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Are Women with Fibromyalgia Less Physically Active than Healthy Women?

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Abstract

Purpose—The primary purpose was to quantify and compare physical activity in fibromyalgia (FM) patients to age-matched healthy controls using both objective and self-report measures. Secondary purposes were to compare self-reported and objective measurement of physical activity and to evaluate the relationship between physical activity and pain and mood.

Method—Patients with FM (n = 39) and healthy controls (n = 40) completed the International Physical Activity Questionnaire and wore an accelerometer at the hip for 7 d. Pain and mood were measured using the McGill Pain Questionnaire, Pain Catastrophizing Scale, Beck Depression Inventory, State–Trait Anxiety Inventory, Profile of Mood States, and Fibromyalgia Impact Questionnaire.

Results—FM patients had significantly lower physical activity than controls measured by both the International Physical Activity Questionnaire and accelerometer ($P < 0.05$). Both groups self-reported significantly greater moderate and vigorous physical activities than were measured by the accelerometer ($P < 0.05$). Self-reported and objective measures of time spent in different intensities of activity showed significant correlations in healthy controls (r = 0.41–0.51, $\rho = 0.41$, $P < 0.05$). No significant correlations between measures were found in FM patients ($P > 0.05$). Finally, physical activity levels were negatively related ($r = -0.37$, $P < 0.05$) to depressed mood for FM patients and positively related ($r = -0.41$, $P < 0.05$) to self-reported vigor for healthy controls.

Conclusions—This controlled study objectively demonstrates that FM patients are less physically active than healthy controls, thus extending on two earlier investigations that did not show differences in total physical activity levels using wrist-mounted actigraphy methods. Physical activity levels were not predictive of pain in FM but were significantly related to depressed mood. FM patients may also have a greater variability in their manner of self-report than healthy controls. Therefore, physical activity measurement in FM patients should not be limited solely to self-report measures.

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Keywords

EXERCISE; CHRONIC PAIN; MUSCLE; ACTIGRAPHY; ACCELEROMETER; SELF-REPORT

Fibromyalgia (FM) is a chronic condition characterized by widespread pain and tenderness (35). The American College of Rheumatology criteria for diagnosis of FM require pain lasting for at least 3 months in all four quadrants of the body and along the axial skeleton, as well as the presence of at least 11 of 18 specific tender points (35). The condition is estimated to affect ~5% of the general population in both the United States and Europe and is more prevalent in women than in men (3,19).

Research indicates that aerobic exercise interventions are efficacious treatments for FM with consistent positive effects on well-being and physical function (7). Pain and depression may also be improved by exercise, although empirical support for these benefits is less consistent (7). On the basis of this research, the American Pain Society has issued recommendations that FM patients be encouraged to perform moderate-intensity exercise two to three times per week (6). Despite the evidence that chronic exercise is beneficial for FM, patients often fear exercise, and anecdotal evidence suggests that most patients are sedentary (14,23,24,32).

Although studies examining the effect of structured exercise training on FM symptoms are prevalent, surprisingly little research has quantified or characterized total physical activity in FM patients. Physical activity in daily routines may have effects that are complementary to structured bouts of exercise (4). For some patients, however, structured exercise interventions may reduce habitual activity, leading to little or no increase in total physical activity. None of the exercise training studies in fibromyalgia (FM) have measured total physical activity behaviors outside the exercise intervention. Given the variability in efficacy for exercise to alleviate pain, a more comprehensive picture of physical activity in FM patients may help to identify which patients are most likely to benefit from exercise interventions.

To our knowledge, only two controlled studies have reported measurements of total physical activity in FM patients, both using accelerometry (17,18). Korszun et al. (18) reported no differences in total daytime activity between FM patients and healthy controls, although a sample of FM patients with comorbid depression did exhibit reduced activity. Kop et al. (17) also found no differences between the total activity of a healthy control group and a combined group of FM and chronic fatigue syndrome (CFS) patients. Results from these studies would lead to the conclusion that physical activity behaviors in FM are similar to those of healthy controls. However, in both studies, the accelerometers were worn on the wrist of participants rather than the recommended hip placement for measurement of physical activity (30,34). There is a need for research where the primary focus is to quantify and characterize physical activity in FM.

