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Differences in daily objective physical activity and sedentary time between women with self-reported fibromyalgia and controls: results from the Canadian Health Measures Survey

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Contributors

PB conceived the study. PB provided statistical expertise in complex survey. GHM and SA conducted the primary statistical analyses and wrote results section. PB and CK wrote introduction and discussion sections. All authors contributed to refinement of the study protocol and approved the final manuscript

Declaration of interest

All authors declare that they have no competing interests for this work.

Abstract

Introduction

Physical activity and sedentary behaviors are important modifiable factors that influence health and quality of life in women with fibromyalgia. The purpose of this study was to compare objectively assessed physical activity and sedentary time in women self-reporting fibromyalgia with a control group.

Method

Data were drawn from the Canadian Health Measures Survey cycle 1, 2 and 3 conducted by Statistics Canada. We included women aged 18 to 79 years with complete accelerometer data. We performed one-way analyses of covariance (adjusted-for socio-demographic and health factors) to determine mean differences in physical activity and sedentary variables (minutes per day of moderate and vigorous physical activity, light physical activity, sedentary and daily steps) between women with and without fibromyalgia.

Results

In total, 4132 participants were included. A cross-sectional weighted analysis indicated that 3,1% of participants self-reported a diagnosis of fibromyalgia. Participants with fibromyalgia spent less time than controls engaged in moderate and vigorous physical activity (M = 19.2 min/d (SE=0.7) vs M = 9.1 min/d (SE=1.2), $p = 0.03$, $\eta^2 = 0.01$). No significant differences were found for daily time spent in light physical activity, sedentary activities and number of steps.

Conclusion

Women participants with self-reported fibromyalgia spent significantly less time in moderate and vigorous physical activity than control. Physical activity promotion interventions for women with self-reported fibromyalgia should, as a priority, target physical activities with moderate to vigorous intensity.

Keywords

Exercise, Fibromyalgia, Canada, Sedentary, walking

Introduction

Fibromylagia is a chronic disease defined by the American College of Rheumatology as generalized pain lasting for longer than three months with tenderness on palpation at least four of five specific tender points [1]. Individuals with fibromyalgia typically experience severe fatigue, sleep disturbances and emotional disorders [2]. Taken together, these symptoms impair daily life activities and reduce health related quality of life [3].

Physical activity and sedentarity levels are major modifiable factors that influence fibromyalgia because they are independently associated with less severe symptoms [4, 5], better sleep quality [6] and higher quality of life [4]. A recent Cochrane review suggested that exercise interventions improve health related quality of life and physical functions at short term. However, authors recommended further trials to draw solid conclusions [7].

The assessment of physical activity and sedentary behaviors is challenging, particularly for adults with fibromyalgia. Indeed, self-reported measures of physical activity were found to be poorly associated with objective measures [8, 9]. Thus, it appears complicated to clearly understand the physical activity and sedentary patterns based on self-reported measures.

Different levels of physical activity and sedentary have been previously objectively measured in women diagnosed with fibromyalgia and compared to healthy controls. Three previous cross-sectional investigations established that patients with fibromyalgia have a significantly reduced duration of moderate and vigorous physical activity (MVPA) [9–11]. Contradictory findings were found about light physical activity (LPA), number of steps and sedentary activities [9–11].

Another issue that needs to be investigated using objective measures is whether daily sedentary time is higher in adults with fibromyalgia. Only one study investigated this question and suggested that participants with fibromyalgia spent significantly more time than controls in sedentary activities [11]. The purpose of this study was to compare objectively assessed physical activity and sedentarity in a representative sample of women self-reporting fibromyalgia with a control group.

Methods

Participants and study background

Data were drawn from the Canadian Health Measures Survey (CHMS) cycle 1, 2 and 3 conducted by Statistics Canada between 2007 and 2013. The CHMS is a national survey representative of approximately 96% of the Canadian population, aged 6 to 79 years [12]. Data were collected in 2 stages. First, sociodemographic and general health information were collected during an in-person household interview at the participants' homes. Then, direct physical measurements were collected during a subsequent visit to a mobile examination center. All respondents provided written informed consent. Ethics approval to conduct the survey was obtained from Health Canada's Research Ethics Board [13]. We included women aged 18 to 79 years with complete physical activity data. Participants with functional limitation or pregnant women were excluded.

Sociodemographic and clinical characteristics.

We used data for age, level of education, household income, working status (yes/no for last 12-month), marital status, smoking status, cotinine levels, and body mass index to describe the sample.

Women with self-reported fibromyalgia (SRF) was defined by the response to the following question during the CHMS interview: "Has a health care provider ever diagnosed you that you had fibromyalgia?". The other self-reported clinical characteristics measured were the following: subjective health compared to previous year, mental health, diagnosis of mood disorder, quality of life, sleep duration, sleep problems and restorative sleep.

