Comparison of the International Physical Activity Questionnaire (IPAQ) with a multi-sensor armband accelerometer in women with fibromyalgia: the al-Ándalus project

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ABSTRACT

Objective. *To compare levels of physical activity (PA) assessed by the International Physical Activity Questionnaire (IPAQ) with PA measured with the SenseWear Pro Armband (SWA) in women with fibromyalgia, and to assess the test-retest reliability of the IPAQ.*

Methods. *The study comprised a total of 183 women with fibromyalgia aged 51.1±8.2 years. Participants wore the SWA for 9 consecutive days and filled in the IPAQ twice (separated by a 9-day interval). Total PA, time spent on moderate and vigorous intensity PA, and sitting time assessed by the IPAQ and the SWA (n=123) were compared.*

Results. *Time spent on PA at different intensities (total, moderate and vigorous) was higher and sedentary time was lower when assessed by the IPAQ compared with the SWA (all $p<0.001$). Differences between the IPAQ and the SWA increased as the minutes per day in the IPAQ increased. The Bland-Altman plots showed no agreement between the IPAQ and the SWA. There was no association between the IPAQ and the SWA in any of the variables studied, except for walking domain from the IPAQ and moderate PA from the SWA ($r_p=0.19$, $p=0.03$). Test-retest systematic differences were found for total PA score, moderate and vigorous intensity, working and domestic domains (all $p<0.05$). The ICCs for those domains without systematic differences (sitting, vehicle, walking, active transport time and leisure domains) ranged from 0.52 to 0.71).*

Conclusions. *The IPAQ differs from objectively measured PA and presents limitations to classify different categories of PA based on SWA data. Moreover, the IPAQ is not a reliable tool to assess PA in women with fibromyalgia.*

Introduction

Fibromyalgia is a chronic musculoskeletal condition (1) found primarily in women and characterised by pain disorder and multiple tender points in all body quadrants (2, 3). It is also usually accompanied by other wide variety of symptoms (2, 4, 5) and it commonly accompanies other chronic conditions (6). Different treatments are currently used to improve the symptomatology of the disease (7-9). Several studies have shown the benefits of regular physical activity (PA) on pain, as well as on body composition, physical fitness (10, 11), flexibility (12), psychological outcomes (13) and global well-being (14) in fibromyalgia patients.

Accelerometers are now extensively used in research focused on measuring PA. A wearable body-monitoring device, namely Armband (SWA), has been recently introduced and validated for the measurement of PA in healthy people (15, 16), in several clinical populations (17-19), as well as in people with fibromyalgia (20). This device is portable and provides an objective assessment of PA. The high prices of accelerometers however, do not always allow the possibility to use them in clinical practice. Alternatively, self-report questionnaires are the most commonly used methods to assess PA at population level, because they are inexpensive and easy to administer. The International Physical Activity Questionnaire (IPAQ) was developed to assess health-related PA. The short and long versions of the IPAQ have been tested extensively (21-25) and are now used in international studies with healthy populations (26, 27).

Physical activity is generally difficult to recall, quantify and categorise in healthy adults. Moreover, the cognitive

problems (attention, working memory, long-term verbal memory and spatial memory) (28, 29) and bipolar disorders (30) associated to fibromyalgia can distort or alter the fibromyalgia patients' perception about their PA levels. Even the nature of fibromyalgia symptoms itself (widespread pain, physical function impairments, reduced PA, tiredness, fatigue, depression, etc.) (5, 31) might also alter the own perception of PA levels. Taken together, this may negatively affect the accuracy of self-reported PA. Therefore, whether self-report measures such as IPAQ are adequate to assess PA in fibromyalgia people is uncertain. The aims of the present study were: i) to compare PA assessed by the IPAQ with PA measured by the SWA (objective measure) in Spanish women with fibromyalgia; ii) to study the test-retest reliability of the IPAQ in Spanish women with fibromyalgia.

