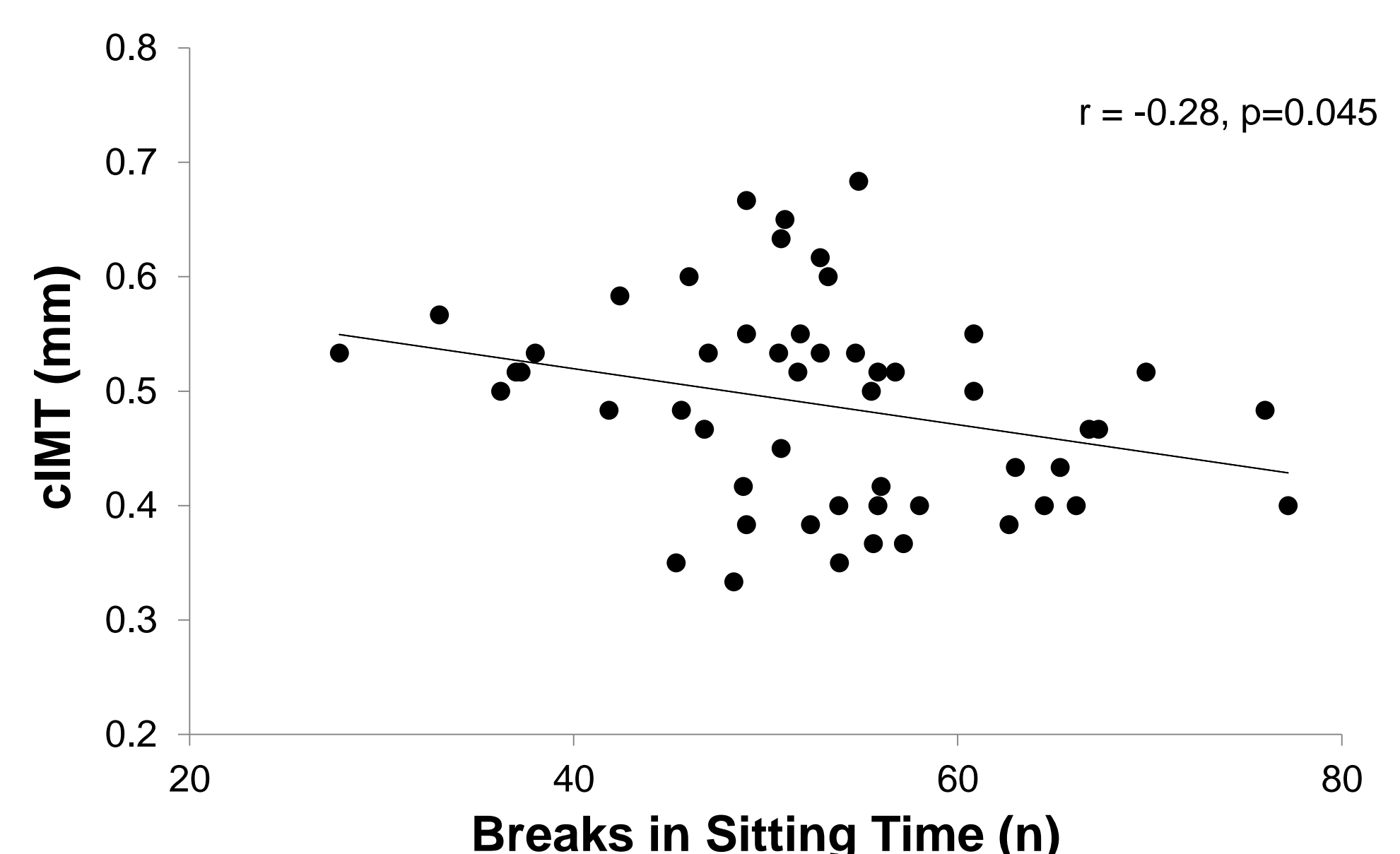


Figure 3. Relation between breaks in sitting time and carotid intima media thickness

After adjustment for the number of breaks in ST, total ST during waking hours and steps were significantly related to cIMT ($\beta=0.02$, $p=0.032$ and $\beta=8.89 \times 10^{-6}$, $p=0.018$) when regressed using separate models against cIMT. The number of breaks in ST had significant odds ratio (OR=1.0745, $p=0.035$) when identifying adolescents with VA.

Conclusion

The lower the number of breaks in ST, the higher the odds of advanced VA in apparently healthy male adolescents. Total ST and steps were significantly related to cIMT independent of the number of breaks in ST. Given that CVD begins in childhood, efforts to reduce overall ST, increase daily steps and break up ST in children and adolescents is encouraged.

Bibliography

1. Howard, G., Sharrett, A.R., Heiss, G., Evans, G.W., Chambless, L.E., Riley, W.A., Burke, G.L. (1993). Carotid artery intimal-medial thickness distribution in general populations as evaluated by B-mode ultrasound. ARIC Investigators. *Stroke*, 24(9), 1297–1304
2. Le, J., Zhang, D., Menees, S., Chen, J., & Raghuvver, G. (2010). "Vascular age" is advanced in children with atherosclerosis-promoting risk factors. *Circulation. Cardiovascular Imaging*, 3(1), 8–14.