Does body composition differ between fibromyalgia patients and controls? The al-Ándalus project

V. Segura-Jiménez[1], V.A. Aparicio[2], I.C. Álvarez-Gallardo[1], A. Carbonell-Baeza[3], I. Tornero-Quiñones[4], M. Delgado-Fernández[1]

[1]Department of Physical Education and Sport, Faculty of Sport Sciences, University of Granada, Granada, Spain;
[2]Department of Physiology, Faculty of Pharmacy, Faculty of Sport Sciences, and Institute of Nutrition and Food Technology, University of Granada, Spain;
[3]Department of Physical Education, Faculty of Education Sciences, University of Cádiz, Cádiz, Spain;
[4]Department of Physical Education, Music and Arts, Faculty of Sciences Education, University of Huelva, Huelva, Spain.

Víctor Segura-Jiménez, BSc
Virginia A. Aparicio, PhD
Inmaculada C. Álvarez-Gallardo, BSc
Ana Carbonell-Baeza, PhD
Inmaculada Tornero-Quiñones, PhD
Manuel Delgado-Fernández, PhD

Please address correspondence to: Víctor Segura Jiménez, Department of Physical Education and Sport, Faculty of Sport Sciences, University of Granada, Carretera de Alfacar, s/n, 18011 Granada, Spain.
E-mail: vsegura@ugr.es

Received on June 15, 2014; accepted in revised form on October 8, 2014.

Clin Exp Rheumatol 2015; 33 (Suppl. 88): S25-S32.

Key words: women, men, body mass index, fat percentage, bio-impedance, cardiorespiratory fitness

Funding: this study was supported by the Spanish Ministry of Science and Innovation (I+D+I DEP2010-15639, grant: BES-2011-047133), the Consejeria de Turismo, Comercio y Deporte (CTCD-201000019242-TRA), the Spanish Ministry of Education (AP-2010-0963), Granada Research of Excelence Initiative on Biohealth (GREIB), Campus BioTic, University of Granada, Spain and the European University of Madrid, Escuela de Estudios Universitarios Real Madrid (2010/04RM).
Competing interests: none declared.

ABSTRACT

Objective. *To characterise the anthropometric and body composition profile of a sample of fibromyalgia women and men from southern Spain and compare them with non-fibromyalgia controls.*

Methods. *The cross-sectional study comprised 566 (51.9±8.3 years) fibromyalgia women vs. 249 (49.3±9.9 years) control women; and 24 (47.0±8.4 years) fibromyalgia men vs. 56 (49.7±11.5 years) control men. Body composition and cardiorespiratory fitness were assessed by means of a bioelectric impedanciometer and the 6-minute walk test, respectively.*

Results. *All body composition parameters (except muscle mass) differed between fibromyalgia and control women (all, $p<0.01$) even after controlling for several key variables (all, $p<0.05$). The effect sizes observed were small-medium. When cardiorespiratory fitness was included as covariate, body composition was no longer different between the women study groups. No differences in body composition were observed between fibromyalgia and control men (all, $p>0.05$). Weight status differed between women groups, with 11% lower normal-weight and 17% higher obesity prevalence for the fibromyalgia women group ($p<0.001$), but not between men groups ($p=0.711$). Seventy-two percent of the fibromyalgia women and 79% of the fibromyalgia men were overweight-obese. Sixty-one percent of the control women and 83% of the control men were overweight-obese.*

Conclusion. *Obesity is a greater common condition among fibromyalgia women compared to their counterparts from southern Spain, which might be explained by lower levels of cardiorespiratory fitness in fibromyalgia. However, fibromyalgia and control men do not differ on either body composition or weight status, in spite of the lower cardiorespiratory fitness found in the fibromyalgia men group.*

Introduction

Fibromyalgia is a chronic disease characterised by musculoskeletal pain, as well as the presence of multiple locations of tender points (1, 2). The most prominent symptoms include fatigue, muscle stiffness, sleep disturbances, muscle pain and memory and cognitive difficulties (1, 3–5). Fibromyalgia patients have a low functional capacity, which limits their daily activities and reduces their health-related quality of life (6). Fibromyalgia is associated to female gender between 40 and 59 years (6), so most of them are perimenopausal. Body composition in this period is characterised by an increase in fat mass, especially abdominal fat, probably due to the oestrogen loss and declines in physical activity levels (7, 8). In the general population, a high body mass index (BMI) is associated with back pain (9, 10), headache as migraine (11) and increased general pain (12). In a recent study, overweight and obese twins were more likely to report low back pain, migraine headache, fibromyalgia, abdominal pain, and chronic widespread pain than their normal-weight twins (13). Moreover, in the longitudinal Norwegian HUNT study (14), conducted on 15,990 women, overweight and obesity was associated with a 60–70% higher risk of incident fibromyalgia, especially if the subjects were physically inactive.