The primary purpose of the current investigation was to quantify and characterize physical activity in a sample of female FM patients compared with a group of age-matched (±3 yr)

healthy female controls using both accelerometry and self-report measures and after standardized measurement methods. Secondary purposes were 1) to compare accelerometry and self-report measures and 2) to examine the relationships between physical activity and measures of pain, mood, and disease severity in FM patients.

METHODS

Participants

The institutional review board at the University of Wisconsin-Madison approved all experimental procedures, and written informed consent was obtained from each participant. Because FM predominately affects women, only females were recruited for this study. FM patients and healthy controls were recruited by newspaper advertisements, fliers in rheumatology clinics, and by mass e-mail to female faculty, staff, and students at the University of Wisconsin-Madison. All participants were recruited as part of a larger study investigating brain responses to pain and were paid $200 for completion of the study. A physician-confirmed diagnosis of FM according to the American College of Rheumatology criteria (35) was required for inclusion in the patient group. Confirmation was obtained from each patient's care provider via a letter indicating that the patient met the widespread pain and tender point criteria for a diagnosis of FM (35). Healthy controls were required to be free of chronic pain complaints to take part in the study.

Owing to the magnetic resonance imaging requirement for the overarching study, participants in both groups were screened for the presence of ferrous metal in their bodies, pregnancy, color-blindness, and claustrophobia. Any FM patient with a comorbid painful disorder (i.e., arthritis) and participants in either group who were taking analgesic, cardiovascular, or high-dose antidepressant medications were also excluded from the study. We did not exclude for CFS in the current investigation; however, only one FM patient reported having comorbid CFS. The diagnosis was confirmed by their primary care physician. Analyses conducted with and without this patient did not alter any of the results of the study. Finally, a trained interviewer screened all participants for exclusionary diagnoses of major depression, substance abuse, and other major Axis I psychiatric disorders using the *Structured Clinical Interview for DSM-IV Disorders* (11). A total of 39 FM patients and 40 healthy controls met criteria for inclusion in the study.

Experimental design and procedures

Each participant completed the study during a 7-d period. On the initial day, participants completed a series of questionnaires to measure mood, pain, and physical activity, including: the State–Trait Anxiety Inventory (STAI (27)), Beck Depression Inventory (BDI (1)), Profile of Mood States (POMS (21)), Pain Catastrophizing Scale (PCS (28)), and the short form of the McGill Pain Questionnaire (MPQ (22)). In addition, each FM patient completed the Fibromyalgia Impact Questionnaire (FIQ (5)).

All participants (n = 39 FM and n = 40 healthy controls) completed the long form of the International Physical Activity Questionnaire (IPAQ (10)) on the first day of the study as a measure of self-reported physical activity. The IPAQ was chosen specifically because it

allows for calculation of subscales based on activity type (i.e., work-related, housework, transportation, and recreation) and intensity levels (walking, moderate, and vigorous). The questionnaire is widely used and has been demonstrated to have acceptable reliability and validity for physical activity measurement (10).

A subset of participants (n = 33 FM and n = 32 healthy controls) was then asked to wear an accelerometer (Acti-Graph GT1M; ActiGraph, LLC, Pensacola, FL) to monitor physical activity for the next 7 d. No accelerometer data were obtained from six patients and eight controls because they were enrolled in the overall study before the ActiGraph monitors were acquired. The activity monitor was attached at the hip, either by an elastic belt or by a small plastic clip. Participants were provided standard instructions and asked to wear the monitor throughout the day and to remove it only if they were planning to sleep or engage in activities that might expose the monitor to water (e.g., showering or swimming). Briefly, participants were instructed that the monitor should be worn at hip level between their side and navel (verbal and visual demonstration) in the upright position. They were further instructed they could wear it on either the right or left side but to stick with the chosen side. The research assistant then demonstrated proper placement of the device and had the participants place the device on themselves. If necessary, adjustments were made to ensure a tight fit. Data were recorded continuously using 1-min epochs.

