Sedentary time is not independently related to postural stability or leg strength in 50-67 year old women.

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</table>
Sedentary time is not independently related to postural stability or leg strength in 50-67 year old women.

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Abstract

Introduction. Most research on sedentary behaviour has focused on cardiometabolic outcomes and markers of metabolic dysfunction while neuromuscular outcomes have received less attention. The objective of the present study was to determine if sedentary time is negatively associated with laboratory-based measures of lower body muscular strength and postural stability in middle-aged women. Methods. Forty-nine women (56.6 ±4.1 years) participated in the study. Participants wore an Actigraph GT3x accelerometer for 7 days to quantify sedentary time and physical activity. Following a familiarization session, assessments of lower body muscular strength and postural stability were performed. Peak torque of knee extensors and flexors was assessed using an isokinetic dynamometer. Postural stability was assessed using computerized dynamic posturography and a composite equilibrium score (CES) was calculated.

Results. Participants spent 9.4±1.3 hours per day (65% of wear time), sedentary and 28.2±17.3 minutes per day (3.3% of wear time) in moderate-to-vigorous physical activity (MVPA). Postural stability and relative peak torque of the knee flexors were significantly associated with time spent sedentary (r = -0.35, p=0.01 and r = -0.31, p=0.03, respectively). Multiple linear regression analyses showed that after adjusting for MVPA, sedentary time was not significantly related to either the CES or peak torque of the knee extensors or flexors.

Discussion. In contrast to our hypothesis, postural stability and leg strength were not independently related to sedentary time. While sedentary behaviour may be an important risk factor for cardiometabolic disease, the present results suggest MVPA may be more important to neuromuscular outcomes.

Key words: aging, sedentary, functional capacity, strength, postural stability, balance
Introduction

There is growing evidence that prolonged sedentary behaviour, defined as any waking activity with an energy expenditure of less than or equal to 1.5 metabolic equivalents (METs) while in a seated or reclined position (Sedentary Behaviour Research Network, 2012), is detrimental to health. Furthermore, the consequences of sedentary behaviour on health may occur independently of the beneficial effects of moderate to vigorous physical activity (Koster et al., 2012). Much of the available research to date has focused on cardiometabolic outcomes and evidence suggests that sedentary time contributes to a wide range of chronic diseases such as diabetes, obesity, hypertension, and cardiovascular disease (Tremblay et al., 2010, Carson et al., 2014). Markers of metabolic dysfunction such as poor insulin sensitivity and large waist circumference have been correlated with acute and chronic sedentary time in a variety of populations (Copeland et al., 2015, Healy et al., 2008, Koster et al., 2012, Krogh-Madsen et al., 2010, Patel et al., 2010, Tremblay et al., 2010). While the effect of sedentary time on cardiometabolic health is becoming clearer, the possible effect on neuromuscular outcomes has received less attention to date. Sedentary time has been implicated in decreased neuromuscular efficiency (Chastin et al., 2012), increased skeletal muscle atrophy (Krogh-Madsen et al., 2010), and sarcopenia (Kortebein et al., 2008). In light of these findings it seems plausible that prolonged sedentary time could have negative effects on strength and balance.

Postural stability (Prata & Scheicher, 2012) and lower body muscular strength (den Ouden et al., 2013) have been positively associated with functional capacity and both are predictive of one’s ability to maintain autonomy with age (Breton et al., 2014). Falls are a growing problem among older adults and women are at greater risk compared to men, which may be partly related to lower muscle strength and poorer postural control (Breton et al., 2014).
Changes in postural stability are more pronounced among elderly women, but a significant decline in the ability to maintain balance in challenging environments (e.g.: eyes closed or unstable surface) is evident in women in their 50’s when measuring sway using a force plate (Choy et al., 2003). In fact, Choy et al. (2003) recommended that balance screening for women should be implemented before the age of 60. Muscular strength also declines by about 10-15% per decade after the age of 30 and this loss accelerates after the age of 50 (Lindle et al. 1997).