Weight status is an important feature that may affect fibromyalgia symptomatology (15–17). Obesity can be considered an aggravating comorbid condition, affecting negatively fibromyalgia severity, global quality of life, fatigue, and physical functioning (18, 19). Overweight and obese fibromyalgia patients also present higher pain sensibility (12, 15, 16), increased sensitivity to tender points palpation, reduced physical functioning and lower-body flexibility (17), shorter sleep duration, and greater restlessness during sleep than normal-weight fibromyalgia patients (14, 17, 20). The prevalence of overweight-obesity found among American women with fibromyalgia was extremely higher when compared to the normal population normative values (61 *vs.* 38%, respectively, with a 32% of obese patients) (16). Similar or even higher prevalence of overweight and obesity has been observed in other studies with fibromyalgia population (15, 20, 21). However, studies comparing body composition between fibromyalgia patients and healthy population of the same geographic area and characteristics are scarce. Based on these studies we cannot determine whether a high BMI and/or obesity are inherent to fibromyalgia. Furthermore, lifestyle and specific characteristics of each country can make the association of fibromyalgia and BMI/obesity different between studies and geographical areas. Therefore it is of relevance to compare a fibromyalgia group with a control group with the same socio-demographic, age and sex features, in order to know if they really are different on body composition and weight status distribution.

Therefore, the present study aims to characterise the anthropometric and body composition profile of a cross-sectional sample of southern Spain fibromyalgia patients and compare them with control participants of similar age range and region, as well as with normative Spanish values.

Material and methods

Participants

Fibromyalgia participants were recruited from different fibromyalgia associations via e-mail, letter or telephone. All participants (n=1042) gave their written informed consent after receiving detailed information about the aims and study procedures. The inclusion criteria for fibromyalgia participants were: 1) to be previously diagnosed by a rheumatologist; 2) to meet the 1990 American College of Rheumatology (ACR) fibromyalgia criteria: widespread pain for more than 3 months and pain with 4 kg/cm^2 of pressure for 11 or more of 18 tender points (1). We also asked fibromyalgia participants to search a non-fibromyalgia individual with similar age and demographic area interested in participate in the study, in order to recruit a control group. The inclusion criteria for control participants were: 1) not to meet the 1990 ACR fibromyalgia criteria. Thirty-eight fibromyalgia participants were not previously diagnosed, 101 fibromyalgia participants did not meet the 1990 ACR criteria whereas 8 control participants met it. The final study sample comprised 566 (51.9±8.3 years) fibromyalgia women *vs.* 249 (49.3±9.9 years) control women; and 24 (47.0±8.4 years) fibromyalgia men *vs.* 56 (49.7±11.5 years) control men from southern Spain (Andalusia). The flow of participants is shown in Figure 1.