Materials and methods

Participants

An invitation to participate in this study was sent to all people from two local Associations of fibromyalgia patients from Granada and Seville (Southern Spain). A total of 243 potentially eligible patients were willing to participate in the study and gave their written informed consent after receiving detailed information about the aims and study procedures. Participants were excluded from the analysis if they did not meet the American College of Rheumatology (ACR) criteria: widespread pain for more than 3 months, and pain ≤4 kg/cm^2 of pressure reported for 11 or more of 18 tender points (2); had acute or terminal illness; had severe dementia (Mini-Mental State Examination (MMSE) <10) (32). Fifty-three participants had less than 11 tender points, 1 participant did not fill the IPAQ test, 1 participant did not fill the MMSE and 5 were men. The final study sample included in the statistical analysis consisted of 183 women with fibromyalgia who filled the IPAQ twice (test-retest) and a subset of 123 women who additionally wore the SWA (the quantity of monitors available). The study protocol was reviewed and approved by the Ethics Committee of the *Hospital Virgen de las Nieves* (Granada, Spain).

Procedures

The participants visited the laboratory twice. At the first visit, the tender points count and the weight and height were measured. The MMSE, demographic data and the IPAQ were also completed and the completion time was recorded. Participants were asked to wear a SWA for 9 consecutive days, starting the same day they received the monitor. They were instructed to wear the SWA on their arm attached by an elastic belt during full day as well as sleeping hours. For security reasons, participants were asked to take them off while bathing. Participants had the second visit with 9 days interval for completing the IPAQ (retest) and they also returned the SWAs to the researchers.

Measures

Tender points count. We assessed 18 tender points according to the ACR criteria for classification of fibromyalgia (2) using a standard pressure algometer (FPK 20; Effegi, Alfonsine, Italy). The total count of positive tender points was recorded for each participant.

Fibromyalgia Impact Questionnaire (FIQ) comprises 10 subscales of disabilities and symptoms (physical function, work missed day, job ability, feel good, pain, fatigue, sleep, stiffness, anxiety and depression) and has previously used and validated for Spanish fibromyalgia patients (33). The total score ranges from 0 to 100. A higher score indicates a greater impact on the person's life.

Body Mass Index (BMI). We measured weight (kg) with an eight-polar tactile-electrode impedanciometer (InBody R20; Biospace, Seoul, Korea). Height (cm) was measured using a stadiometer (Seca 22, Hamburg, Germany). BMI was calculated as weight (in kilograms) divided by height (in meters) squared.

Mini-Mental State Examination (32) is a brief cognitive screening test used to assess cognitive capacity and severity of dementia for the exclusion criteria. The MMSE asks questions that assess five areas of cognitive functioning: orientation, immediate memory, attention/concentration, delayed recall and language.

International Physical Activity Questionnaire is used internationally to obtain comparable estimates of PA at population level (21). The original questionnaire was developed for adults aged 18–65 years (21). The long form of the IPAQ includes 27 items that identify the frequency (times per week) and duration (minutes or hours per day) of PA performed in different domains of PA in the last seven days: occupation, transportation, housework, house maintenance and family care, recreation, sport and leisure, and time spent sitting in a weekday and in a weekend day. To adapt the questionnaire to our study population, two items were added about time spent lying as an indicator of sedentary behaviour. Sitting and lying were summed and combined as total sitting time. For all PA domains, participation in vigorous and moderate intensity PA was obtained. Sedentary time was set as sitting plus vehicle transport time. There are no cultural aspects to be acknowledged when using the Spanish version of the IPAQ.

One Metabolic Equivalent (MET) is the amount of oxygen consumed while sitting at rest and is equal to 3.5 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$ and 1 $kcal \cdot kg^{-1} \cdot hr^{-1}$ as the caloric equivalent for adults (34). PA intensities were set according to the IPAQ guidelines: moderate intensity as 4 METs, vigorous intensity as 8 METs, and walking as 3.3 METs. Total day PA (MET-min/day) was computed by multiplying METs by minutes of participation in the specific category of PA, and divided by 7 days. Sitting was expressed as min/day. The methods used to score the long-IPAQ can be found on the IPAQ website (www.ipaq.ki.se).

SenseWear Pro Armband

The wearable body-monitoring device (SenseWear Pro$_3$ Armband (Body Media, Pittsburgh, PA)) measures energy expenditure. The SWA has been used recently to compare objective vs. self-reported PA (35) and sedentary time (36) in fibromyalgia patients. The SWA incorporates an ample variety of measured parameter (biaxial accelerometry, heat flux, galvanic skin response, skin

Table I. Clinical and sociodemographic characteristics of fibromyalgia women, n=183.