Sedentary time has been shown previously to be inversely associated with balance and physical function, even after adjusting for moderate to vigorous physical activity (Davis et al., 2014; Santos et al., 2012; Seguin et al., 2012). These studies used either self-reported physical function (Seguin et al., 2012), or field tests to assess balance and strength, such as the 8-foot up-and-go (Santos et al., 2012), and the ability to maintain semi-tandem standing for 10 seconds (Davis et al., 2014). While these tests are simple to administer, laboratory measures of strength and balance may be more sensitive than performance-based tests. Both studies (Davis et al., 2014; Santos et al., 2012) also examined men and women over the age of 70, and it is not known if sedentary behaviour can negatively impact strength and balance in women in their 50’s and 60’s, which is a time of accelerated decline in neuromuscular function (Choy et al., 2003; Lindle et al., 1997). Thus, the objective of the present study was to determine if sedentary time is negatively associated with laboratory-based measures of lower body muscular strength and postural stability in middle-aged women. It was hypothesized that sedentary time would be inversely related to postural stability and lower body strength, independent of moderate to vigorous physical activity.
Methods

Participants

Recruitment was done via online notice board advertising and community posters. Inclusion criteria mandated that female participants be 50-70 years old and engaged in full-time employment (minimum of 30 hours per week). We chose women who were employed full time as the workplace is a key setting for prolonged bouts of sedentary time (Parry & Straker, 2013). Participants were screened for contraindications and were excluded if they had any unstable health condition, acute neurological or musculoskeletal injury, or physical limitation that precluded them from completing the testing.

Procedures

Participants attended the laboratory for two sessions. At the first session descriptive information was collected, including age and anthropometric data (Table 1), and participants were familiarized with the procedures, including a practice test using the isokinetic dynamometer (the same protocol that is explained in “muscular strength” section was used). Height and weight were recorded to the nearest 0.5 cm and 0.1 kg, respectively, using a mechanical beam scale (Pelstar LLC, McCook, IL). They were then provided with an accelerometer to wear for 7 days in order to objectively monitor sedentary time and physical activity. At the completion of the 7 days, they returned the accelerometer to the lab and completed the assessments of strength and postural stability. All procedures were reviewed and approved by the Institutional Human Subject research Committee and all participants provided written informed consent.

Postural stability

Postural stability refers to the ability of the postural control system to maintain the body’s center of gravity over the base of support during perturbation (Chaudhry et al., 2004). Postural
stability was assessed using the NeuroCom Equitest CRS+ Balance Master computerized dynamic posturography system (Clackamas, OR). Standing with feet shoulder width apart and aligned coaxially to the force platform, the participants were instructed to remain as still and upright as possible throughout the sensory organization test (SOT). For detailed description of the SOT see Fong et al. (2012). Briefly, the SOT consisted of 18 trials (3 trials of 6 conditions at 20 seconds per trial) and trial conditions varied according to three visual conditions (eyes open, eyes closed, and sway-referenced visual surround) and two platform conditions (fixed or sway-referenced). Subjects were aware of trial conditions for the first set only, with the second and third set of trials being randomized and unknown to subjects. Weighted trial scores were used to calculate a composite equilibrium score (CES), describing overall performance and based on a 1 - 100 scale, with higher scores indicating better postural stability. Previous studies have shown CES to be inversely related to fall risk (Wallmann, 2001) and positively related to muscular strength (Fukagawa et al., 1995) in women. Vouriot et al. (2004) found a higher incidence of falls in women with CESs of less than 78 and lower incidence in scores greater than 78.

Muscular strength

Each participant completed one familiarization trial and one strength assessment on two separate occasions (i.e. familiarization occurred during the initial visit, and the strength assessment at follow-up) approximately seven to 10 days apart; data from follow-up were used in the analysis. Peak torque of the dominant knee extensors and flexors were assessed using the Humac NORM® dynamometer (CSMI Inc, Clackamas, OR) at 60 degrees per second. Leg dominance was defined as the lower limb preferentially used for voluntary motor tasks (Sadeghi et al., 2000), and was identified by asking each participant which leg they would chose to kick a ball with. Following a five-minute warm up on a cycle ergometer, participants completed one
trial set of five repetitions followed by a 60 second rest and a set of five test repetitions. Repetitions were continuous, wherein the participant was directed to extend and then flex forcefully without pause.