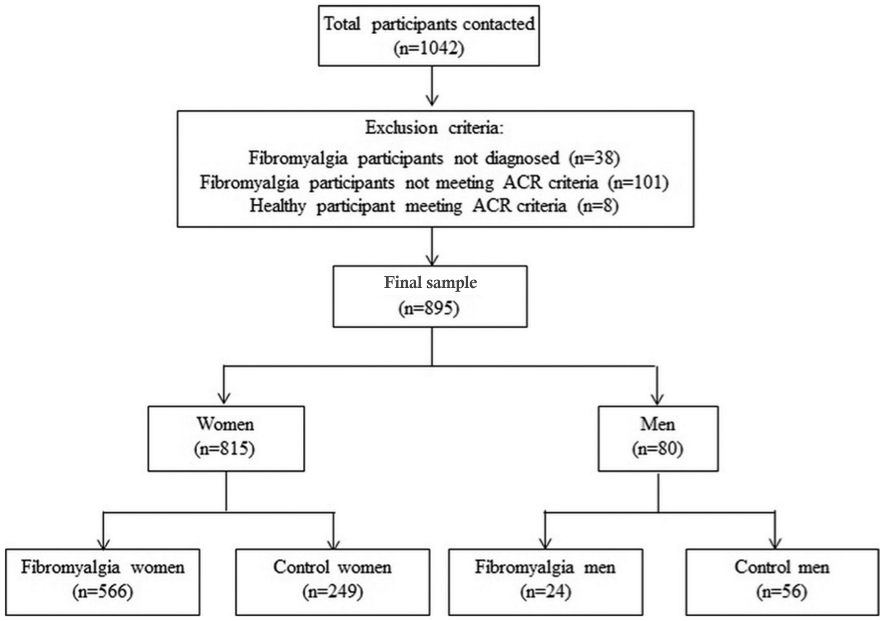

Fig. 1. Flow chart of participants.

All the measurements were performed in a single day for both groups and by the same trained researchers group in order to reduce inter-examiners error. The study was reviewed and approved by the Ethics Committee of the *Hospital Virgen de las Nieves* (Granada, Spain).

Procedures

• *Anthropometry and body composition*

We used a portable eight-polar tactile-electrode impedanciometer (InBody R20, Biospace, Seoul, Korea) to measure weight (kg), body fat (kg and %) and skeletal muscle mass (kg). The validity of this instrument has been reported elsewhere (22). Height (cm) was measured using a stadiometer (Seca 22, Hamburg, Germany). BMI was calculated as weight (kg) divided by height (m) squared and categorised using the international criteria: underweight (<18.5 kg/m^2), normal-weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2) and obese (≥30.0 kg/m^2). Waist circumference (cm) was measured with the participant standing at the middle point between the ribs and ileac crest (Harpenden anthropometric tape Holtain Ltd).

In all cases, the measurements were made at least two hours after the last meal, released from clothing and metal objects and having remained standing at least 5 minutes before the assessment. Following the manufacturer's recommendations, we asked them not to have a shower, not to practice intense physical exercise and not to ingest large amounts of fluid in the hour before the measurement.

• *Reliability of the body composition analysis*

In order to study the reliability of the impedanciometer, two successive measurements with an interval of 5 min-