Variable	n	%
Tender points count, mean (SD)	17.3	(1.6)
FIQ, mean (SD)*	64.6	(18.6)
Body mass index*	28.2	(5.3)
MMSE, mean (SD)	28.2	(1.9)
Age (years)		
≤50	72	39.3
>50	111	60.7
Years since clinical diagnosis*		
≤5 years	82	45.3
>5 years	99	54.7
Marital status		
Married	149	80.9
Unmarried	18	9.8
Separated / Divorced / Widowed	17	9.3
Educational status*		
Unfinished studies	12	6.6
Primary school	88	48.4
Secondary school	47	25.8
University degree	35	19.2
Occupational status*		
Working	62	39.5
Unemployed	64	40.8
Retired	31	19.7

Values are n and % unless otherwise indicated. SD, standard deviation. *Missing data.

temperature, near-body temperature) and demographic characteristics (gender, age, weight, height) into proprietary algorithms to estimate energy expenditure.

Following the manufacturer's recommendations, the SWA was worn on the right upper arm over the triceps muscle at the midpoint between the acromion and olecranon processes. Nine days of consecutive data were collected. Energy expenditure was computed at 1-minute intervals. Data obtained using the SWA were downloaded using software developed by the manufacturer (SenseWear Professional software version 6.1[a]).

The first and last days of recording were not included in the analysis to minimise reactivity. We excluded from the analyses data with less than 7 days of collection and a threshold of 95% "on-body" time was used to include an individual in the data analysis. Sleeping time was removed from analysis. We set the PA levels as follows:

a) total PA, expressed as a measure of overall PA; and time engaged in b) sedentary, c) moderate, and d) vigorous intensity PA based upon the IPAQ cut-off of <3, 3-6, and >6 METs per minute, respectively.

Statistical analysis

The difference between the objective and subjective measures of PA was calculated by means of paired *t*-test. Concordance between the IPAQ and the SWA scores was done using the concordance correlation coefficient (r_c). Pearson correlation coefficient (r_p) was calculated as additional information for the r_c (37). We assessed the agreement between the objective (SWA) and subjective (IPAQ) measures of PA following the Bland-Altman method (38). The association between the mean difference and the magnitude of the measurement (*i.e.* heteroscedasticity) was examined by conducting regression analysis after inverting negative data. We calculated the mean difference, 95% confidence intervals (CIs) of the difference, and the 95% limits of agreement (mean difference ± 1.96 standard deviation (SD) of the differences).

We studied the test-retest reliability of the IPAQ with a paired *t*-test. We also calculated the SD of the mean differences, the 95% CIs for the mean difference, the 2-way mixed average measures intraclass correlation coefficient (ICC) (39), 95% of CIs for ICC, the standard error of the measurement (SEM) (40), and the intra-individual SD (41). The agreement between test and retest was also studied following the Bland-Altman method (38) as described above. All analyses were performed using the Statistical Package for Social Sciences IBM-SPSS, version 20.0 for Windows, and the level of significance was set at $p<0.05$.

Results

The clinical and sociodemographic characteristics of the sample are shown in Table I. The mean time required to complete the IPAQ was 14 minutes in both test and retest.

Table II. Descriptive physical activity (PA) data from the International Physical Activity Questionnaire (IPAQ) and the SenseWear armband (SWA), by sex, age and body mass index (BMI).