Physical activity data processing

Responses to the IPAQ questionnaire were scored based on the accompanying instructions (available at www.ipaq.ki.se/ipaq.htm). The long form of the IPAQ allows subscales for work-related, transportation, housework, and recreational physical activity to be computed, as well as calculations of weekly time spent walking, in moderate-intensity (3–6 METs) and in vigorous-intensity (>6 METs) activities. The scoring rules recommend truncating responses within these three intensity categories to normalize the data and to be consistent with the scoring rules of the IPAQ short form; however, the question format of the long form prevents these rules from being directly applied. To approximate the effect of the rules for the short form, we chose to truncate each individual question to a maximum of 180 min and to set a maximum for time spent at each intensity (walking, moderate, and vigorous) of 21 $h \cdot wk^{-1}$.

Accelerometer data were initially processed using the software included with the ActiGraph monitor to determine the number of minutes spent in each of five activity levels: sedentary (<100 counts per minute), light (100–760 counts per minute), Matthews moderate free-living (760–5724 counts per minute), Freedson moderate (1952–5724 counts per minute), and vigorous (>5724 counts per minute). The moderate and vigorous cut points were chosen based on data indicating that they correspond to energy expenditures of 3–6 and >6 METs, respectively (13). Because cut points based on laboratory data may fail to capture some moderate-intensity activity, a cut point at 760 counts per minute was added, which might better capture moderate activities during free-living conditions (20). The activity data were then further processed by in-house software to exclude days with <10 h of wear time and any participants who had less than three weekdays and one weekend day of usable data. Average minutes spent in each activity level and mean total counts were then calculated for

weekdays and weekend days separately and a weighted average (i.e., five times the weekday average and two times the weekend average) was calculated for each subject's entire monitoring period. Finally, average counts per minute were derived by dividing total activity counts by total wear time.

Statistical analyses

Because several of the IPAQ physical activity variables were not normally distributed, nonparametric tests were used. Nonparametric tests were also used for comparisons and associations involving estimated time spent in vigorous activities by the accelerometers. Mann–Whitney *U* and Wilcoxon signed-rank tests were used for group comparisons, and Spearman ρ was used for correlation analyses. Data appearing in tables and analyzed using nonparametric tests are denoted with a superscripted letter *a* and explained in the table legend. Otherwise, parametric tests were used including *t*-tests for group comparisons and Pearson *r* correlation analyses. Family-wise corrections for multiple comparisons were applied separately to physical characteristics, IPAQ, accelerometer, and questionnaire data using the Holm method (15) to maintain the level of significance at $\alpha = 0.05$. Significant differences for family-wise–corrected comparisons are identified in the body of the text as $P < 0.05$. For secondary analyses, exact *P* values are reported. Corrections for multiple comparisons were not applied to these analyses because they were considered exploratory.

Owing to the number of nonparametric comparisons, we chose to calculate the Common Language effect size (CL (33)). This effect size is an estimate of the degree of separation between distributions and makes no parametric assumptions. The formula for CL is as follows:

$$\mathrm{CL}=\Pr(X_{\mathrm{FM}}<X_{\mathrm{CO}})+\frac{1}{2}\Pr(X_{\mathrm{FM}}=X_{\mathrm{CO}}) \quad [1]$$

It is interpreted as a probability and represents the likelihood that a randomly selected score from the distribution of FM scores will be less than a randomly selected score from the distribution of healthy control (CO in formula) scores. As such, the extreme values of 0 and 1 would suggest no overlap between distributions, whereas the midpoint value of 0.5 would suggest that the distributions are equivalent.

RESULTS

Participant characteristics

Participant characteristics, symptoms, and mood are summarized in Tables 1 and 2. The groups did not differ in their physical characteristics, race, or marital status, but a greater percentage of healthy controls had completed advanced education and were used full-time. Compared with healthy controls, the FM group had elevated pain symptoms and mood disturbance as indicated by the BDI, MPQ, PCS, POMS, and STAI.