Objective measures of physical activity and sedentary

Physical activity and sedentary behaviors were objectively measured using the Actical accelerometer (Phillips -Respironics). Actical recorded time-stamped acceleration in all directions, thereby indicating the intensity of physical activity [14]. Participants were instructed to wear an Actical accelerometer over their right hip on an elasticized belt during their waking hours for seven consecutive days (weight: 17 grams). Accelerometer signals are also translated into steps accumulated per minute. The Actical has been validated to measure physical activity in adults [14]. In order to be included in the analyses, respondents had to have four or more valid days of actigraphic data (i.e., defined as 10 or more hours

of wear time) [15]. Accelerometer data were not included in the analyses if a participant had extreme counts (i.e., 20 000 cpm) [16]. The number of minutes per day spent in physical activity at different intensity levels was categorized using standard count value per minute (cpm) for adults: sedentary (<100 count value per minute [cpm]), light (100 to 1534 cpm), moderate and vigorous (⩾1535 cpm) [17]. The following variables were separately used in analyses: average steps per day, average minutes per day of LPA and MVPA, and average minutes per day of sedentarity.

Statistical analyses

To account for the complex, multistage probability sampling design, weights (i.e., activity monitor subsample weights combining cycle 1, 2, 3) and bootstraps provided by the CHMS were used in the analyses. Differences in socio-demographic and physical activity/sedentary characteristics were assessed with t-test and chi-square test. The data on MVPA were not normally distributed and were therefore log transformed. We performed one-way analyses of covariance (ANCOVA) to determine mean differences in physical activity and sedentary variables between women with and without SRF. Age, body mass index, accelerometer wearing time, season, occupational status, smoking (cotinine), education level and income were included in all ANCOVA. All analyses were carried out using *survey* [18] package in R version 3.3.

Results

Data from 4132 participants were available for the analyses. Cross-sectional weighted analyses indicated that 3.1% of CHMS women self-reported a diagnosis of fibromyalgia. Women with SRF were significantly older, had a higher body mass index, and were less likely to be employed. They reported a significant deterioration of health during the last 12-month, a higher frequency of impaired mental health and sleep outcomes. On average, women with SRF spent 9.1 (SE = 1.2), 196.6 (SE = 8.6) and 546.8 (SE = 12.6) minutes per day of MVPA, LPA and sedentary behavior, respectively. They also performed 6084 (SE = 318) daily steps. Data from six univariate outliers were excluded because of extreme accelerometer data. Table 1 shows weighted characteristics of participants included in the analyses.

The participants with SRF spent less time than controls engaged in MVPA (M = 9.1 min/d (SE=1.2), p = 0.03 versus M = 19.3 min/d (SE=0.7), η^2= 0.01). No significant differences were found for daily time

spent in light PA, sedentary activities and average step counts. Figure 1 shows the daily physical activity and sedentary time in participants with and without SRF (see online for supplementary tables and detailed results).

Discussion

The purpose of the present study was to compare physical activity and sedentary durations in women with SRF with a control group in a representative national sample. The key finding of this study was that only daily MVPA duration was significantly lower in women with SRF, whereas no significant differences was found for time spent in LPA, sedentary and daily number of steps.

The weighted SRF prevalence (3.1%) in our sample was in accordance with international studies [19], ranged from 2.4 to 6.8%. Participants with SRF had a deteriorated perceived health, mental health, quality of life and sleep. In comparison to previous investigations including female with diagnosis of fibromyalgia [9, 11], CHMS's women with SRF had similar time spent in daily physical activity and sedentary activities.

The significant lower level of MVPA in women with SRF is consistent with previous findings including participants with diagnosis of fibromyalgia [9–11]. However, the effect size was small compared to those observed in these studies [9–11]. Regarding to daily LPA, no significant difference was also observed in two previous investigations [9, 10]. However, it is inconsistent with a study showing that women with fibromyalgia spent lower time in LPA [11]. Findings from daily step counts suggest that women with or without SRF take similar steps per day. It differs from Segura-Jiménez et al. that found a significant difference (with large effect) between fibromyalgia patients and controls [11]. In the current study, participants with SRF spent ~7 hours per day being engaged in sedentary behaviors; it was not significantly lower than control subjects. Segura-Jiménez et al. reported a significant difference between females diagnosed with fibromyalgia and control subjects [11]. Our findings contrast with the aforementioned study for time spent in LPA, sedentary activities and daily steps. These differences might be attributable to recruitment strategies of participants (i.e., passive recruitment versus national

sampling strategy [12]), to determination of fibromyalgia status (i.e., self-reported versus diagnosed), but also to the use of different accelerometers.