**Sedentary time**

Physical activity and sedentary time were objectively measured using the ActiGraph GT3X activity monitor (ActiGraph, LLC., Pensacola, FL). The accelerometer was fixed with a nylon belt across the waist and over the dominant hip. Participants were instructed to wear the device for all waking hours for seven consecutive days. Removal was permitted for hygiene purposes, aquatic activity and sleep. A log sheet was kept of the date, time device was put on and removed, as well as work start time and work finish time.

The ActiGraph recorded in 60 second epochs and a minimum wear time of 10 hours per day for 4 days was required. Non-wear time was identified by 90 consecutive minutes of zero counts with a 2 minute spike tolerance (Choi et al., 2011). Simply, counts refer to the magnitude of gravitational force produced over a given time (1 count is equal to 0.01664 grams of force per second) and reflect movement intensity (ActiGraph Service, 2011).

Accelerometer data were reduced using ActiLife version 6.1 software (ActiGraph, LLC., Pensacola, FL). Sedentary time was defined as <100 counts per minute (cpm); and moderate to vigorous physical activity (MVPA) was defined as >1951 (Freedson et al., 1998). Outcome variables included: average sedentary time per day, proportion of total time spent sedentary, proportion of total time spent in sedentary bouts (bouts of 10 or more consecutive minutes of counts<100), proportion of total time spent in MVPA, and meeting or not meeting physical activity guidelines of ≥150 minutes per week of MVPA (Tremblay et al., 2011).

**Data Analysis**
All statistical analyses were performed using SPSS v21 (SPSS Inc, Chicago, Illinois, USA). Descriptive statistics (mean ±SD) were calculated for all variables. Proportion of time spent in MVPA and average MVPA per day did not meet the criteria of a normal distribution and a square root transformation was applied prior to analyses. Outliers were identified by a z-score of ±3.29 (Tabachnick & Fidell, 2007, p. 73) and were eliminated from analysis. Bivariate associations between sedentary time, physical activity, relative leg strength, and balance were assessed using Pearson’s correlation analysis. Multiple linear regression analyses were used to investigate associations between the dependent variables (CES and absolute peak torque of knee extensors and knee flexors) and independent variables (age, BMI, proportion of time spent sedentary, and proportion of time spent in MVPA). For CES, regression models were developed in the following sequence: Model 1: age. Model 2: Model 1 plus proportion of time spent sedentary. Model 3: Model 2 plus proportion of time spent in MVPA. For absolute peak torque of the knee extensors and flexors, regression models were developed in the following sequence: Model 1: age. Model 2: Model 1 plus body mass index. Model 3: Model 2 plus proportion of time spent sedentary. Model 4: Model 3 plus proportion of time spent in MVPA. Statistical significance was set at p<0.05.

Results

Participants

Fifty women volunteered for this study. After screening for outliers, data from one participant was removed due to a sedentary time value that was 35.4% of wear time (z-score = 3.51). Of the remaining 49 participants, one was unable to complete the strength testing due to injury, thus the strength analyses have a sample size of 48. Participant characteristics are summarized in Table 1.
On average, subjects spent 65% or 9.4 (±1.3) hours of their day sedentary. An additional 31.3% (4.5 hours) was spent in light activity and 3.3% (28.2 minutes) was spent in MVPA. Canada’s Physical Activity Guideline of 150 minutes per week of MVPA was met by 59% of women, with 19 of 49 reaching the recommendation in bouts of 10 minutes or longer.

Postural stability and strength

Bivariate correlation analyses demonstrated both postural stability and muscle strength were significantly associated with age, time spent sedentary, and time spent in MVPA (Table 2). The CES was inversely related to age (p = 0.04) and proportion of time spent sedentary (p = 0.01) and positively related to proportion of time spent in MVPA (p = 0.001). Knee extensor strength was positively associated with MVPA (p = 0.016) while knee flexor strength was inversely related to time spent sedentary (p = 0.033).

The results of the multivariate linear regression analyses for the CES are shown in Table 3. Age and time spent sedentary accounted for 12.5% (p = 0.017) of the variance in the CES. Adding time spent in MVPA to the model increased the $R^2$ to 22.5% (p = 0.002), and MVPA was the only significant parameter in model 3 (p = 0.012). For absolute peak torque of the knee extensors, the largest amount of variance was explained by the combination of age, BMI, time spent sedentary and time spent in MVPA (Table 4). Age, BMI, and time spent in MVPA were significant variables in the model, while time spent sedentary was not a significant predictor of knee extensor strength (p = 0.38). For absolute peak torque of the knee flexors, only 4.6% of the variance was explained by the same independent variables, none of which were significant.