Physical activity: IPAQ

Results from the IPAQ are shown in Table 3. The FM group reported significantly less transportation-related ($P < 0.05$), recreational ($P < 0.05$), and total ($P < 0.05$) physical activity and less time spent walking ($P < 0.05$) than healthy controls. No differences were found in job-related or housework physical activity, nor did reported time spent sitting differ between groups. Comparison of intensity subscales between patients and controls revealed that FM patients reported significantly less time spent in vigorous activities ($P < 0.05$) than controls. No group differences were found for time spent in moderate-intensity activities ($P > 0.05$). Because only a subset of our participants had data for both IPAQ and accelerometer measures, we compared self-reported physical activity between those individuals with accelerometer data and those without accelerometer data. There were no significant differences ($P > 0.05$) for any of the physical activity domains. On the basis of this comparison, we concluded that removing these individuals did not change any of the physical activity values for the IPAQ data.

Physical activity: accelerometer

Of the initial 33 FM patients and 32 controls who received accelerometers, data from 26 FM patients and 26 controls met criteria for inclusion in the analyses. Seven patients and six controls were excluded from analyses because of insufficient data quality (i.e., less than three weekdays and one weekend day of complete data). Demographic characteristics, questionnaire scores, and self-reported physical activity for participants included in accelerometer analyses were not significantly different from those without sufficient data for inclusion ($P > 0.05$). Neither the number of days worn (FM = 6.4 ± 0.8, control = 6.7 ± 0.6) nor minutes of wear time (FM = 901 ± 126, control = 933 ± 109) differed between groups.

Daily counts and average counts per minute were significantly lower in the FM group than in healthy controls ($P < 0.05$; Table 4). Patients also spent significantly less time in moderate-intensity activities, as defined by both the Matthews (760–5724 counts per minute) and Freedson cut points (1952–5724 counts per minute), and vigorous-intensity (>5724 counts per minute) activities than did controls ($P < 0.05$). The amount of time spent in sedentary (<100 counts per minute) and light-intensity (100–760 counts per minute) activities did not differ between groups ($P > 0.05$).

IPAQ/accelerometer agreement

For the control group, self-reports of time spent in moderate and vigorous physical activities were significantly greater than the amount of time measured at these intensities by the accelerometer ($P = 0.012$ and $P = 0.008$, respectively). In the FM group, self-reports of time in moderate activities were also greater compared with the accelerometer measurement ($P = 0.001$), whereas there was no difference detected for vigorous activities ($P = 0.208$). Table 5 lists the relationships between IPAQ and accelerometer data, and Figure 1 illustrates the relationship between moderate activity from the IPAQ and moderate activity, as defined by Matthews, from the accelerometer. For the FM group, no significant correlations between the IPAQ and accelerometer were found. For the control group, self-reported moderate activity from the IPAQ was significantly and positively correlated with both light ($r = 0.41$, $P = 0.04$) and moderate ($r = 0.51$, $P = 0.008$) accelerometer estimates. In addition, self-

reported vigorous activity was significantly and positively related to vigorous counts per minute ($r = 0.41$, $P = 0.04$).

Activity levels and symptoms

For FM patients, depressed mood as measured by the BDI was negatively associated ($r = -0.37$, $P = 0.03$) with time recorded in moderate activities (1952–5724 counts per minute). In addition, self-reported time spent sitting was positively related ($r = 0.49$, $P = 0.002$) to depressed mood as measured by the POMS. For controls, self-reported moderate physical activity from the IPAQ was positively related ($r = 0.41$, $P = 0.01$) to scores on the vigor subscale of the POMS. Sedentary time from the accelerometers (<100 counts per minute) was negatively associated ($r = -0.35$, $P = 0.04$) with vigor. No other significant relationships between either self-reported or measured physical activity and pain, mood, or FIQ score were found for either patients or controls ($P > 0.05$).

DISCUSSION

The primary finding of the present study is that FM patients are significantly less physically active than a similar group of healthy controls. This was demonstrated both by self-report and objective assessment methods. We also report that self-reported physical activity is not significantly associated with objectively measured physical activity in FM but shows the usual weak to moderate relationships in controls, and physical activity is significantly related to depressed mood in a clinically nondepressed sample of FM patients but is not associated with pain or disease impact (as measured by the FIQ).