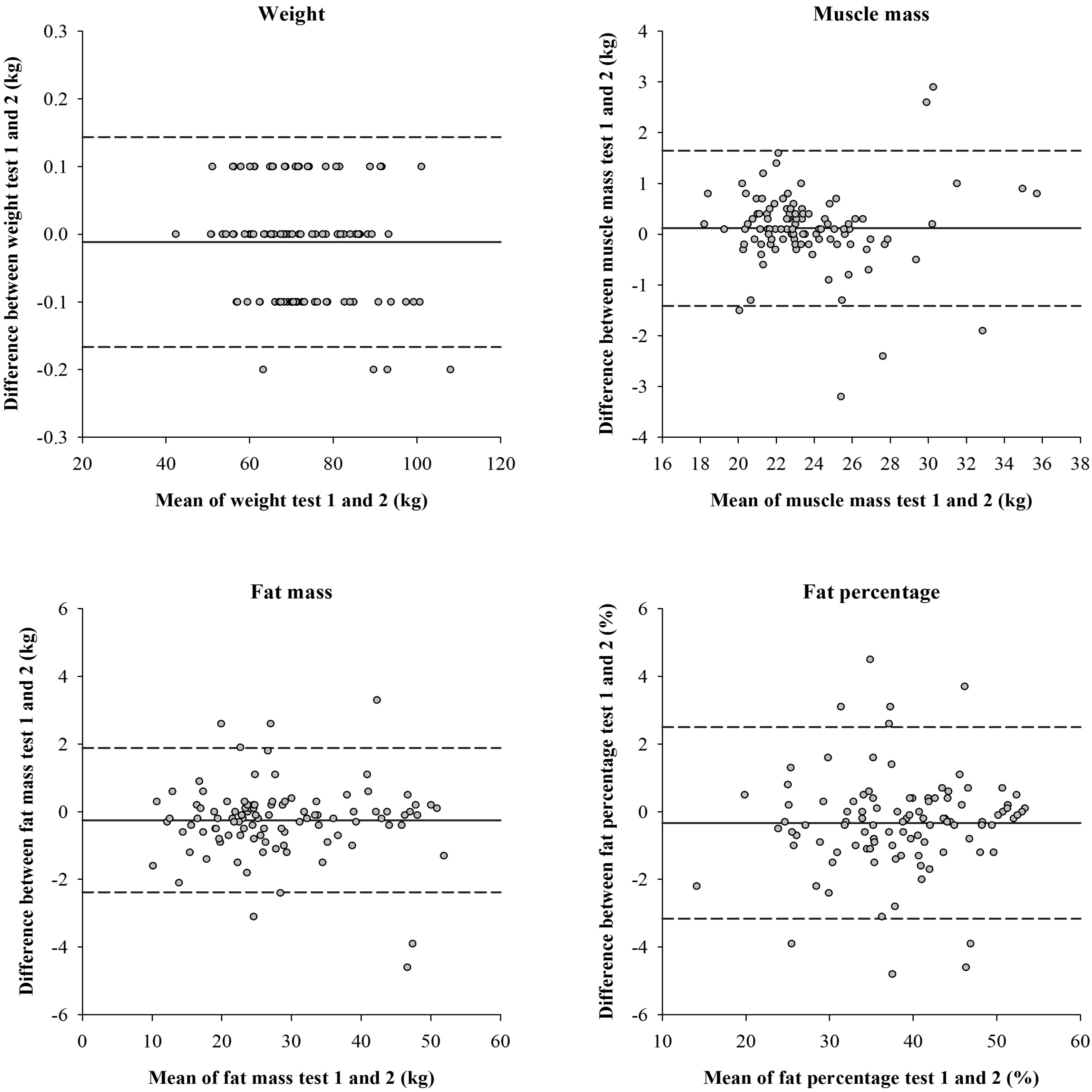

Fig. 2. Bland-Altman plots for the variables weight, muscle mass, fat mass and fat percentage in a subsample of fibromyalgia patients (n=102). The central line represents the mean of the differences between re-test and pre-test. The discontinuous lines represent the upper and lower limits agreement (mean difference ± 1.96 standard deviation).

utes between them were carried out in a randomly selected subsample (n=102). The impedanciometer reliability was examined following the Bland-Altman method (23, 24). The Bland-Altman plots (Fig. 2) showed graphically the impedanciometer reliability based on the systematic error (mean difference between measurements) and random error (limit of 95% agreement). Both, systematic error (close to 0) and limits of agreement observed, suggest that the reliability of the measurements is high.

• *Tender points*
We assessed 18 tender points according to the 1990 ACR fibromyalgia criteria using a standard pressure algo-meter (FPK 20; Wagner Instruments, Greenwich, CT, USA). The mean of two successive measurements at each tender point was used for the analysis. Tender point scored as positive when the patient noted pain at pressure ≤4 kg/cm^2. The total count of positive tender points was recorded for each participant.

• *Cardiorespiratory fitness*
We used the 6-minute walk test, which involves determining the maximum distance (m) that can be walked in 6 minutes along a 45.7 m rectangular course (25).

Statistical analysis

Descriptive analysis of socio-demographic and clinical characteristics was performed using parametric (Student's *t*-test) and non-parametric (Mann-Whitney U-test) tests for continuous variables in women and men, respectively; whereas categorical variables were assessed using Chi-square test. Body composition comparisons between fibromyalgia and control groups were performed using one-way analysis of variance (ANOVA). Age, educational status, occupational status and height were subsequently entered as covariates (ANCOVA). The use of analgesics, laxatives, antidepressants and stimulants were further added as covariates to the previous model. Finally, we tested the model with the inclusion of cardiorespiratory fitness as covariate. Differences on weight status categories were analysed using Chi-squared test. The Cohen's *d* was used to calculate the effect size and was interpreted as small (~0.25), medium (~0.5) or large (~0.8 or greater) (26). All analyses were performed using the Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, version 20.0, Armonk, NY) and the level of significance was set at $p<0.05$.

Table I. Socio-demographic and clinical characteristics of the study sample by groups.