	Total PA			Sitting	Sedentary			Moderate	Walking	Moderate + Walking			Vigorous		
	IPAQ min/day	SWA min/day	*p*	IPAQ min/day	IPAQ min/day	SWA[II] min/day	*p*	IPAQ min/day	IPAQ min/day	IPAQ min/day	SWA[II] min/day	*p*	IPAQ min/day	SWA[II] min/day	*p*
All (n=123)	323 (264)	111 (70)	<0.001	319 (171)	359 (195)	907 (136)	<0.001	222 (199)	77 (97)	298 (235)	110 (69)	<0.001	24 (68)	1 (5)	<0.001
	(103; 500)	(64; 146)		(197; 413)	(227; 446)	(817; 973)		(56; 345)	(14; 104)	(97; 467)	(64; 143)		(0; 17)	(0; 1)	
Age (years)															
23-50 (n=53)	268 (231)	135 (80)	<0.001	345 (194)	395 (238)	878 (105)	<0.001	189; 176)	54 (62)	242 (200)	133 (77)	<0.001	25 (82)	3 (7)	0.048
	(52; 431)	(77; 176)		(199; 444)	(228; 482)	(818; 936)		(35; 290)	(11; 73)	(51; 383)	(77; 174)		(0; 7)	(0; 2)	
51-64 (n=70)	364 (281)	93 (57)	<0.001	300 (149)	332 (152)	929 (153)	<0.001	247 (214)	94 (115)	341 (252)	93 (56)	<0.001	23 (56)	0 (1)	0.001
	(154; 538)	(58; 109)		(197; 386)	(223; 425)	(817; 1004)		(69; 370)	(17; 134)	(145; 519)	(58; 109)		(0; 22)	(0; 0)	
BMI ($m \cdot kg^{-1}$)															
<25 (n=36)	207 (197)	142 (85)	0.049	335 (201)	379 (240)	864 (94)	<0.001	135 (139)	68 (87)	203 (198)	139 (83)	0.054	4 (18)	3 (7)	0.491
	(39; 286)	(75; 181)		(198; 401)	(226; 426)	(791; 938)		(22; 220)	(12; 102)	(39; 285)	(73; 175)		(0; 0)	(0; 2)	
25-29.9 (n=49)	422 (292)	115 (63)	<0.001	318 (157)	360 (181)	919 (156)	<0.001	285 (223)	95 (106)	381 (252)	113 (62)	<0.001	41 (97)	1 (4)	0.006
	(174; 582)	(76; 136)		(199; 429)	(225; 461)	(817; 987)		(108; 397)	(29; 149)	(164; 542)	(76; 136)		(0; 34)	(0; 1)	
>30 (n=37)	306 (239)	79 (48)	<0.001	303 (162)	338 (170)	935 (138)	<0.001	221 (192)	63 (95)	284 (215)	79 (47)	<0.001	22 (44)	0 (1)	0.005
	(111; 513)	(46; 105)		(193; 409)	(224; 449)	(859; 1005)		(45; 335)	(13; 54)	(100; 468)	(45; 104)		(0; 17)	(0; 0)	

Values are means (standard deviation), and interquartile ranges. Difference IPAQ – SWA tested for total PA, sedentary time, moderate and vigorous PA intensities using *t*-test. [II]Cut-off values for sedentary, moderate and vigorous were <3, 3-6, and >6 METs*min/day, respectively.

Table III. Concordance correlation coefficient (r_c) and Pearson correlation coefficient (r_p) for total physical activity (PA) and time spent on PA intensities from the International Physical Activity Questionnaire (IPAQ) and the SenseWear armband (SWA), n=123.

IPAQ (min/day)	SWA (min/day)	r_c	r_p	$P_{Pearson}$
Sitting	Sedentary	-0.01	-0.12	0.18
Sitting + Transport	Sedentary	-0.02	-0.11	0.22
Moderate	Moderate	0.03	0.06	0.54
Moderate + Walking	Moderate	0.04	0.13	0.16
Walking	Moderate	0.17	0.19	0.03
Vigorous	Vigorous	0.01	0.04	0.63
Total PA	Total PA	0.04	0.11	0.21

The PA levels for the IPAQ and the SWA by age and BMI are shown in Table II. The IPAQ estimates (min/day) were higher in total PA, moderate and vigorous intensity PA, and lower in sedentary time as compared to the SWA (all $p<0.001$). Similar results were observed across age and BMI groups (see Table II).

The concordance correlation coefficients between the IPAQ and the SWA ranged from 0.01 to 0.17; whereas the Pearson correlation coefficients ranged from 0.04 to 0.19 (see Table III).

Figure 1 shows the Bland-Altman plot for inter-method agreement between the IPAQ and the SWA. The mean difference (SD) for total PA, vigorous intensity PA, walking time and moderate plus walking time from the IPAQ and SWA was -211 (265), -23 (68), 33 (108) and -188 (237) min/day, respectively (all $p<0.001$). The differences between the IPAQ and the SWA values were greater as the PA levels increased for total, vigorous, walking and moderate plus walking PA ($R^2=0.79$; $R^2=0.99$; $R^2=0.41$; $R^2=0.76$, respectively; all $p<0.001$).

