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Objective and subjective measures of physical functioning in women with fibromyalgia: what type of measure is associated most clearly with subjective well-being?

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ABSTRACT

Purpose: To find modifiable factors that are related to subjective well-being would be valuable for improving interventions in fibromyalgia. Physical activity, sedentary behaviour, and physical fitness may represent potential areas to optimize treatment regimens. In fibromyalgia, there is a discordance between clinical observations and patient-reported outcomes (objective and subjective assessments). Therefore, the present study aims at analyzing the associations of objective and subjective evaluations of physical activity, sedentary behaviour, and physical fitness with subjective well-being and determine if and how objective and subjective associations differ.

Methods: In this population-based cross-sectional study participated 375 women with fibromyalgia from the al-Ándalus project (Spain). Physical activity, sedentary behaviour, and physical fitness were objectively (accelerometers and performance testing) and subjectively (questionnaires) measured. Participants self-reported their levels of positive affect, negative affect, and life satisfaction.

Results: In the most conservative multivariate analysis, we found independent associations of the objective measures of physical activity with positive affect and life satisfaction and sedentary behaviour with positive affect. No such relationship was seen with subjective measures of the same behaviours. Moreover, we observed that objective and subjective physical fitness evaluations were independent of each other related to subjective well-being.

Conclusions: Independent associations of the objective measures (but not the subjective assessments) of physical activity with positive affect and life satisfaction, and of sedentary behaviour with positive affect were observed. However, objective measures and subjective appraisals of physical fitness appear to be independently related to well-being, which should be considered when developing physical exercise interventions for fibromyalgia.

➤ IMPLICATIONS FOR REHABILITATION

- The analysis of concurrent associations of objective and subjective evaluations of physical functioning with subjective well-being offers indications for modifiable targets in rehabilitation that can improve well-being in fibromyalgia.
- Exercise-based rehabilitation may help women with fibromyalgia to improve subjective well-being, particularly positive affect.
- Rehabilitation should focus on both the objective physical performance of women with fibromyalgia and on their perceptions of what they can do physically.
- When rehabilitation aims at enhancing positive affect or life satisfaction by changing the lifestyle of women with fibromyalgia, physical activity and sedentary behaviour should be objectively monitored.

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Supplemental data for this article can be accessed at here.

Introduction

Subjective well-being in people with fibromyalgia is reportedly low [1]. Subjective well-being is people's evaluation of their own life on affective (positive and negative) and cognitive (satisfaction with life) dimensions [2,3]. In particular, positive affect is indicated to be a key determinant of adaptation to fibromyalgia [4–7]. Finding modifiable factors that are related to subjective well-being would be valuable for improving intervention programs in fibromyalgia.

Physical activity (any bodily movement produced by skeletal muscles that result in energy expenditure above basal metabolic rate [8]), sedentary behaviour (activity performed while awake that is done in a seated or lying position and does not increase energy expenditure substantially), and physical fitness (set of attributes that people have or achieve that relate to the ability to perform physical activities [8]) are well-known determinants of health in fibromyalgia [9–11]. While physical activity, sedentary behaviour, and physical fitness are related to subjective well-being in diverse populations [2,3,12], to what extent these relate to subjective well-being in fibromyalgia is not known.

The epidemiological study of physical activity, sedentary behaviour, and physical fitness usually relies on self-reports [13–15]. A major strength of self-reported assessments is that they give an account of what the person really experiences and perceives. Moreover, the method is cheap, fast, and feasible [16]. Nonetheless, due to unreliable recall and biases in answering tendencies (e.g., social desirability), data provided by questionnaires are not always accurate reflections of actual physical activity, sedentary behaviour, and physical fitness [13,16,17]. People with rheumatic and musculoskeletal diseases tend to rate their physical functioning worse than what is observed [18,19]. This is also seen in fibromyalgia, where self-reported function and observations of physical functioning are discordant [18,20]. Studies have shown that objectively quantifying physical activity and sedentary behaviour using accelerometers tends to reveal lower amounts of physical activity and higher amounts of sedentary behaviour when compared to self-reported measures in fibromyalgia patients [21,22].