The main strengths of this study include the use of objective data of physical activity and sedentary behaviors from a nationally representative sample. Thus, our findings are generalizable to the Canadian women population. The major limitation was that fibromyalgia diagnosis was self-reported and not provided by medical records or checked by a doctor. This study is also limited by its cross-sectional design restricting the ability to make causal inferences.

Taken together, our results support that only MVPA duration is significantly lower in women with SRF. Thus, physical activity promotion interventions for women with fibromyalgia should, as a priority, target physical activities with moderate to vigorous intensity [20, 21]. It is important to note that physical activities with moderate intensity are more readily adopted and maintained than vigorous physical activity [21]. Even if the fibromyalgia was not associated with higher time spent in sedentary, researchers and clinicians should be not discouraged to develop intervention to reduce the sedentary activities among their patients. Indeed, the sedentary behavior has deleterious effects on pain for women with fibromyalgia [5].

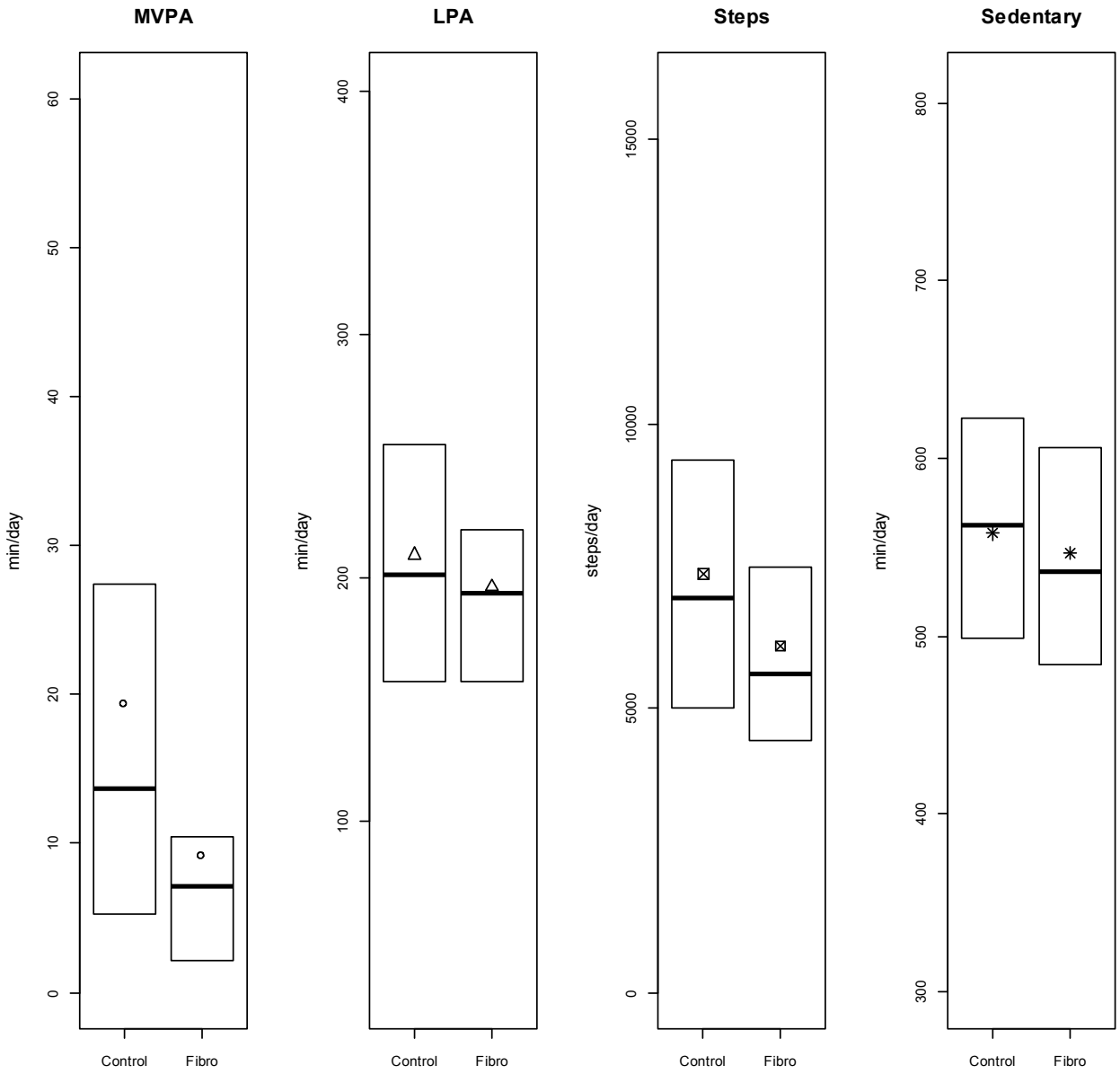
196 **Table 1**
197 Weighted women characteristics of the Canadian Health Measures Survey (cycle 1,2,3)
198