Group comparisons

Our data documenting lower levels of total physical activity assessed with both the IPAQ and accelerometers extend on two earlier studies that found no differences between the total physical activity of FM patients and healthy controls (17,18). Korszun et al. (18) reported no differences in total physical activity between FM patients and healthy controls. However, FM patients with comorbid depression exhibited reduced activity. Similarly, Kop et al. (17) found no differences in total physical activity between a mixed group of patients (FM, CFS, or both) and healthy controls but did report that patients spent significantly less time in high-intensity activities.

Several study characteristics might account for the discrepant results between this study and the two earlier reports. Differences in the choice of accelerometer device preclude direct comparisons of physical activity levels between the present study and those of Kop et al. (17) and Korszun et al. (18). However, the most significant methodological difference between studies is the location of the accelerometer. Measuring sleep quality was a major focus of both previous studies. Therefore, both used wrist-mounted accelerometry. Our studies primary purpose was to quantify and compare physical activity levels in FM patients and healthy controls. For that reason, our participants wore accelerometers at the hip, a placement recommended for quantifying total physical activity (29,30,34). Compared with hip placement, wrist-mounted accelerometers have a proportionally greater response to activities that involve primarily upper-body movement [e.g., many household activities

(29)]. Our data from the subscales of the IPAQ indicate that FM patients do not significantly differ from controls in their job-related or household activities but engage in less transportation-related and recreational physical activities. Job-related and household activities are likely to involve proportionally more upper-body motion, whereas transportation-related and recreational activities are largely characterized by whole-body movement. Wrist-mounted accelerometry may be less sensitive to the physical activities that are most affected by FM (i.e., recreational). Thus, differences in accelerometer placement may explain why no differences were found in earlier studies. Attaching accelerometers at the hip is recommended for future studies evaluating physical activity in FM (30,34).

Given the heterogeneity of the FM population, another possibility is that differences in patient groups or healthy comparison groups might explain the discrepant results. Comparison of the present study's participants with those of the earlier studies reveals few differences, however. In the study by Kop et al. (17), CFS patients and FM patients were combined in the patient group. This heterogeneity in the patient group could have affected the results. However, it is unlikely to explain why no differences in total physical activity were found between patients and controls because reduced physical activity has been consistently shown in CFS patients (2,9,26,31). Further, the demographic characteristic of patients in the study of Kop et al. (age = 41.5 yr, body mass index = 26.6 $kg \cdot m^{-2}$) are similar to the patients in our study. The healthy comparison group in the earlier study by Korszun et al. (18) was slightly older (53.4 ± 2.4 yr) than the FM group (49.2 ± 2.4 yr). As physical activity tends to decrease with age (8), an older control group might have masked some differences in physical activity. Again, these differences are unlikely to explain the difference in study outcomes considering the large effect observed in the current study. Korszun et al. (18) reported no difference between the total activity of FM-only patients and controls; however, they did report that a small sample (n = 6) of FM patients who had comorbid depression were less active than healthy controls. Our results extend on those of Korszun et al. by demonstrating that FM patients free of current major depressive disorder are significantly less active than healthy controls.

Comparison of self-reported and objectively measure physical activity estimates

When the results of the IPAQ and ActiGraph were compared, a few interesting findings emerged. First, self-reports of time spent in moderate and vigorous physical activity were much greater than the time measured at these intensities by the accelerometer. Second, no significant relationship between the two measures was found for FM patients. For healthy controls, the IPAQ and accelerometer measures of moderate and vigorous activity were significantly correlated and the moderate-intensity IPAQ subscale correlated with the light-intensity range (100–760 counts per minute) of the accelerometer. The lack of a significant relationship between IPAQ and accelerometer measures in FM suggests greater variability in the patients' manner of self-report when referenced to objective measures of physical activity or that current self-report instruments fail to adequately capture physical activity behaviors in FM patients. The results are consistent with a recent study demonstrating no association between self-reported physical activity, as measured by the short-form IPAQ and the Community Health Activities Model Program for Seniors questionnaires and accelerometer-measured physical activity in FM patients (16). These results suggest that

both subjective and objective measures of physical activity should be used concomitantly in future research. For the healthy controls in our study, the significant positive correlation between self-reported moderate-intensity activity and both the light-intensity and Matthews' moderate-intensity ranges supports Matthews' (20) view that commonly used cut points based on laboratory data might not effectively capture some moderate-intensity activities of daily living. This may be particularly relevant for sedentary populations where activities of daily living may constitute a considerable amount of an individual's moderate-intensity activities.