Discussion
We found a moderate but significant correlation between proportion of time spent sedentary and both postural stability and peak torque of the knee flexors in women over 50 years of age. MVPA was positively related to postural stability and peak torque of the knee extensors. In contrast to our hypothesis, multiple linear regression analysis showed that time spent sedentary was not related to either postural stability or muscular strength after adjusting for MVPA. However, MVPA was significantly related to both peak torque of the knee extensors and the CES. To our knowledge this is the first study to demonstrate a positive relationship between objectively measured physical activity and postural stability.

Our findings are inconsistent with previous reports by Santos et al. (2012) and Davis et al. (2014) who both reported sedentary time to be related to measures of balance and lower extremity function independently of MVPA. This may be a result of the younger population used in our study (56.6 ± 4.1 years) compared to Santos et al. (2012) (74.3 ± 6.9 years) and Davis et al. (2014) (78.5 ± 5.7 years). It is possible that the effects of prolonged sedentary time on neuromuscular function accumulate as we age and will only be observed in an older adult population.

It is also likely that the laboratory-based assessments we used provide different information than the field tests used by previous researchers (Davis et al., 2014; Santos et al., 2012). The assessments used in the present study (i.e. dynamic posturography and isokinetic dynamometry) attempt to isolate one component of physical function whereas tests used in previous investigations more closely mimic activities of daily living. For example, the 8-foot up-&-go test used by Santos et al. (2012) will assess an individual’s coordination, balance, agility and power simultaneously rather than attempt to strictly isolate postural sway or isokinetic strength in a closed system. Because functional capacity relies on the coordinated and synergistic
activation of multiple systems, it may be more practical to use performance-based field tests in order to establish a relationship between sedentary time and functional capacity. That said, laboratory tests such as those in the present study are likely more sensitive to changes in balance and strength which could be valuable when examining a younger population. Furthermore, laboratory assessments may help us understand the mechanisms underlying the relationship between sedentary time or physical activity and neuromuscular function.

Time spent in MVPA was a significant correlate of postural stability, a result that has been previously reported in post-menopausal women (Brooke-Wavell et al., 1997) and reviewed in the literature (Skelton, 2001). It has been suggested that most of the risk factors for postural instability (i.e. poor proprioception, coordination, and power) are primarily explained by inactivity and aging (Lord et al. 1991). Postural stability across an array of visual and support surface conditions begins to diminish near the 4th decade of life and dramatically declines during and after the 5th decade (Choy et al., 2003). However, physical activity interventions such as Tai Chi (Voukelatos et al., 2007) and simple conditioning performed twice a week (Lord et al., 1996) have been shown to be highly effective in improving stability outcomes. The present results further support the importance of physical activity for preserving postural stability and preventing falls.

After accounting for age and BMI, peak torque around the knee during both extension and flexion was not associated with time spent sedentary. Time spent in MVPA was a significant predictor of the strength of the knee extensors but not knee flexors. This outcome is consistent with literature demonstrating the neuromuscular benefits of physical activity, as higher levels of MVPA are associated with increased strength (Warburton et al., 2006). The fact that MVPA was not associated with strength of the knee flexors is somewhat surprising. It is possible that
maximal contraction of the flexors was not achieved due to the protocol that was used, as flexion immediately followed knee extension and participants may have been more focused on maximal extension. In addition, flexor strength was assessed in a seated position, whereas many common knee flexor exercises are done in a lying or standing position (e.g. prone or standing hamstring curls, and supine hip extensions).

Our results show full-time working women over 50 spend approximately 9.4 (±1.3) hours (or 64%) of their day sedentary, which is considerably higher than previous reports (Hagstromer et al., 2007; Healy et al., 2008; Matthews et al., 2008). This discrepancy may be explained by the fact that the sample used in the present study was not nationally representative, and that 90% of the women were employed full-time in office-based occupations (i.e. administrative, managerial, and financial) which would significantly contribute to daily sedentary time (Parry & Straker, 2013).

