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Profiles of resistance training behavior and sedentary time among older adults: Associations with health-related quality of life and psychosocial health☆

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ABSTRACT

Background. The primary objective of this study was to gain a better understanding of the associations of health-related quality of life (HRQoL) and psychosocial factors (e.g., satisfaction with life, level of self-esteem, anxiety, depression) with resistance training and sedentary behavior profiles.

Methods. For this cross-sectional study, 358 older adults (≥55 years of age) across Alberta, Canada, completed self-reported measures of resistance training behavior, sedentary time, HRQoL, and psychosocial health (e.g., depression, anxiety, self-esteem, satisfaction with life). Participants were placed into one of four profiles with respect to their sedentary and resistance training behaviors. Data were collected in Alberta, Canada between August 2013 and January 2014.

Results. Pairwise comparisons indicated that those in the low SED/low RT group had a higher mental health composite (MHC) score compared to those in the high SED/low RT group ($M_{diff} = 3.9$, $p = 0.008$). Compared to those in the high SED/low RT group, those in the low SED/high RT groups had significantly higher MHC scores ($M_{diff} = 4.8$, $p < 0.001$). Those in the low SED/high RT group reported significantly higher physical health composite scores (PHC) ($M_{diff} = 3.7$, $p = 0.019$), compared to the high SED/low RT group. Lower depression symptom scores were observed in the low SED/high RT groups compared to the high SED/low RT group, ($M_{diff} = -0.60$, $p < 0.001$).

Conclusion. Resistance training, regardless of sedentary time, was significantly associated with HRQoL and psychosocial health.

Introduction

Research suggests moderate-to-vigorous physical activity (MVPA) among older adults has positive effects on participant-reported psychosocial health outcomes such as depression, mood, anxiety, and health-related quality of life (HRQoL) (Kimura et al., 2010). A growing body of intervention research has demonstrated positive associations of resistance training (RT) with HRQoL and psychosocial health outcomes (Brovold et al., 2012; Katula et al., 2008; Kimura et al., 2010).

Sedentary behaviors (SED) have been conceptualized as sitting or reclining and are in the energy-expenditure range of 1.0 to 1.5 metabolic equivalents (METs) (Owen, 2012). Sedentary behaviors are not to be confused with physical inactivity (i.e., performing insufficient amounts of moderate-to-vigorous intensity physical activity; Sedentary Behaviour Research Network, 2012). Emerging evidence suggests older adults who spend large amounts of time sedentary report poorer HRQoL compared to older adults who sit less (Vallance et al., 2013). One recent systematic review suggested older adults are sedentary on average for 9.4 h a day as determined by objective measures (5.4 h a day for self-report measures) (Harvey et al., 2014).

Recent studies have examined physical activity in concert with sedentary time with data suggesting large amounts of sedentary time have hazardous health consequences irrespective of how physically active an individual is (Owen et al., 2010; Van der Ploeg et al., 2012). To date, no studies have dually considered profiles of both resistance training and sedentary behaviors among older adults. The primary objective of this study was to determine associations of HRQoL and psychosocial factors with resistance training and sedentary behavior among older adults.

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Methods

Participants and procedures

Older adults (men and women) across Alberta, Canada were invited to participate in this study. Inclusion criteria included (a) men and women ≥55 years of age and (b) free from chronic medical and orthopedic conditions that may preclude resistance training (e.g., use of a mobility aid, recent knee or hip replacement).

Older adults were recruited by placing a series of research notices in urban and rural newspapers. After pre-screening, a survey package containing a detailed information letter, questionnaire, business reply envelope and $5 gift card to a local coffee chain was sent to each interested participant. We conducted a second mail out 3 weeks later to those subjects who did not respond to the initial mail out. Data were collected in Alberta, Canada between August 2013 and January 2014. Ethical approval was obtained from the Athabasca University Research Ethics Board.