	Women			Men		
	Fibromyalgia (n=566)	Control (n=249)	*p*	Fibromyalgia (n=24)	Control (n=56)	*p*
	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
Age (years)	51.9 (8.3)	49.3 (9.9)	<0.001	47.0 (8.4)	49.7 (11.5)	0.231
Tender points count (kg/cm^2)	16.8 (1.9)	3.2 (2.9)	<0.001	16.7 (1.8)	1.1 (2.2)	<0.001
6-minute walk test (m)	480.1 (87.5)	575.4 (66.9)	<0.001	525.6 (129.2)	631.4 (81.9)	0.001
	n (%)	n (%)		n (%)	n (%)	
Marital status						
Married	426 (75.3)	175 (70.6)	NS	15 (62.5)	41 (73.2)	NS
Single	52 (9.2)	34 (13.7)		8 (33.3)	14 (25.0)	
Separated	15 (2.7)	12 (4.8)		0 (0.0)	0 (0.0)	
Divorced	45 (8.0)	16 (6.5)		1 (4.2)	1 (1.8)	
Widow	28 (4.9)	11 (4.4)		0 (0.0)	0 (0.0)	
Educational status						
No studies	56 (9.9)	17 (6.8)	0.022	1 (4.2)	3 (5.4)	NS
Primary school	261 (46.2)	93 (37.3)		10 (41.7)	19 (33.9)	
Professional training	90 (15.9)	39 (15.7)		4 (16.7)	15 (26.8)	
Secondary school	69 (12.2)	43 (17.3)		4 (16.7)	9 (16.1)	
University medium degree	51 (9.0)	31 (12.4)		3 (12.5)	4 (7.1)	
University higher degree	38 (6.7)	26 (10.4)		2 (8.3)	6 (10.7)	
Current occupational status						
Working	145 (25.8)	99 (39.8)	<0.001	3 (12.5)	30 (53.6)	<0.001
Unemployed	94 (16.8)	40 (16.1)		5 (20.8)	11 (19.6)	
Sick leave	43 (7.7)	2 (0.8)		6 (25.0)	0 (0.0)	
Retired/pensioner	111 (19.8)	15 (6.0)		10 (41.7)	15 (26.8)	
Housewife	168 (29.9)	93 (37.3)		0 (0.0)	0 (0.0)	
Medication						
Analgesics	513 (90.8)	131 (53.0)	<0.001	23 (95.8)	23 (41.1)	<0.001
Laxatives	117 (20.7)	21 (8.5)	<0.001	4 (16.7)	0 (0.0)	0.002
Antidepressants	335 (59.3)	25 (10.1)	<0.001	16 (66.7)	7 (12.5)	<0.001
Stimulants	36 (6.4)	1 (0.4)	<0.001	2 (8.3)	0 (0.0)	0.029
Contraceptives	14 (2.5)	11 (4.5)	NS			
Hormonal replacement for menopause	14 (2.5)	8 (3.2)	NS			
Medication for losing weight	13 (2.3)	4 (1.6)	NS	1 (4.2)	0 (0.0)	NS

SD: standard deviation; NS: not significant.

Results

Socio-demographic characteristics of the study samples by gender are presented in Table I. No differences between women groups were observed on marital status. Age, tender points count, cardiorespiratory fitness, educational status and current occupational status differed between women groups (all, $p<0.05$). No differences between men groups were observed on age, marital status, and educational status. Men groups differed on tender points count, cardiorespiratory fitness and occupational status (all, $p<0.001$).

Significant differences in all the anthropometric and body composition variables (Table II) were observed between fibromyalgia and control women (all, $p<0.01$), except in the muscle mass ($p=0.271$). Weight, waist circumference, BMI, fat percentage and fat mass were significantly higher in the fibromyalgia women group compared to the control group (mean difference = 3.5 kg, 5.1 cm, 2.0 kg/m^2, 3.2% and 3.6 kg, respectively; all, $p<0.01$). The effect sizes observed in the body composition parameters between the women groups were small-medium. The results did not materially change after adjusting for age, educational status, occupational status and height (all, $p<0.05$). The findings persisted after additionally adjusting for the use of analgesics, laxatives, antidepressants and stimulants (all, $p<0.05$), except for height ($p>0.05$). No differences on body composition parameters between fibromyalgia and control women were shown when cardiorespiratory fitness was included as a covariate (all, $p>0.05$). No significant differences were observed between fibromyalgia and control men in any of the anthropometric and body composition variables studied (all, $p>0.05$).

Weight status categories by groups are shown in Figure 3. Only 4 women from the fibromyalgia (0.7%) and control group (1.6%) were underweight, so we included them in the normal-weight groups. Weight status differed between women groups, with an 11% lower normal-weight and a 17% higher obesity prevalence for the fibromyalgia women group ($p<0.001$). Seventy-two percent of the fibromyalgia women and 61% of the control women were overweight-obese (BMI≥25.0 kg/m^2). No differences between fibromyalgia and control men were observed in weight status ($p>0.05$). Seventy-nine percent of the fibromyalgia men and 83% of the control men were overweight-obese.