The key strength of this study was the utilization of accelerometry, computerized dynamic posturography, and isokinetic dynamometry in the objective quantification of sedentary time and physical activity, postural stability and leg strength, respectively. However, some limitations should be noted. The sample size is small which may have diluted the strength of the associations. Additionally, the use of full-time working adults may have led to a selection bias known as the “healthy worker effect” (Li and Sung, 1999). It is plausible that women working into later years continue working partially due to superior health. Our data support a “healthy worker effect”, as current physical activity recommendations of 150 minutes of MVPA per week were met by 29 women (or 59%), with 19 of 49 women (or 39%) accumulating their 150 minutes in bouts of 10 minutes or longer. In contrast, Colley et al. (2011) found only 14% of Canadian women of similar age accumulate 150 minutes of MVPA in bouts of 10 minutes or longer and
Tucker et al. (2011) found 6.5% of American adults aged 50-59 reach 150 minutes per week of MVPA. These findings suggest that although women over 50 who work full-time spend much of their day sitting, they may also spend more time in purposeful activity than an age-matched, nationally representative sample. Furthermore, a recent study by Saidj et al. (2014) found that leisure- and work-sitting time were differentially associated with muscular fitness. Thus, our findings may not be applicable to other populations, such as women who are not working or women with poor health. Finally, although accelerometry is the current gold standard in objectively quantifying patterns of physical activity and sedentary time in free-living individuals, they do have limitations. One such limitation is their inability to capture non-ambulatory activity such as cycling, swimming, or resistance training. Therefore, while we found a relationship between MVPA and both lower body muscular strength and postural stability, we cannot comment on the type of exercise that is most likely to benefit these specific neuromuscular outcomes. It is possible that the relationships would be stronger with resistance-based exercise compared to endurance activity.

Conclusion

Mounting evidence suggests sedentary time is a unique health risk factor but the majority of research to date has focused on cardiovascular and metabolic outcomes (Healy et al., 2008; Koster et al., 2012; Tremblay et al., 2010). While sedentary behaviour may be an important risk factor for cardiometabolic disease, the present results suggest MVPA may be more important to neuromuscular outcomes than sedentary time. Accretion and preservation of both postural stability and lower leg function are important determinants of individual autonomy and
independence and, as such, emphasis should be placed on increasing MVPA as a means to increase and preserve muscular strength and balance.

References


Table 1. Participant characteristics of full-time working women ages 50 – 70 (N = 49).

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>56.6</td>
<td>4.1</td>
<td>50 - 67</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.64</td>
<td>.06</td>
<td>1.46 - 1.78</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>73.2</td>
<td>14.3</td>
<td>50 - 115.8</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.1</td>
<td>5.3</td>
<td>18.6 - 41.0</td>
</tr>
<tr>
<td>Avg. sedentary time per day (hours)</td>
<td>9.4</td>
<td>1.3</td>
<td>6.3 - 12.1</td>
</tr>
<tr>
<td>% Time spent sedentary</td>
<td>65.3</td>
<td>7.3</td>
<td>45.0 - 82.4</td>
</tr>
<tr>
<td>Avg. MVPA per day (min)</td>
<td>28.2</td>
<td>17.3</td>
<td>3.3 - 81.3</td>
</tr>
<tr>
<td>% Time spent in MVPA</td>
<td>3.3</td>
<td>2.0</td>
<td>.4 - 9.6</td>
</tr>
<tr>
<td>CES</td>
<td>74.5</td>
<td>5.4</td>
<td>59.0-86.0</td>
</tr>
<tr>
<td>Absolute peak torque extensors (Nm) at 60°•sec⁻¹  (N=48)</td>
<td>91.5</td>
<td>12.6</td>
<td>60-127</td>
</tr>
<tr>
<td>Absolute peak torque flexors (Nm) at 60°•sec⁻¹ (N=48)</td>
<td>77.6</td>
<td>12.8</td>
<td>54-118</td>
</tr>
</tbody>
</table>

CES = composite equilibrium score; MVPA = moderate to vigorous physical activity.
Table 2. Bivariate correlations of postural stability and strength with select independent variables in full-time working women ages 50–70.