The aim of the present study was to analyze the associations of objective and subjective evaluations of physical activity, sedentary behaviour, and physical fitness with subjective well-being. Due to the known discordance between objective and subjective evaluations of physical activity in fibromyalgia, we sought to determine the independent strength of each of the associations with subjective well-being. Moreover, we examined whether the interaction of objective and subjective evaluations were additively associated with the components of subjective well-being.

Participants and methods

Participants

The present research used data obtained within the al-Ándalus project, which studied physical activity and physical fitness in relation to health outcomes in fibromyalgia. Detailed description of the methods and sampling procedures followed in the al-Ándalus project are provided elsewhere [23]. Briefly, the participants were recruited mainly via local associations of fibromyalgia in all provinces of Andalusia (southern Spain). All interested participants ($n = 646$) received an invitation to participate in this study. Potentially eligible participants who were interested in participating in the study attended a meeting where we provided information about the study aims and procedures.

The study inclusion criteria were (i) a certified diagnosis of fibromyalgia by a rheumatologist and (ii) meeting 1990 American College of Rheumatology (ACR) fibromyalgia criteria at the time of screening [24]. Exclusion criteria were (i) male gender, (ii) being older than 65 years old, (iii) have a terminal illness, (iv) severe cognitive impairment, or (v) not completing all study evaluations.

The assessments of the present study were carried out between November 2011 and January 2013. All participants provided written informed consent before participation. Fully trained researchers performed all assessments. The Ethics Committee of the Hospital Virgen de las Nieves (Granada, Spain) approved the present study; Registration number: 15/11/2013-N72. The ethical guidelines of the Declaration of Helsinki were followed.

Instruments

Measures related to inclusion criteria and potential confounders

The Mini-Mental State Examination (MMSE) [25,26] was used to screen for severe cognitive impairment. Those participants with scores lower than 10 were excluded.

A Standard Socio-demographic Questionnaire was filled out by the participants indicating their age, gender, education level (i.e., unfinished, primary, secondary, or university studies), and marital status (i.e., married, single, separated/divorced, or widowed). To assess an exclusion criterion, we also include the question "Have you ever been diagnosed with a terminal illness?."

Tenderness: To confirm that participants met the 1990 ACR criteria for classification of fibromyalgia, we performed a physical palpation of the tender points with a standard pressure algometer (FPK 20; Wagner Instruments, Greenwich, CT) [24].

A bioelectrical impedance analyzer (InBody R20; Biospace, Seoul, South Korea) was used to estimate body fat (%). The measurements were made at least two hours after the last meal, with participants undressed, free of metal objects, and having been standing for at least five min prior to the assessment.

Measures related to physical activity and sedentary behaviour

Triaxial accelerometers GT3X+ (Actigraph, Pensacola, FL) were used to quantify physical activity and sedentary behaviour. Activity counts were measured at a rate of 30 Hz and stored at an epoch length of 60 s [27,28]. Participants wore the accelerometer on the hip up to 9 days. The first and last days were excluded from the analyses. A total of 7 continuous days with a minimum of 10 valid hours per day was required for being included in the study analysis. Sedentary behaviour and physical activity were calculated based upon recommended vector magnitude cut point [27,28]: 0–199 and $\geq$200 counts per minute, respectively. We used the manufacturer software (Actilife^{TM} v.6.11.7 desktop) for data download, reduction, cleaning and analyses purposes. Further details are available elsewhere [9].

The leisure time physical activity instrument (LTPAI) and *physical activity at homework or workplace instrument (PAHWI)* was developed to subjectively assess physical activity in fibromyalgia [29–31]. The LTPAI focuses on the assessment of leisure time and the PAHWI focuses on occupational- and housework-related physical activity. To compute a subjective assessment of physical activity (min/week), the total scores of the LTPAI and PAHWI were summed.