As we obtained statistical significant

Table II. Anthropometric and body composition characteristics of the study sample by groups.

	Women							Men		
	Fibromyalgia (n=563) Mean (SD)	Control (n=249) Mean (SD)	P_1	P_2	P_3	P_4	Effect size	Fibromyalgia (n=24) Mean (SD)	Control (n=56) Mean (SD)	P_1
Weight (kg)	71.3 (13.8)	67.8 (12.7)	0.001	<0.001	0.034	NS	-0.26	81.5 (13.3)	82.9 (12.6)	NS
Height (cm)	158.0 (6.1)	159.7 (6.2)	<0.001	0.028	NS	NS	0.28	171.0 (7.6)	171.2 (6.9)	NS
Waist circumference (cm)	90.6 (12.9)	85.4 (12.6)	<0.001	<0.001	0.016	NS	-0.40	97.5 (12.2)	97.0 (12.8)	NS
Body mass index (kg/m^2)	28.6 (5.4)	26.6 (4.7)	<0.001	<0.001	0.025	NS	-0.38	27.9 (4.6)	28.3 (3.9)	NS
Fat percentage (%)	40.0 (7.8)	36.8 (7.5)	<0.001	<0.001	0.014	NS	-0.42	28.5 (8.7)	28.9 (5.8)	NS
Muscle mass (kg)	22.8 (3.3)	23.0 (3.4)	NS	NS	NS	NS		31.7 (4.3)	33.1 (5.1)	NS
Fat mass (kg)	29.2 (10.5)	25.6 (9.2)	<0.001	<0.001	0.018	NS	-0.36	24.4 (10.6)	24.4 (7.3)	NS

Values represent mean (standard deviation [SD]) of model 1. P_1: unadjusted model; P_2: model adjusted for age, educational status, occupational status and height; P_3: model adjusted for age, educational status, occupational status, height, analgesics, laxatives, antidepressants and stimulants; P_4: model adjusted for cardiorespiratory fitness; NS: not significant.

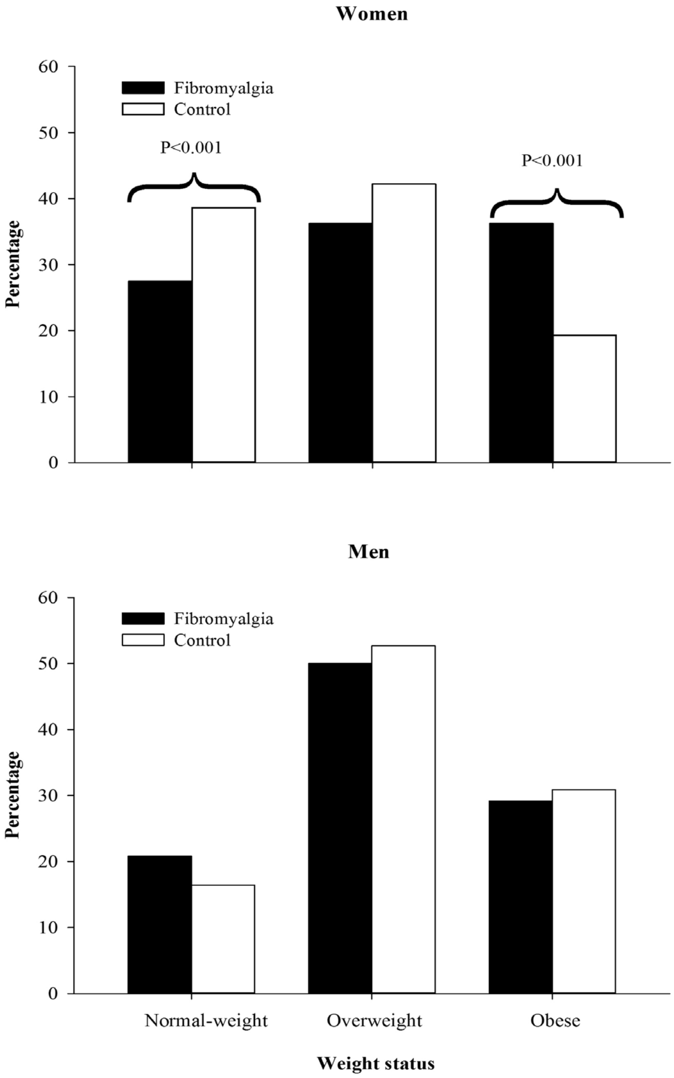

Fig. 3. Weight status of the study sample by groups. Normal-weight (BMI: ≤24.99kg/m^2); overweight (BMI: 25.0-29.99 kg/m^2); obese (BMI>30.0 kg/m^2).

differences on age between women groups, we repeated all the analyses with age-matched (35–65 age range, p>0.05) groups and all the results aforementioned persisted.