Measures

Resistance training was assessed by three survey items asking overall years of experience, resistance training frequency and typical training session duration. Participants were asked how often they did resistance training activities over a typical week during the past month (i.e., 0 to 7 days). For those who were resistance trained, participants were asked to indicate duration of their typical training sessions (i.e., less than 10 min, between 10 and 30 min, between 30 and 60 min and more than 60 min). Prior to completing the resistance training survey, participants were provided with a comprehensive definition of resistance training (American College of Sports Medicine (ACSM), 2009) and specific examples of both isometric and isotonic resistance exercises.

Sedentary time was assessed using the Total and Domain Specific Measure of Sitting (Marshall et al., 2014). The TDSMS includes five items assessing time spent sitting (hours and min) on a typical day during the past week in the following domains: a) while traveling to and from places, b) while at work, c) while watching television, d) while using a computer at home, and e) at leisure not including watching television, on a weekday and a weekend day.

HRQoL was assessed using the RAND-12 (12 items) (Ware et al., 1996), which measures physical and mental dimensions of HRQoL taken from the RAND-36 Health Status Inventory (Maddigan et al., 2004). The RAND-12 gives two scores; a mental health component scale (MHC) and a physical health component scale (PHC), each comprising six items. A PHC score ≤42 suggests that perceived physical health problems are impeding life functioning, while an MHC score ≤38 likely indicates that an individual is experiencing psychological symptoms that might be impeding life functioning (Ware et al., 1996).

Psychosocial health

Depression symptoms were assessed using the Patient Health Questionnaire, PHQ-2, a two-item version of the PHQ-9 depression screener (Forti and Organisation for Economic Cooperation and Development, 2014). Anxiety was assessed using the two-item Generalized Anxiety Disorder scale (GAD-2) (Kroenke et al., 2007). Self-esteem was measured by the 10-item Rosenberg Self-Esteem Scale (RSES). Satisfaction with life was assessed using Diener's five-item Satisfaction With Life Scale (SWLS) (Diener et al., 1985).

Statistical analysis

Participants were categorized as not meeting resistance training guidelines (<2 days per week) or meeting resistance training guidelines (≥2 days per week) (American College of Sports Medicine (ACSM), 2009). A median-split categorized those into a low sedentary time (<482 total min/day; coded as 0) and high sedentary time group (≥482 min/day; coded as 1). Four profiles were generated and included 1) low sedentary/not meeting resistance training guidelines (low SED/low RT), 2) low sedentary/meeting resistance training guidelines (low SED/high RT), 3) high sedentary/not meeting resistance training guidelines (high SED/low RT), and 4) high sedentary/meeting resistance training guidelines (high SED/high RT) (Table 1).

Two multivariate analyses of covariance variance models were generated to test for differences in HRQoL (i.e., PHC and MHC) and psychosocial health variables between SED and RT behavioral profiles. Variables that were associated with the dependent variables (bivariate correlation = $p < 0.20$) were included as covariates. For HRQoL, covariates included age, smoking, income, marital status, gender, and chronic disease (i.e., at least one chronic disease). For the psychosocial model, covariates included age, income, employment status, education, marital status, gender, and chronic disease. Data were entered and analyzed in SPSS version 19.

Results

A total of 393 individuals contacted the study team to participate, of which 358 participants returned a completed survey, for a response rate of 91% (358 out of 393). The sample contained 236 women (66%). The mean age of the participants was 66.5 years ($SD = 8.0$).

The total average sedentary time per day was 544.4 min ($SD = 369.1$), or 9.1 h per day (Table 2). Adjusted mean HRQoL and psychosocial health scores across resistance training and sedentary time profiles are shown in Table 2. For HRQoL, the mean scores were as follows: MHC score ($M = 47.6, SD = 8.2$); PHC score ($M = 52.30, SD = 9.4$); and global health composite (GHC) score ($M = 49.7$, $SD = 8.5$). These mean scores reflect a mild disability level.