Table IV shows the test-retest mean differences and SDs, 95% CI of the mean differences, the ICCs and 95% CI of ICCs, the SEMs, the intra-individual SDs and the coefficients of repeatabili-

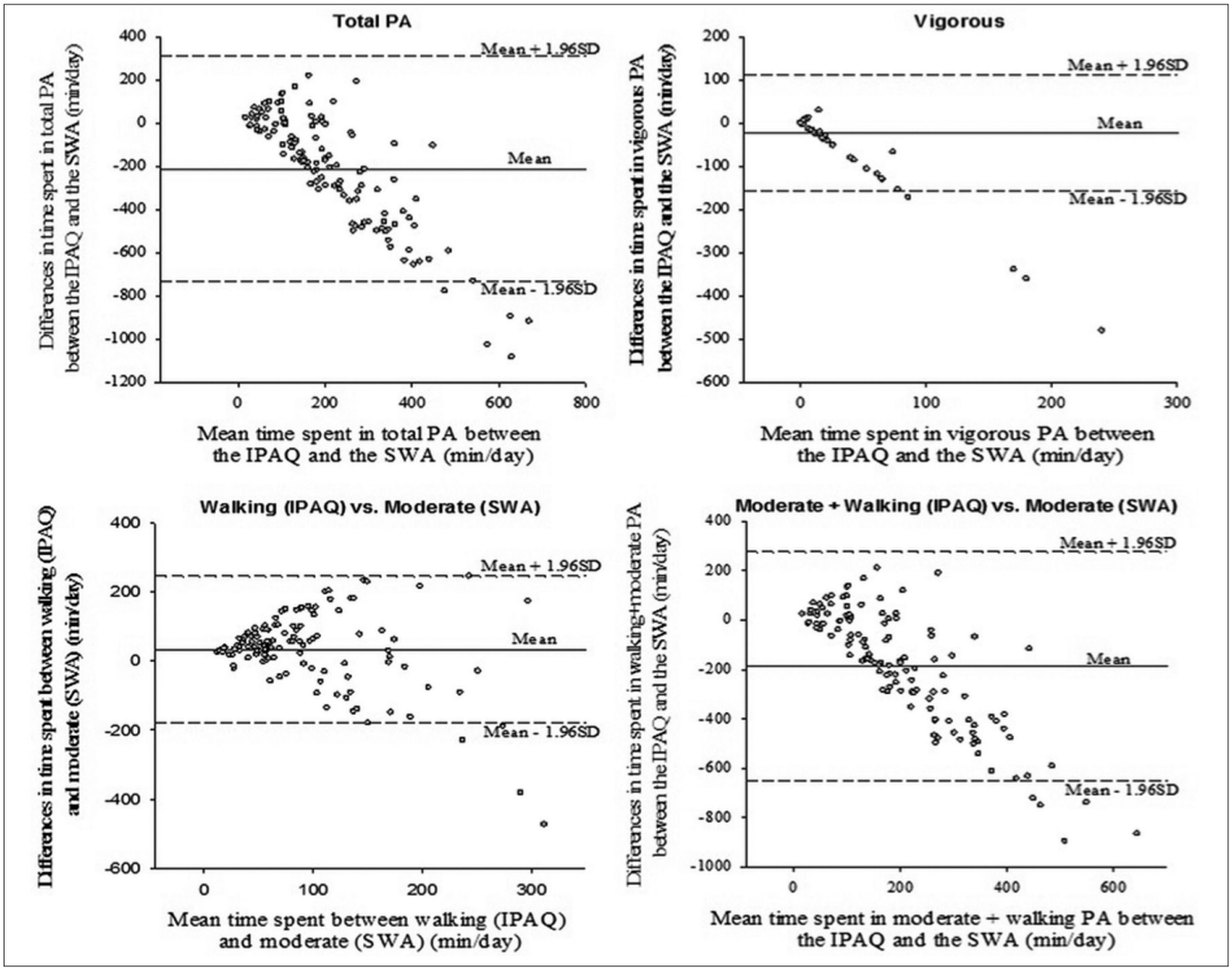

Fig. 1. Bland-Altman plot for inter-method agreement between the International Physical Activity Questionnaire (IPAQ) and the SenseWear armband (SWA).