The Sedentary Behavior Questionnaire (SBQ) [21,32] was used to assess the time (minutes per day) spent on various sedentary behaviours; e.g., TV viewing, studying or playing video games. The questions were asked for a usual weekday and weekend day separately. Responses for a usual weekday were multiplied by five

and weekend by two. Then, to compute a subjective assessment of sedentary behaviour (min/week), we summed the sedentary time of week and weekend.

Measures related to physical fitness

The Senior Fitness Test battery [33] is a performance-based test battery that was developed to measure the major physical parameters associated with functional mobility: flexibility (the *"chair sit-and-reach"* and "*back scratch*" tests), muscular strength (the *"30-s chair stand"* and "*30-s arm curl"* tests), motor agility ("*8-foot up-and-go test"*), and cardio-respiratory fitness ("*6-min walk test"*). Psychometric properties of these tests are adequate in fibromyalgia patients [33,34]. Information of these tests is available at the following link: https://upotv.upo.es/series/58da216a238583e0478b48f0.

The International Fitness Scale (IFIS) [35] was used to subjectively assess overall physical fitness. The IFIS comprises five questions assessing overall fitness and specific fitness components (i.e., cardiorespiratory fitness, muscular strength, speed-agility, and flexibility). Participants report their assessments on a 5-point Likert-scale ranging from (1) '*very poor*' to (5) '*very good*'. In the present study we used only the first item of the IFIS to assess subjective overall physical fitness (i.e., *'Your general physical fitness is … '*).

Measures related to the components of subjective well-being

The positive and negative affect schedule (PANAS) [36,37] was designed to assess positive affect and negative affect. This questionnaire has 20 items, 10 for positive affect and 10 for negative affect. The 2-factor structure of the PANAS has shown satisfactory psychometric properties in fibromyalgia [38]. Participants respond to each item on a 5-point Likert-scale ranging from (1) "*very slightly or not at all"* to (5) "*extremely*." The time-frame adopted was "*in general*." The scores range is 10–50 for both positive affect and negative affect, where higher scores reflect more of the affective state.

The *Satisfaction with Life Scale (SWLS)* [39,40] is a 5-item questionnaire that assesses the perceived global life satisfaction (i.e., the cognitive component of subjective-well-being) on a 5-point Likert-scale ranging from (1) "*strongly disagree*" to (5) "*strongly agree*." The SWLS scores range from 5 to 25, where higher scores reflect better cognitive well-being. The time frame of the SWLS is "*in general*."

Procedure

The assessments were conducted over three consecutive days. On day 1, participants were interviewed using the MMSE, filled out sociodemographic and clinical data surveys, and had measurements of body composition and tender points. On day 2, participants received questionnaires to be filled out at home: the LTPAI, PAHWI, SBQ, IFIS, PANAS, and SWLS. On day 3, participants returned the questionnaires to the research team and performed the Senior Fitness Test battery. Afterwards, participants were instructed to wear the accelerometers for 9 consecutive days.

Statistical analyses

Pearson's correlations of age, education level (unfinished/primary education versus secondary/university education), marital status (married versus unmarried), and body fat (%) with positive affect, negative affect, and satisfaction with life (hereinafter referred to as the components of subjective well-being) were computed to determine their role as potential confounders. Significant correlations emerged for age with positive affect, negative affect, and satisfaction with life ($r = 0.14$, $r = -0.19$, and $r = 0.12$, respectively; $p \leq 0.03$); education level with positive affect ($r = 0.11$, $p = 0.04$); and marital status with satisfaction with life ($r = -0.19$, $p < 0.001$). Thus, age, education level, and marital status were included as covariates in all analyses.