<table>
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<tr>
<th></th>
<th>CES (N = 49)</th>
<th>Relative peak torque of extensors (N = 48)</th>
<th>Relative peak torque of flexors (N = 48)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>Age</td>
<td>-.295</td>
<td>.04</td>
<td>-.340</td>
</tr>
<tr>
<td>Proportion of time spent sedentary (%)</td>
<td>-.346</td>
<td>.01</td>
<td>-.241</td>
</tr>
<tr>
<td>Number of sedentary breaks</td>
<td>-.220</td>
<td>.133</td>
<td>-.109</td>
</tr>
<tr>
<td>Proportion of time spent in MVPA (%)</td>
<td>.455</td>
<td>.001</td>
<td>.345</td>
</tr>
</tbody>
</table>

CES = composite equilibrium score; MVPA = moderate to vigorous physical activity.
Table 3 Standardized coefficient $\beta$ and significance of parameters for multiple linear regression analysis of composite equilibrium score in full-time working women ages 50 – 70 (N = 49).

<table>
<thead>
<tr>
<th></th>
<th>Model 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th></th>
<th>Model 2&lt;sup&gt;b&lt;/sup&gt;</th>
<th></th>
<th>Model 3&lt;sup&gt;c&lt;/sup&gt;</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>95% CI</td>
<td>P</td>
<td>B</td>
<td>95% CI</td>
<td>P</td>
</tr>
<tr>
<td>Age</td>
<td>-.295</td>
<td>(-.763, -.020)</td>
<td>.040</td>
<td>-.213</td>
<td>(-.659, .093)</td>
<td>.137</td>
</tr>
<tr>
<td>Time spent sedentary</td>
<td>-.285</td>
<td>(-.420, -.001)</td>
<td>.049</td>
<td>-.158</td>
<td>(-.327, .093)</td>
<td>.269</td>
</tr>
<tr>
<td>Time spent in MVPA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model adjusted $R^2$ (p for model)</td>
<td>.068 (.040)</td>
<td></td>
<td></td>
<td>.125 (.017)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MVPA = moderate to vigorous physical activity

<sup>a</sup> Model 1: adjusted for age

<sup>b</sup> Model 2: adjusted for age and proportion of time spent sedentary

<sup>c</sup> Model 3: adjusted for age, proportion of time spent sedentary, and proportion of time in MVPA
Table 4. Standardized coefficient β and significance of parameters for multiple linear regression analysis of knee extensor absolute peak torque at 60°·sec⁻¹ in full-time working women ages 50 – 70 (N = 48).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Model 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th></th>
<th>Model 2&lt;sup&gt;b&lt;/sup&gt;</th>
<th></th>
<th>Model 3&lt;sup&gt;c&lt;/sup&gt;</th>
<th></th>
<th>Model 4&lt;sup&gt;d&lt;/sup&gt;</th>
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<tbody>
<tr>
<td></td>
<td>B 95% CI P</td>
<td>B 95% CI P</td>
<td>B 95% CI P</td>
<td>B 95% CI P</td>
<td>B 95% CI P</td>
<td>B 95% CI P</td>
<td>B 95% CI P</td>
<td>B 95% CI P</td>
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<tr>
<td>Age</td>
<td>-.404 (-2.13, -.418) .004</td>
<td>-.455 (-2.28, -.581) .001</td>
<td>-.458 (-.563,.921) .002</td>
<td>-.432 (2.20,-.521) .002</td>
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<tr>
<td>BMI</td>
<td>.249 (-.053,1.132) .070</td>
<td>.247 (-.076,1.33) .079</td>
<td>.270 (.013, 1.35) .046</td>
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<tr>
<td>Time spent sedentary</td>
<td>.233 .014 (-.482, .532) .921</td>
<td>.124 (-2.87, .737) .380</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Time spent in MVPA</td>
<td>.325 (1.13, 13.9) .022</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Model adjusted R² (p for model)</td>
<td>.145 (.004)</td>
<td>.189 (.003)</td>
<td>.170 (.010)</td>
<td>.249 (.002)</td>
<td></td>
<td></td>
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</tbody>
</table>

MVPA = moderate to vigorous physical activity

<sup>a</sup> Model 1: adjusted for age

<sup>b</sup> Model 2: adjusted for age and BMI.

<sup>c</sup> Model 3: adjusted for age, BMI, and proportion of time spent sedentary.

<sup>d</sup> Model 4: adjusted for age, BMI, proportion of time spent sedentary, and proportion of time in MVPA