Table IV. Test-retest agreement and measurement errors for the International Physical Activity Questionnaire (IPAQ), n=183.

	Mean test (SD)	Mean retest (SD)	Mean difference (SD)	95% CI Mean difference	Intra-individual (SD)	SEM	ICC	95% CI ICC	Coefficient of Repeatability
IPAQ, total score (MET/day)	924 (874)	1172 (1198)	-249 (90)***	-380; -117	2378	639	0.77	0.70; 0.83	1299
Sitting (min/day)	318 (174)	314 (167)	4 (167)	-21; 28	35	118	0.68	0.58; 0.76	232
Vehicle (min/day)	45 (64)	43 (67)	2 (75)	-9; 13	19	53	0.52	0.35; 0.64	104
Walking (MET/day)	280 (364)	326 (422)	-46 (374)	-101; 8	441	265	0.71	0.61; 0.78	523
Moderate (MET/day)	500 (439)	634 (621)	-134 (608)**	-222; -45	1277	430	0.53	0.37; 0.65	863
Vigorous (MET/day)	144 (395)	198 (581)	-54 (366)*	-107; 0	513	259	0.84	0.79; 0.88	513
Working (MET/day)	202 (554)	352 (936)	-149 (656)**	-245; -54	1430	464	0.78	0.70; 0.83	932
Active Transport (MET/day)	142 (221)	152 (237)	-11 (256)	-48; 27	103	181	0.55	0.39; 0.66	355
Domestic (MET/day)	415 (353)	483 (484)	-68 (443)*	-132; -3	648	313	0.62	0.50; 0.72	621
Leisure (MET/day)	158 (231)	185 (229)	-27 (256)	-64; 10	257	181	0.55	0.40; 0.67	357

Differences between the test and retest from the IPAQ tested for physical activity using a *t*-test. *p<0.05; **p<0.01; ***p< 0.001. Confidence intervals (CI); intraclass correlation coefficient (ICC); standard deviation (SD); standard error of the measurement (SEM).

ty. No systematic test-retest differences were found for sitting, vehicle, walking, active transport time and leisure domains. Systematic differences were found for total PA score (p<0.001), moderate intensity (p=0.003), vigorous intensity (p=0.049), working (p=0.002), and domestic (p=0.04) domains. The ICCs ranged from 0.52 to 0.84. The ICCs for those domains without systematic differences (sitting, vehicle, walking, active transport time and leisure domains) ranged from 0.52 to 0.71. The SEMs were overall satisfactory for sitting, vehicle, walking, active transport time and leisure domains from IPAQ (see Table IV). Mean differences between test and retest were lower than the SEM for sitting, vehicle, walking, active transport time and leisure domains; ranging from -46 to 4 min/day. The coefficient of repeatability was less than 2 SDs for all the variables studied from the IPAQ.

Figure 2 shows the Bland-Altman graph for the test-retest of the IPAQ. The differences between the test-retest values were greater as time reported in vehicle, walking, active transport, and leisure domains increased (R^2=0.40; R^2=0.47; R^2=0.60, R^2=0.50; respectively, all p<0.001), whereas no positive association was found for sitting domain (R^2=0.01, p=0.153).

Discussion

The present study showed that self-reported IPAQ differed with SWA when assessing PA levels in Spanish women with fibromyalgia. The results also suggested that IPAQ has poor to good test-retest reliability. Taken together, these findings suggest that self-reported IPAQ should not be used to assess PA in Spanish women with fibromyalgia.

A previous study by McLoughlin *et al*. (42) showed that women with fibromyalgia reported significantly higher levels of moderate and vigorous PA with the IPAQ than those measured by the accelerometer. In the present study we also showed significantly greater minutes per day reported with the IPAQ than those measured with the SWA. The study by Kaleth *et al*. (43) in patients with fibromyalgia aged 49.1±9.6 years found no significant relationship between the IPAQ short-version and accelerometry, which concur with other findings (42) when using the IPAQ long-form. These results are in agreement with our findings, yet we used the SWA instead of an Actigraph. Unlike the above mentioned studies in a fibromyalgia population (42, 43), we conducted the Bland-Altman method, since this technique is more adequate and informative when analysing the agreement between different methods (44). In other validation studies with the IPAQ *versus* an accelerometer with Swedish adults (45) and adolescents (46), they found similar results, showing that IPAQ gave significantly higher estimates of PA than the objective measure (Actigraph). They also showed higher differences between both methods when the time spent on PA measured by the accelerometer was higher. These studies however showed a significant poor-to-moderate agreement between the IPAQ and the objective measure (45, 46). Other previous validation studies in healthy people from different countries (23-25, 47, 48) also showed slightly higher correlation coefficients than those obtained in our study. It is noteworthy that the correlation coefficient has previously been criticised in the analysis of measurement method comparison data (44), so previous studies using solely this technique are not appropriate.