Prior to running the main analyses, we transformed the scores of the physical fitness tests into an overall score of objective physical fitness, as previously validated [20,41–43]. We computed a set of normalized *z*-scores [(value-mean)/standard deviation (SD)], which leads to a mean score of 0. In addition, we used data from the "6-min walk test" to compute a "cardio-respiratory fitness *z*-score". The mean of the *z*-scores of the "chair sit- and-reach" and "back scratch" tests were used to compute a "flexibility *z*-score." For a better representation of the performance of higher scores, we used inverted "8-foot up-and-go test" score to compute a "motor agility/dynamic balance *z*-score." The mean of the *z*-scores of the "30-s chair stand" and "arm curl" tests were used to compute a "muscular strength *z*-score." Finally, we calculated an overall objective physical fitness score as the mean of the four *z*-scores of physical fitness.

The association of objective and subjective physical activity, sedentary behaviour, and physical fitness with the components of subjective well-being was analyzed with a twofold complementary approach. First, we built separate adjusted regression models where the single association of each independent variable measure (i.e., the objective and subjective measures of physical activity, sedentary behaviour, and physical fitness) with each dependent variable measure (i.e., the individual components of subjective well-being). This approach created 18 separate models (i.e., 6 independent variables * 3 dependent variables). Second, we determined whether the associations of objective physical activity, sedentary time, and physical fitness with the components of subjective well-being were independent of subjective physical activity. Accordingly, a hierarchical multivariate regression model was performed as follows: step 1, covariates; step 2, the objective measure of the independent variable; step 3, the subjective measure of the independent variable and each of the components of subjective well-being in separate models. To check the opposite (whether the subjective assessment of the dependent variables were associated, independently of their objective measure, with the components of subjective well-being), the order of the last two steps were exchanged in such models.

This twofold approach provided a comprehensive understanding of the strength of the mutually independent association of objective and subjective physical activity, sedentary behaviour, and physical fitness with the components of subjective well-being. Moreover, when significant associations of objective and subjective measures of a same component of physical functioning emerged, we examined whether their interaction was associated with the components of subjective well-being. To do so, we centered the objective and subjective data of physical functioning (value – mean) and multiplied their values resulting in the interaction term of centered objective and subjective data. This interaction term was entered in separate, for each dependent variable, hierarchical regression model in the last step: step 1, covariates; step 2, objective physical functioning component; step 3, subjective physical functioning component; step 4, interaction term.

The level of significance was set at $p < 0.05$. Analyses were performed with Statistical Package for Social Sciences (IBM SPSS Statistics for Mac, version 20.0; Armonk, NY). In line with the Open Science framework, the SPSS version of the current study

Table 1. Characteristics of the participants, $n = 375$.

Characteristics	Value
Age (years old), mean (*SD*)	50.8 (7.3)
Education level, *n* (%)	
Unfinished studies	30 (8.0)
Primary	185 (49.3)
Secondary (and vocational)	107 (28.5)
University degree	53 (14.1)
Marital status, *n* (%)	
Married	287 (76.5)
Single	27 (7.2)
Separated/divorced	44 (11.7)
Widowed	17 (4.5)
Body fat (%), mean *(SD)*	40.0 (7.6)
Physical activity (min/week), mean *(SD)*	
Objective (accelerometry)	3260 (743)
Subjective (LTPAI and PAHWI)	2692 (1508)
Sedentary behaviour (min/week), mean *(SD)*	
Objective (accelerometry)	3213 (724)
Subjective (SBQ)	1165 (506)
Physical fitness, mean *(SD)*	
Objective	0.0 (3.1)
Subjective (IFIS) [1–5]	2.2 (0.8)
Subjective well-being, mean (*SD*)	
Positive affect (PANAS) [10–50]	23.0 (6.8)
Negative affect (PANAS) [10–50]	23.9 (8.3)
Satisfaction with life (SWLS) [5–25]	14.1 (4.5)

SD: standard deviation; IFIS: the International Fitness Scale; LTPAI: the Leisure Time Physical Activity Instrument; PAHWI: the Physical Activity at Home and Work Instrument; PANAS: the Positive and Negative Affect Schedule; SBQ: the Sedentary Behavior Questionnaire; SWLS: the Satisfaction with Life Scale.

dataset as well as the syntax file is publicly accessible as Supplemental Material.