Relationships among physical activity, mood, and symptoms

Moderate physical activity as measured by the accelerometer was negatively associated with depressed mood in FM patients. Further, being sedentary (as measured by self-reported time spent sitting) was positively related to depressed mood. However, unlike Kop et al. (17), we did not find any significant associations between physical activity and pain. The study by Kop et al. (17) used objective physical activity monitoring, time-locked to pain ratings, to demonstrate a negative relationship between pain symptoms and both current and immediately subsequent levels of physical activity. It may be that real-time assessments are necessary to capture the dynamic relationship between physical symptoms and physical activity. For controls, self-reported moderate physical activity was positively associated with self-reported vigor, whereas estimates of sedentary time from the accelerometer were negatively associated with self-reported vigor. These data are consistent with meta-analytic data demonstrating that physical activity has a moderate effect on fatigue and vigor in healthy men and women (25).

Directions for future research

Measuring physical activity accumulated in daily routines may play an important role in better understanding FM. Although current controlled trials have generally demonstrated positive effects of structured exercise in FM patients, many equivocal or ambiguous findings remain (7). In CFS, it has been suggested that initiating an exercise program might cause CFS patients to compensate by reducing other types of physical activity throughout the day (2). It is plausible that a similar phenomenon occurs in FM patients. Examining only structured exercise behaviors yields an incomplete picture of the spectrum of physical activity behaviors. To our knowledge, none of the standardized exercise training trials have included measures of total physical activity outside the structured exercise setting. However, Fontaine et al. (12) recently reported on the effectiveness of a lifestyle physical activity program, during which patients wore pedometers and were asked to accumulate at least 30 min of self-selected moderate activities, 5–7 $d \cdot wk^{-1}$. Compared with an education control group, FM patients in the lifestyle physical activity program group reported significant reductions in perceived functional deficits and pain while demonstrating a 54% increase in average steps per day. Further, adherence to the trial was excellent with 87% completing the 12-wk intervention. These results highlight the importance of obtaining measures of daily physical activity behaviors and demonstrate the potential effectiveness of physical activity performed outside the traditional exercise training environment.

The results of this investigation should be considered in light of the limitations of the methods. Our sample consisted of only female FM patients and controls eligible for magnetic resonance imaging testing and, therefore, is not generalizable to the extant population of men and women with FM. Our sample sizes for determining relationships between the accelerometer and self-report measures were small ($n = 26$). It is possible that significant relationships for the FM group would have been detected had our sample been larger. However, only the relationship between self-reported vigorous activity and moderate-intensity activity from the accelerometer approached significance ($\rho = -0.35$, $P = 0.08$). Differences in physical activity behaviors between groups were apparent with this sample size, and large effects were detected between groups. The associations between the physical activity measures and physical activity and symptoms should be viewed with caution because both measures represent a restricted range of possible responses. Finally, the timing of our measurements was not ideal. As this study was part of a larger project, self-reported physical activity was obtained at baseline, whereas accelerometer data were obtained during the week immediately after the baseline assessment. Stronger relationships between the two measures may have been found were self-reported physical activity data collected after the week that the accelerometer was worn, a methodological improvement that we are currently using. Although the relationships may be underestimated, this did not affect the main aim of the study; to compare the physical activity behaviors of FM patients and healthy sedentary controls.

In sum, this study clearly demonstrates that FM patients are less physically active than age- and sex-matched healthy controls; a notion that is widely held in the public but that has received little scientific attention. Our findings extend on previous research that showed reduced peak activity levels (17) and reduced levels in FM with comorbid depression (18) using wrist-mounted actigraphy by demonstrating significant reductions in total physical activity levels in FM patients free from major depressive disorder. These results underscore the importance of using standardized and validated methods to assess physical activity in FM and highlight the complimentary information provided by self-report and actigraphy. Actigraphy provides an objective measure of the quantity of physical activity, whereas self-report instruments survey the respondent's perceptions of how physically active they are. Both measures provide useful information. It is currently unclear whether objectively measured behavior or self-reported perceptions of physical activity are more relevant to understanding FM.