The absence of relationship and the observed differences between the IPAQ and an objective measure in the present and previous studies conducted with fibromyalgia population (42, 43) may be due to the inability of the IPAQ for classifying correctly subjects in light or low-moderate intensity PA level. Because this type of activities is the most common in the fibromyalgia population (42), this could result in poor recall, and therefore corroborate the great differences obtained between the results with the IPAQ and the SWA. Our patients underestimated their total sedentary behaviour time and overestimated time spent on PA. This finding has been previously described (49). This may be the result of social desirability bias, whereby the patients underestimate undesirable behaviours and overestimate desirable behaviours. Other reason could be that exercise is perceived as more painful and requiring more effort in this population, as corroborated by Cook *et al*. (50) in patients with chronic fatigue syndrome and co-

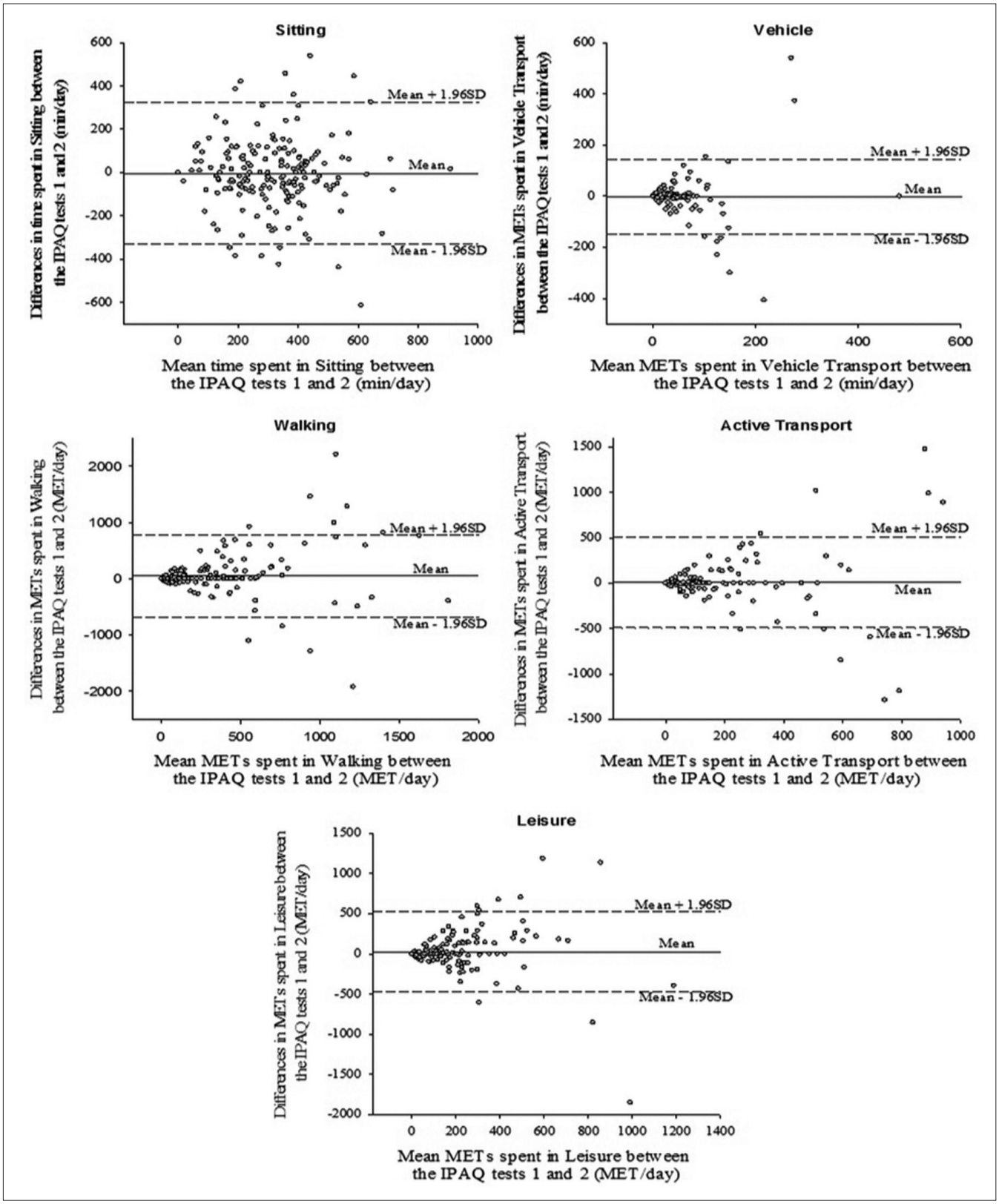

Fig. 2. Bland-Altman plot for test-retest agreement for the International Physical Activity Questionnaire (IPAQ).

morbid fibromyalgia. This perception might manifest in an overestimation of the PA performed (51). Moreover, fibromyalgia patients may also have a greater variability in their manner of self-report than healthy controls (42). Therefore, the absence of a significant relationship between the IPAQ and the SWA in the present study suggests that the IPAQ fail to adequately capture PA behaviours in fibromyalgia patients.

The present study did not show over-

all satisfactory test-retest reliability for the IPAQ domains. The mean difference was low for sitting, vehicle, walking, active transport and leisure activities from the IPAQ. Despite we obtained ICC values from 0.52 to 0.84 in all domains and PA intensities, total, moderate and vigorous PA, and working and domestic domains showed significant test-retest mean differences, so that we did not accept the good reliability of the instrument in these specific PA intensities and domains. Kaleth *et al*. (43) showed low reliability of the IPAQ short-form in a smaller sample (n=28) of patients with fibromyalgia than ours (n=183). Furthermore, they only provided the ICC as a reliability measure, whereas we provided a greater number of reliability measures. Specifically the use of the SEM (together with the ICC) has been highly recommended (40). This measure provides an absolute index of reliability, unlike the ICC which