Results

Of 646 potential participants with fibromyalgia, 271 were excluded because of the following reasons: 39 were not previously diagnosed by a rheumatologist, 99 did not fulfill the 1990 ACR criteria, 21 were men, 25 were older than 65 years old, 1 showed severe cognitive impairment, 2 reported having a terminal illness, 53 did not meet the accelerometer criteria, 4 did not fill out all of the questionnaires, 20 did not perform all of the physical fitness tests, and 7 did not have data in all the potential confounders. Table 1 presents the characteristics of the 375 women with fibromyalgia that were included in the study.

The results of the univariate analyses show that both objective and subjective physical activity are often associated with the three components of subjective well-being (Table 2).

Table 3 shows the incremental multivariate associations of physical functioning with the components of subjective well-being. We observed that the amount of objective time spent in physical activity was associated with higher positive affect ($t = 3.61$, $p < 0.001$) and satisfaction with life ($t = 2.80$, $p = 0.005$), independent of subjective reporting of time spent in physical activity. The full models, adjusted for age, education level, and marital status explained a 7% and 6% of the variability of positive affect [adjusted $R^2 = 0.073$, F (5, 369) = 6.93, $p < 0.001$] and satisfaction with life [adjusted $R^2 = 0.062$, F (5, 369) = 5.97, $p < 0.001$]. Objectively measured sedentary behaviour was negatively associated with positive affect ($t = -2.28$, $p = 0.023$) independent of subjectively reported sedentary behaviour, explaining a 3% of the variability of positive affect [adjusted $R^2 = 0.034$, F (5, 369) = 3.66, $p = 0.003$]. Higher levels of objective and subjective physical fitness were consistently related to more favorable scores on positive affect ($t = 4.77$ and $t = 4.74$, respectively; both $p < 0.001$), negative affect ($t = -3.20$, $p = 0.002$; $t = -4.34$, $p < 0.001$; respectively) and satisfaction with life ($t = 3.23$, $t = 4.039$, respectively; both $p \leq 0.001$) independently of each other. The models explained between 13% and 17% of the variability in the components of subjective well-being [adjusted R^2 values were 0.169, F (5, 369) = 16.22, for positive affect; 0.127, F (5, 369) = 11.86, for negative affect; 0.129, F (5, 369) = 12.07, for satisfaction with life; all $p < 0.001$].

Finally, the interaction of objective and subjective physical fitness was not associated with any component of subjective well-being (p values ranging from 0.3 to 0.6). This indicates that combining objective and subjective physical fitness together does not explain more of the variance in subjective well-being than simply adding the two together. The whole of subjective well-being is not greater than its' objectively and subjectively measured parts.

Discussion

This study showed that higher levels of objective physical activity were associated with higher reports of positive affect and satisfaction with life. Objective sedentary behaviour had the opposite relationship with positive affect. Higher levels of both objective and subjective physical fitness were consistently and independently related to more favorable scores on all the components of subjective well-being. Finally, the interaction of objective and subjective physical fitness evaluations was not associated with any component of subjective well-being, suggesting that actual physical activity and a person's idea of physical activity influence well-being separately.

In fibromyalgia, subjective well-being is known to be important for better health [4–7]. Identifying determinants of subjective well-being that can be altered, such as physical activity, sedentary behaviour, and physical fitness, represents potential areas to optimize treatment regimens [7,44]. This study found that objective and subjective measurements of physical activity, sedentary behaviour, and physical fitness have a small impact on the various aspects of subjective well-being.

Physical fitness was the most consistent relation and had the highest association (from 5% to 10% explained variance) with all of the components of subjective well-being. How premorbid physical fitness influence long-term fibromyalgia outcomes may be worth studying with a prospective, longitudinal observational approach. Our cross-sectional design cannot query the issue of causality, of whether improving physical fitness leads to improved well-being, or vice versa. It is likely that association of physical activity, sedentary behaviour, and physical fitness with subjective well-being is bidirectional and that enhancement of one will increase the other [2,3]. Future experimental research addressing such issues of causality, by revealing how changes in physical fitness impact well-being, is warranted.