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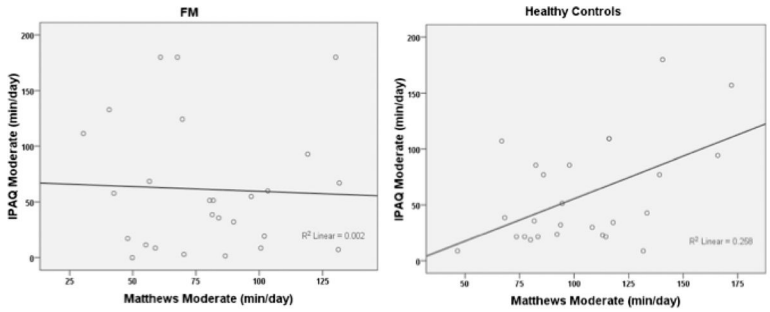

FIGURE 1.

Relationship between objectively monitored activity (Matthews moderate (760–5274) cut point) and self-reported activity (IPAQ moderate subscale) in FM patients (*top; n* = 26) and controls (*bottom; n* = 26).

TABLE 1

Physical and demographic characteristics in FM patients and healthy controls (CO).

	FM (*n* = 39)	CO (*n* = 40)	*P*
Age (yr), mean ± SD	42.7 ± 12.06	40.8 ± 9.10	0.40
Height (cm), mean ± SD	165.95 ± 7.22	166.01 ± 5.72	0.966
Weight (kg), mean ± SD	70.33 ± 15.11	70.63 ± 14.48	0.926
Body mass index ($kg \cdot m^{-2}$), mean ± SD	25.48 ± 4.86	25.74 ± 5.01	0.812
Education, *n* (%)			
Less than high school	0 (0)	0 (0)	
High school diploma	7 (17.9)	0 (0)	
Some college	9 (23.1)	3 (7.5)	
College graduate	11 (28.2)	16 (40.0)	
Some postgraduate	2 (5.1)	2 (5.0)	
Postgraduate degree	10 (25.6)	19 (47.5)	
Employment status, *n* (%)			
Full-time	14 (35.9)	28 (70.0)	
Part-time	9 (23.1)	8 (20.0)	
Unemployed, looking	0 (0)	1 (2.0)	
Unemployed, health reasons	6 (15.4)	0 (0)	
Retired	2 (5.1)	0 (0)	
Never worked	1 (2.6)	0 (0)	
Other	6 (15.4)	3 (7.5)	
Not reported	1 (2.6)	0 (0)	
Marital status, *n* (%)			
Married	22 (56.4)	23 (57.5)	
Divorced	7 (17.9)	5 (12.5)	
Never married	8 (20.5)	10 (25.0)	
Separated	1 (2.6)	0 (0)	
Living as married	1 (2.6)	2 (5.0)	
Race, *n* (%)			
White, not Hispanic	36 (92.3)	36 (90.0)	
White, Hispanic	3 (7.7)	3 (7.5)	
Asian	0 (0)	1 (2.5)	

TABLE 2

Pain and mood measures in FM patients and healthy controls (CO).

	FM (n = 39)	CO (n = 40)	P
BDI total	9.59 ± 6.64	2.89 ± 2.49	<0.001*
MPQ total	12.45 ± 7.95	0.73 ± 0.93	<0.001*
PCS total	13.86 ± 7.70	8.48 ± 7.00	0.002*
POMS TMD	133.78 ± 25.91	102.51 ± 14.51	<0.001*
STAI trait anxiety	35.95 ± 10.42	27.33 ± 5.80	<0.001*
Years of chronic pain	14.69 ± 8.42		
FIQ total	51.91 ± 14.84		

*Significant at $\alpha = 0.05$ after family-wise correction for multiple comparisons using the Holm method.