The four categories representing participant's activity levels are as follows: low SED/low RT ($n = 78$); low SED/high RT ($n = 103$); high SED/low RT ($n = 88$); and high SED/high RT ($n = 89$) (Table 2). For HRQoL, the overall MANCOVA was significant when comparing behavioral profiles [Wilks' $\lambda = 0.935$, $F(6,664) = 3.789$, $p = 0.001$]. Pairwise comparisons indicated that those in the low SED/low RT group had a higher MHC score compared to those in the high SED/low RT group ($M_{diff} = 3.9$, $p = 0.008$). Compared to those in the high SED/low RT group, participants in the low SED/high RT groups had significantly higher MHC scores ($M_{diff} = 4.8$, $p < 0.001$). For PHC, compared to the

Table 1
Descriptive statistics for average daily weekday and weekend sedentary behaviors among older adults.

Sedentary behaviors	Weekday		Weekend		*p*
	Mean (*SD*)	Range	Mean (*SD*)	Range	
a. Minutes spent sitting while traveling to and from places	60.9 (48.1)	(0, 300)	59.9 (57.1)	(0, 420)	0.000
b. Minutes spent sitting while working or volunteering	113.2 (161.1)	(0, 600)	34.0 (91.0)	(0, 720)	0.000
c. Minutes spent sitting watching television	153.3 (108.4)	(0, 720)	171.2 (122.6)	(0, 925)	0.000
d. Minutes spent sitting while using computer at home	86.1 (100.5)	(0, 600)	81.2 (104.9)	(0, 900)	0.000
e. Minutes spent sitting during leisure time	117.6 (105.6)	(0, 720)	144.0 (113.3)	(0, 720)	0.000
f. Total sitting time	563.4 (428.0)	(0, 5130)	496.9 (292.1)	(0, 2700)	0.000

Data are presented as the mean (M), standard deviation (SD) and range.

Table 2
HRQoL and psychosocial health (adjusted) mean scores across resistance training and sedentary time profiles.

Model	Low SED/Low RT[1] ($n = 78$)	Low SED/High RT[2] ($n = 103$)	High SED/Low RT[3] ($n = 88$)	High SED/High RT[4] ($n = 89$)	F	p
HRQoL ($n = 343$) [Wilks' $\lambda = 0.935$, $F(6,664) = 3.789$, $p < 0.001$]						
PHC	52.8 (0.97)	54.0 (0.84)[3]	50.3 (0.89)[2]	52.2 (0.92)	3.00	$p = 0.031$
MHC	48.4 (0.88)[3]	49.3 (0.76)[3]	44.5 (0.82)[1,2,4]	48.6 (0.84)[3]	7.06	$p < 0.001$
Psychosocial health ($n = 351$) [Wilks' $\lambda = 0.897$, $F(12,897) = 3.115$, $p < 0.001$]						
Depressive	0.43 (0.11)[3]	0.31 (0.10)[3]	0.91 (0.11)[1,2]	0.63 (0.11)	6.04	$p < 0.001$
Anxiety	0.71 (0.14)	0.60 (0.12)[3]	1.3 (0.13)[2]	1.1 (0.13)	5.82	$p = 0.001$
Satisfaction with life	27.7 (0.70)[3]	29.2 (0.61)[3]	24.9 (0.66)[1,2]	27.1 (0.66)	7.62	$p < 0.001$
Self-esteem	16.4 (0.56)	14.4 (0.49)	16.2 (0.52)	15.8 (0.53)	2.91	$p = 0.035$

SED = sedentary time; RT = resistance training.
Data are presented as the mean and standard error.
Superscript numerals denote statistically significant group comparison.
Data are presented as the mean (M), standard deviation (SD), and standard error (SE). PHC = physical health composite score, MHC = mental health composite score. HRQoL model adjusted for income, age, chronic disease, gender, and marital status. Psychosocial health model adjusted for employment status, education, income, age, chronic disease, gender, and marital status.

high SED/low RT group, participants in the low SED/high RT group reported significantly higher PHC scores ($M_{diff} = 3.7$, $p = 0.019$).