These findings may have implications regarding mechanism of action. Objective physical activity has its greatest influence on positive affect, compared with a smaller influence on satisfaction with life and no influence on negative affect. Actually, our findings are in line with the Wiese, Kuykendall, and Tay's meta-analysis [2]. They suggested that, on one hand, physical activity impacts physiologically on a person, which is more related to emotions than to cognitions; i.e., positive affect and satisfaction with life, respectively. On the other hand, the potential role of physical activity on negative affect is expected to be as a protector against highly demanding circumstances [2], as, for example, during episodes with more severe fibromyalgia. If this is true, the main effects of physical activity on negative affect in our present study may not be found because the study did not focus

Table 2. Results of univariate regression analyses examining the association of objective and subjective evaluations of physical activity, sedentary behaviour, and physical fitness with three components of subjective well-being, $n = 375$.

	Dependent Variable					
	Positive affect (PANAS)		Negative affect (PANAS)		Satisfaction with life (SWLS)	
Independent Variable	β	Adj. R^2 change	β	Adj. R^2 change	β	Adj. R^2 change
Physical activity						
Objective	0.22***	0.045***	−0.08	0.003	0.16**	0.023**
Subjective	0.14**	0.017**	−0.05	<0.001	0.07	0.003
Sedentary behaviour						
Objective	−0.12*	0.011*	0.01	<0.001	−0.10	0.007
Subjective	−0.02	<0.001	0.01	<0.001	−0.02	<0.001
Physical fitness						
Objective	0.32***	0.095***	−0.24***	0.052***	0.24***	0.051***
Subjective	0.31***	0.094***	−0.28***	0.072***	0.26***	0.065***

Single regressions were performed using age, education level and marital status as covariates. β, standardized regression coefficient; Adj R^2: adjusted R^2 with significance levels of F-change. $p^* \leq 0.05$, $p^{**} \leq 0.01$, $p^{***} \leq 0.001$. PANAS: the Positive and Negative Affect Schedule; SWLS: the Satisfaction with Life Scale. Objective physical activity and sedentary behaviour (both, min/week) were measured with triaxial accelerometers GT3X+ (Actigraph, Pensacola, Florida, USA). Subjective physical activity was assessed with the Leisure Time Physical Activity Instrument and Physical Activity at Home and Work Instrument. Subjective sedentary behaviour was assessed with the Sedentary Behavior Questionnaire. Objective (z-score) and subjective physical fitness was assessed with the Senior Fitness Test Battery and the International Fitness Scale, respectively.

Table 3. Results of multivariate regression analyses examining the mutually independent associations of objectively and subjectively measured physical activity, sedentary behaviour, and physical fitness with three components of subjective well-being, $n = 375$.

	Dependent variables					
	Positive affect (PANAS)		Negative affect (PANAS)		Satisfaction with life (SWLS)	
Independent Variables	β	Adj. R^2 change	β	Adj. R^2 change	β	Adj. R^2 change
Physical activity						
Model 1						
Step 1: Objective	0.22***	0.045***			0.16**	0.023**
Step 2: Subjective	0.07	0.002			0.02	<0.001
Model 2						
Step 1: Subjective	0.14**	0.017**			0.07	0.003
Step 2: Objective	0.19***	0.030***			0.15**	0.017**
Sedentary behaviour						
Model 1						
Step 1: Objective	−0.12*	0.011*				
Step 2: Subjective	0.02	<0.001				
Model 2						
Step 1: Subjective	−0.02	<0.001				
Step 2: Objective	−0.12*	0.011*				
Physical fitness						
Model 1						
Step 1: Objective	0.32***	0.095***	−0.24***	0.052***	0.24***	0.051***
Step 2: Subjective	0.24***	0.048***	−0.22***	0.042***	0.21***	0.036***
Model 2						
Step 1: Subjective	0.31***	0.094***	−0.28***	0.072***	0.26***	0.065***
Step 2: Objective	0.25***	0.049***	−0.17**	0.022**	0.17***	0.022***