Discussion

The present study describes body composition in a sample of fibromyalgia women and men from southern Spain and compares them with controls. Fibromyalgia women showed higher total and central body fat but not higher muscle mass than control women. All body composition parameters differences were explained by a lower cardiorespiratory fitness in the fibromyalgia women group. However, no differences between men groups were found in any anthropometric or body composition characteristics. Most studies which have analysed body weight of fibromyalgia patients observed a higher prevalence of obesity when compared to reference values (15, 16, 21). Likewise, we observed that weight status differed between fibromyalgia and control women, with a greater rate of fibromyalgia women with overweight-obese prevalence when compared to their control peers (72 *vs.* 61%, respectively). However, no differences in weight status were found between fibromyalgia and control men. To note is that the impedanciometry showed a high test-retest reliability to measure body composition in the fibromyalgia sample.

Previous studies have reported high obesity rates in fibromyalgia women but all of them failed to directly compare them with a pairwise control group of similar characteristics (15, 17, 20, 21, 27, 28). The results of the present study showed higher weight, BMI, waist circumference, fat percentage and fat mass in the fibromyalgia women compared to control women group. The absence of differences between both groups in muscle mass might indicate that differences on body weight were not attributable to this variable, but could be explained by a greater fat in favour of fibromyalgia women. Waist circumference was also higher in the fibromyalgia women compared to the control women, which implies higher central body fat and consequently higher cardiovascular disease risk (29). Since some pharmacology has been linked to body weight gain (30), we further adjusted our analysis for these variables. Body composition differences between fibromyalgia and control women remained statistically significant when use of medication was controlled. However, body composition differences between women groups were explained by a lower cardiorespiratory fitness in the fibromyalgia group. This highlights the importance of cardiorespiratory fitness, which is usually impaired in fibromyalgia patients (31), to control and balance the body composition profile in fibromyalgia women. Fibromyalgia men did not show differences in any anthropometric or body composition measures compared to the control men, although is important to note that mean body fat percentages were high in both groups (~29%). BMI and body weight in the fibromyalgia women group was 28.6±5.4 kg/m^2 and 71.3±13.8 kg, respectively. These values are similar to those reported in other European (16, 32) and Spanish (27, 33) reference studies.

Sotillo *et al*. (34) previously studied the body composition characteristics in adult population from the same geographic area as ours. When we categorised by the same age range (data not shown) and compared our data with these reference values (34), we observed that the BMI obtained in the fibromyalgia women group was similar to the healthy women group by Sotillo *et al*. However, higher body fat percentage and waist circumference were observed in fibromyalgia women, whereas similar values were observed between control women and the reference group (34). Both, the fibromyalgia and control men groups showed higher BMI than the reference values (34). Furthermore they also showed higher body fat percentages and waist circumferences, indicating higher obesity rates for both fibromyalgia and control men compared to the previous reference study (34).

Approximately 72% of the fibromyalgia women sample was overweight-obese. The prevalence of fibromyalgia women overweight-obese was an 11% higher than that of the control women group. High percentages of overweight-obesity in fibromyalgia women are alarming, but we must consider that similar (16, 20, 21) or even higher (15, 17) percentages have been observed in previous international studies conducted in this population. Otherwise, men groups did not differ in their overweight-obesity prevalence. However a ~80% of fibromyalgia and control men were categorised as overweight-obese. To note is that categorising by BMI can have numerous limitations since high indices of BMI could be related to a greater muscle mass in some individuals (35). In our men sample, muscle mass corresponded to a 40% of total body weight. In any case, mean fat percentages in both men groups were quite high (>20%) (36).