is a relative measure of reliability (40). Other researches with different study populations showed that the IPAQ short-form seems not to be a good indicator of PA behaviour (52-54). Previous studies examining the reliability of IPAQ showed reliability coefficients greater than 0.70 (21, 23, 55-58), whereas other studies showed low reliability coefficients (25, 59, 60). The heteroscedasticity observed in the Bland-Altman plots of the IPAQ test-retest suggested that the reproducibility of the data decreased as the amount of reported time in a specific domain (vehicle, walking, active transport and leisure) increased. This was not the case for sitting domain (heteroscedasticity was not observed). Good levels of repeatability were obtained for the sitting, the vehicle, the walking, the active transport and the leisure activities from the IPAQ, which suggests that the recall was repeatable irrespective of the amount of reported activity.

The present study has some limitations. The absence of a healthy group did not allow direct comparison. The sample is of convenience, which results in some limitations: by lessening representativeness of the Spanish population who have fibromyalgia and unknown levels of sampling error. Otherwise, our sample population was between 23 to 64 years old, which is the same as for whom the IPAQ was designed and which strengthens de validity of our results. The SWA is a valid device to measure PA in people with fibromyalgia (20). General criticisms of belt-mounted PA monitors include the inability to detect arm movements and load work performed by pushing, lifting, or carrying objects. The SWA may solve these issues through heat production measurements and placement on the upper arm. The quality of the SWA data (7 consecutive valid days) was an important strength of our study. The absence of a men sample did not let us know whether these findings apply to men, so future studies should analyse the validity and reliability of the IPAQ in men with fibromyalgia.

In conclusion, the present study showed that the IPAQ is not comparable with a multi-sensor armband accelerometer (SenseWear Pro_3 Armband) and is not a reliable tool to assess PA in women with fibromyalgia. The results suggest that the IPAQ overestimates PA. The instrument reported acceptable test-retest reliability in sitting, vehicle, walking, active transport and leisure activities; but not in the total PA score, moderate and vigorous intensity, as well as working and domestic domains.

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