Hierarchical regressions were performed using age, education level and marital status as covariates. For every dependent variable of physical functioning, the objective component was first entered into the model (results are shown above the dashed line) and subjective component was first entered into the model (results shown below the dashed line). β, standardized regression coefficient; Adj R^2, adjusted R^2 with significance levels of F-change. $p^* \leq 0.05$, $p^{**} \leq 0.01$, $p^{***} \leq 0.001$.

PANAS: the Positive and Negative Affect Schedule; SWLSL the Satisfaction with Life Scale; V: variable. Objective physical activity and sedentary behavior (both, min/week) were measured with triaxial accelerometers GT3X+ (Actigraph, Pensacola, Florida, USA). Subjective physical activity was assessed with the Leisure Time Physical Activity Instrument and Physical Activity at Home and Work Instrument. Subjective sedentary was assessed with the Sedentary Behavior Questionnaire. Objective (z-score) and subjective physical fitness was assessed with the Senior Fitness Test Battery and the International Fitness Scale, respectively.

on people with fibromyalgia who were currently experiencing more severe fibromyalgia. Collectively, it seems possible that the benefits of physical activity for well-being may favour emotional neuronal circuitry over cognitive circuitry, and that any such mechanism would behave in a non-linear fashion [2].

Another interesting finding of our study was that the objective measures of physical activity and sedentary behaviour were more strongly correlated to subjective well-being than their corresponding subjective assessments. We would typically expect self-reported methods to correlate more closely with each other than objective tests due to the common method variance effect [45]. Shared variance between similar modes of measurement (such as two different self-report questionnaires) is expected to be higher than the shared variance between different modes of measurement (such as observed and self-reported physical activity). This again emphasizes the strength of our finding that objective measures of physical activity and sedentary behaviour are more strongly related to health outcomes than their subjective alternatives, as previously reported [46–48].

We found that objective and subjective evaluations of physical fitness seem to provide different and complementary information in regards to well-being. What one thinks they can do (or believes that they are expected to do) is unrelated to what they actually can do in regards to how fibromyalgia patients feel about their

well-being. It seems clear that both aspects of physical fitness should be measured in future fibromyalgia studies where physical fitness is relevant.

This study does have its limitations. Causality cannot be considered in cross-sectional studies. Men and the elderly were not included, limiting generalizability. There were a fair number of persons who were excluded because they were unable to complete the study measures correctly. We used the LTPAI and PAHWI, which was developed specifically for people with fibromyalgia [30] and better accounts for the low intensity physical activity of this population [49]. However, these questionnaires ask patients to recall only a single weekday and weekend day and impute activity for the week, which is less precise method than daily diaries. Strengths of the study include accurate tracking of objective free-living activity, use of measures of physical fitness that are clinically meaningful, a substantial sample size, and the use of participants from a well-described fibromyalgia cohort [23].

To conclude, using conservative multivariate analyses, we found independent associations of the objective measures (but not the subjective assessments) of physical activity with positive affect and satisfaction with life, and of sedentary behaviour with positive affect. Moreover, we observed consistent and independent associations of both objective and subjective physical fitness evaluations with all the components of subjective well-being. Our findings suggest that physical fitness regimens may be helpful in improving subjective well-being in fibromyalgia. Interventions that consider how to improve both objective physical fitness and subjective appraisal of physical fitness may perform better than those that focus only on one of these aspects of physical fitness. Future fibromyalgia studies should consider both objective and subjective measures of physical fitness to capture their separate contributions to subjective well-being.

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Ethical approval

All procedures were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Moreover, informed consent was obtained from all individual participants included in the study.

Disclosure statement

No potential conflict of interest was reported by the authors.

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