BDI, Beck Depression Inventory; FIQ, Fibromyalgia Impact Questionnaire; MPQ, McGill Pain Questionnaire; PCS, Pain Catastrophizing Scale; POMS TMD, Profile of Mood States Total Mood Disturbance; STAI, State–Trait Anxiety Inventory.

TABLE 3

Self-reported physical activity in FM patients and healthy controls (CO).

	FM (n = 39)	CO (n = 40)	P [a]	Effect Size CL
Job-related (MET·min·wk^{-1})	911 ± 2497	1310 ± 2469	0.10	0.60
Transportation (MET·min·wk^{-1})	231 ± 293	747 ± 1204	0.002*	0.70
Housework (MET·min·wk^{-1})	1193 ± 1548	122 ± 974	0.20	0.58
Recreation (MET·min·wk^{-1})	443 ± 743	1183 ± 1300	0.01*	0.66
Total (MET·min·wk^{-1})	2741 ± 3081	4338 ± 3232	0.006*	0.68
Sitting time (min·d^{-1})	412 ± 194	374 ± 142	0.81	0.52
Walking (min·d^{-1})	32 ± 42	59 ± 58	0.01*	0.67
Moderate (min·d^{-1})	59 ± 58	70 ± 52	0.18	0.59
Vigorous (min·d^{-1})	5 ± 16	17 ± 21	<0.001*	0.70

All measures are expressed as mean ± SD.

*Significant at $\alpha = 0.05$ after family-wise correction for multiple comparisons using the Holm method.

[a]Analyzed using Mann–Whitney U test.

TABLE 4

Objectively measured total physical activity in FM patients and healthy controls (CO).

	FM (*n* = 26)	CO (*n* = 26)	*P*	Effect Size CL
Daily counts ($\times 10^3$)	200 ± 57	271 ± 71	<0.001*	0.79
Counts per minute	224 ± 61	294 ± 79	0.001*	0.76
Minutes sedentary	1154 ± 59	1127 ± 73	0.15	0.63
Minutes light	205 ± 48	206 ± 55	0.94	0.51
Minutes moderate (Matthews)	80 ± 29	104 ± 31	0.006*	0.71
Minutes moderate (Freedson)	15 ± 8	29 ± 12	<0.001*	0.80
Minutes vigorous	0.6 ± 2	2.3 ± 5	0.006*[a]	0.69

Measures are mean ± SD expressed as counts and minutes per day.

Sedentary = <100 counts per minute, light = 100–760 counts per minute, moderate Matthews = 760–5724, moderate Freedson = 1952–5724 counts per minute, vigorous = >5724 counts per minute.

*Significant at $\alpha = 0.05$ after family-wise correction for multiple comparisons using the Holm method.

[a]Analyzed using Mann–Whitney *U* test.

TABLE 5

Correlations between self-reported (IPAQ) and measured (actigraphy) physical activity in FM patients (n = 26) and healthy controls (CO: n = 26).

	Accelerometer				
	Light	**Moderate (Matthews)**	**Moderate (Freedson)**	**Vigorous**	**Total**
FM					
IPAQ moderate	$r = 0.17$	$r = -0.04$	$r = -0.26$	$\rho = -0.02$	$r = -0.11$
IPAQ vigorous	$\rho = 0.06$	$\rho = -0.35$	$\rho = -0.128$	$\rho = 0.275$	$\rho = -0.21$
IPAQ total	$r = 0.18$	$r = -0.04$	$r = -0.18$	$\rho = 0.00$	$r = -0.01$
CO					
IPAQ moderate	$r = 0.41^{*}$	$r = 0.51^{**}$	$r = -0.03$	$\rho = 0.09$	$r = 0.17$
IPAQ vigorous	$\rho = -0.04$	$\rho = -0.06$	$\rho = -0.19$	$\rho = 0.41^{*}$	$\rho = 0.24$
IPAQ total	$r = 0.34$	$r = 0.45^{*}$	$r = -0.12$	$\rho = 0.11$	$r = 0.22$

r, Pearson correlations; ρ, Spearman rho correlations.

$^{*}P < 0.05$.

$^{**}P = 0.01$.