For the psychosocial health variables, the overall MANCOVA was significant when comparing behavioral profiles [Wilks' $\lambda = 0.897$, $F(12,897) = 3.115$, $p < 0.001$]. For depression, compared to the high SED/low RT group, lower depression symptom scores were observed in both the low SED/low RT ($M_{diff} = -0.48$ $p = 0.014$) and low SED/high RT groups ($M_{diff} = -0.60$, $p < 0.001$). For SWLS, compared to the high SED/low RT group, higher scores were observed in both the low SED/low RT ($M_{diff} = 2.8$, $p = 0.022$) and low SED/high RT groups ($M_{diff} = 4.3$, $p < 0.001$). For anxiety, the low SED/high RT group reported significantly lower scores compared to the high SED/low RT group ($M_{diff} = -0.67$, $p = 0.001$). The low SED/low RT group reported significantly lower scores than the high SED/low RT group ($M_{diff} = -0.57$, $p = 0.018$).

Discussion

Our data indicated that specific profiles of resistance training and sedentary time are associated with HRQoL and psychosocial health. In particular, participants engaging in high volumes of sedentary time (i.e., ≥482 minday) as well as not meeting resistance training guidelines (i.e., at least two times per week) reported significantly poorer HRQoL (i.e., poorer scores on the PHC and MHC) and also significantly more symptoms of depression and anxiety, and lower satisfaction with life.

Resistance training has been shown to improve several indices of well-being including depression, anxiety and quality of life for older adults (Chodzko-Zajko et al., 2009). Data supporting an association between sedentary time and HRQoL and psychosocial health are emerging. Among older adults, Vallance et al. (2013) found those in the highest quartile of sedentary time had poorer HRQoL compared to older adults in the lowest quartile of sedentary time. Further, a substantial body of evidence supports the link between sedentary time and depression (e.g., Vallance et al., 2011; Zhai et al., 2014). As hypothesized, we found older adults with the highest levels of sedentary time combined with the lowest levels of resistance training reported significantly poorer scores across HRQoL and psychosocial health indices compared to older adults with low levels of sedentary time and high levels of resistance training. Our data extend this literature base by examining different combinations of sedentary time and resistance training behaviors.

Regardless of resistance training profile, those who engaged in low amounts of sedentary time reported higher HRQoL and lower depression scores compared to those engaging in high amounts of sedentary time. This suggests that resistance training may not necessarily be protective of HRQoL and depression on its own, but that the amount of time spent being sedentary is more important. In the general population, some evidence has emerged suggesting that health consequences associated with excessive sedentary time (e.g., higher mortality) are independent of whether an individual is physically active or not (e.g., the 'active couch potato' hypothesis) (Owen, 2012; van der Ploeg et al., 2012). Our data provides some confirmation (albeit with respect to resistance training) of this hypothesis given low SED/low RT participants reported significantly lower HRQoL and depression scores compared to participants in the low SED/high RT group.

The primary limitations of this study are the self-report measures and the lack of generalizability to the older Albertan population. We did not include a measure of resistance training duration as interpreting any specified duration is difficult and open to misinterpretation. Further, our resistance training behavior measure had no previous evidence of validity and reliability. However, our single-item indicator of resistance training behavior is similar to measurement approaches used in larger scale population-based initiations (e.g., National Health and Nutrition Examination Survey). Associations were not adjusted for light activity and MVPA, and therefore represent total effects including time displacement (that is, that more sedentary time displaces time that would otherwise be spent in light activity or MVPA). The overall descriptive statistics for the HRQoL, depressive symptoms, anxiety, self-esteem, and satisfaction with life variables suggest that our sample of older adults was generally very healthy. As a result, our study recruitment methods may have led to a response bias whereby individuals who were generally healthy and interested in the study topic participated.

Our data suggests older adults engaging in high volumes of daily sedentary time as well as not meeting resistance training guidelines reported significantly poorer HRQoL. Rather than studying health behaviors in isolation, it may be worthwhile to examine multiple health behaviors and establish profiles of health behaviors when examining how these behaviors are associated with outcomes such as HRQoL and psychosocial health. Along with encouraging older adults to engage in resistance training, it appears equally important to encourage older adults to spend less time in sedentary pursuits.

Conflict of interest

All authors declare no conflict of interest.

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