	Control	Fibromyalgia	Univariate test	p
Age (years) M(Se)	45.3 (0.4)	53.7 (1.2)	t = 6.6	0.0004E-07
BMI M(Se)	25.8 (0.1)	27.9 (0.7)	t = 2.7	0.006
Worked at job last year %(N)	73.2 (8 690 005)	56.5 (219 611)	F = 6.8	0.009
Marital status (alone) %(N)	36.2 (4 398 513)	27.3 (106 656)	F = 1.7	0.19
Income %(N)				
<$20k	7.9 (959 712)	16.5 (64 350)	F = 2.1	0.06
$20k-$29,99k	8.4 (1 018 836)	9.9 (38 744)		
$30k-$39,99k	11.2 (1 360 983)	6.2 (24 422)		
$40k-$49,99k	10.2 (1 243 557)	4.6 (18 119)		
$50k-$59,99k	9.4 (1 139 840)	13.3 (51 909)		
$60k-$69,99k	15.6 (1899 393)	23.7 (92 739)		
$70k-$79,99k	11.5 (1 403 111)	10.5 (41 084)		
>=$80k	26 (3 165 686)	15.3 (59 819)		
Education %(N)				
Highschool or lower	15.2 (1 855 470)	10.8 (42 484)	F = 2.5	0.06
College	28.7 (3 498 369)	36.4 (144 143)		
University	28.7 (3 492 245)	11.4 (44 963)		
Missing	27.4 (3 340 848)	41.4 (163 783)		
Self reported symptoms and disease				
Self-rated health compared to 1 year ago %(N)				
Much-somewhat better/about the same	86 (10 486 224)	66.4 (259 676)	F = 15.5	0.0009E-01
Somewhat-much worse	14 (1 704 894)	33.6 (131 511)		
Self reported mood disorder %(N)	12 (1 465 261)	40.8 (159 722)	F = 28.5	0.0001E-03
Psychosocial outcomes				
Self-perceived quality of life %(N)				
fair/poor	5.3 (641 309)	21.7 (85 383)	F = 29	0.0001E-03
(very)good/excellent	94.7 (11 547 982)	78.3 (307 631)		
Self-rated mental health %(N)				
fair/poor	5.6 (687 791)	19.9 (78 003)	F = 26.2	0.0004E-03
(very)good/excellent	94.4 (11 501 649)	80.1 (314 861)		
Sleep outcomes				
Sleep duration (hr) M(Se)	7.2 (0.04)	6.6 (0.2)	t = -3.5	0.0004
Frequency of sleep problems %(N)				
Never/rarely/sometimes	76.4 (9 316 384)	45.6 (178 502)	F = 37.8	0.0002E-05
Most of /all the time	23.6 (2 874 098)	54.4 (213 322)		
Restorative sleep %(N)				
Most of /all the time	55.8 (6 797 406)	34.5 (134 978)	F = 7.4	0.007
Never/rarely/sometimes	44.2 (5 393 139)	65.5 (256 782)		
Smoking variables				
Smoking %(N)	18 (2 192 101)	18.4 (72 016)	F = 0.005	0.94
Levels of cotinine M(Se)	196.6 (16.6)	263.0 (90)	t = 0.7	0.46
Season				
Autumn %(N)	31.7 (3 867 069)	43.5 (170 123)	F = 2.7	0.04
Spring %(N)	25.4 (3 099 844)	31 (121 110)		
Summer %(N)	22 (2 680 042)	7.6 (29 798)		
Winter %(N)	20.8 (2 534 208)	17.8 (69 836)		
Characteristics of physical activity and sedentary				

Acc wearing time (hr/day) M(Se)	13.1 (0.06)	12.5 (0.2)	t = -2.7	0.006
MVPA (min/day) M (Se)	19.2 (0.7)	9.1 (1.2)	t = -7.0	0.0002E-08
LPA (min/day) M (Se)	209.5 (2.0)	196.6 (8.6)	t = -1.4	0.14
Steps (steps/day) M (Se)	7360.4 (92)	6084.5 (318)	t = -3.8	0.0001
Sed (min/day) M (Se)	557.7 (3.0)	546.8 (12.6)	t = -0.9	0.38

Notes. BMI = Body Mass Index, Acc = Accelerometer, LPA = Light Physical Activity, MVPA = Moderate and Vigorous Physical Activity, Sed = Sedentary behavior, min = minutes, hr = hours

Figure 1 Daily physical activity and sedentary time (weighted) in participants with and without self-reported fibromyalgia.



Notes. MVPA = Moderate and Vigorous Physical Activity, LPA = Light Physical Activity. The whiskers are voluntary missing because Statistic Canada does not allow figures with individual representation.

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