Fibromyalgia women and men from the present study presented an approximately twice obesity prevalence than the reference values reported by the Spanish national studies DORICA (37) and SEEDO (38), with rates for women and men from southern Spain of ~17% and ~13.0%, respectively. Our control women showed similar obesity prevalence to the reference DORICA and SEEDO values. By contrast, control men did not, showing approximately twice obesity prevalence than these previous studies (37, 38). Greater obesity rates in fibromyalgia women compared to healthy controls may be due to some characteristics of this condition, as the lower resting metabolic rate (39), and the tendency to hypothyroidism (20). In addition, there are other symptoms, such as fatigue, nauseas, pain in the joints and legs, etc. (40) which can difficult them to perform both, physical activity and daily tasks. This fact could explain that fibromyalgia individuals are less physically active than healthy controls (41) and spend considerable time in sedentary activities (42), which might lead to eventual deconditioning and consequently result in higher BMI and body fat percentage.

Taken together, the high obesity prevalence showed in previous international (15, 17, 20, 21) and national (27, 28, 43) studies; the higher levels of BMI, weight, fat percentage and obesity prevalence of fibromyalgia women compared to Spanish reference values (34, 38, 43); and the differences between fibromyalgia and control women in the present study, suggest that fibromyalgia women have higher body fat and are generally more obese than healthy women. We do not know previous body composition studies in fibromyalgia men to compare our results with, but our data invite to think that, although they present worse cardiorespiratory fitness than controls, their body composition does not differ from that of healthy men, noting that both groups showed worrisome levels of obesity. It has been shown that overweight-obesity prevalence is higher in Spanish adult men compared to women (44, 45), which is in agreement with the results of the present study. Therefore, the fact that Spanish male adults usually present high rates of overweight-obesity might explain the absence of body composition differences with respect to fibromyalgia men.

Obesity is associated with cardiovascular diseases, cardiorespiratory changes, metabolic, musculoskeletal and digestive disorders, and other disturbances such as psychological and psychosocial disorders, lower quality of life, infertility or menstrual dysfunction (36). Weight-loss has proven to reduce musculoskeletal pain (46), which directly affects to our study population. One potential mechanism may be that a reduction of weight decrease the biomechanical stress on the load bearing joints, reducing pain responses (46). After a behavioural weight loss treatment (32), weight decline significantly predicted a reduction in fibromyalgia-related symptoms, body satisfaction, and quality of life. Behavioural weight-loss programs, with diet changes (32, 47) and involving exercise designed and adapted to this specific population (2, 48) might positively influence fibromyalgia symptoms and overall quality of life. Furthermore, due to the fact that women with chronic pain are at an increased risk for metabolic syndrome (49), both diet and physical activity could improve fibromyalgia symptoms and reduce metabolic syndrome by decreasing central obesity, dyslipidaemia, hypertension, and insulin resistance (50). Therefore, to keep a healthy (normal) weight status is highly recommended in this population, since it is not only associated with decreased risk for developing fibromyalgia but might be also a relevant and a useful way to improve fibromyalgia symptomatology in women (28).

Some limitations must be mentioned. First, the cross-sectional study do not allow ascertaining whether obesity is cause or consequence of fibromyalgia. Second, the results of the present study might be not clinically relevant due to the relatively low estimated mean difference observed in the anthropometric and body composition markers between fibromyalgia and control women. However, the observed differences suggest a worse body composition profile in fibromyalgia women compared to their healthy counterparts. Third, it is possible that the absence of statistical differences in body composition between men groups might be explained by the low sample size. Future studies with larger male samples might be helpful. Fourth, it would be also interesting to further investigate fibromyalgia populations from other Spanish geographic areas. On the other hand, strength of the present study is that individually tailored medication used for fibromyalgia symptomatology was registered and used as covariate in the analyses, in order to avoid a cofounder effect on body composition due to medication. Furthermore, we analysed body composition in almost six hundred fibromyalgia individuals, which allow us to have reference values with a relatively large sample size.

In conclusion, the present study provides a detailed and reliable measure of body composition in a large fibromyalgia sample from southern Spain. Our results concur with international studies and suggest that Spanish fibromyalgia women show higher body weight, waist circumference, body mass index and fat percentage compared to control women with similar age range and socio-demographic characteristics, as well as with reference values. Furthermore, weight status also differs between the study groups of women, with a lower prevalence of normal-weight and higher of overweight-obesity in fibromyalgia. However, these body composition differences might be explained by a lower cardiorespiratory fitness in the fibromyalgia group. Fibromyalgia men and the male control group do not differ in either anthropometric and body composition parameters or weight status, although both groups showed worryingly high fat percentages. A greater awareness among fibromyalgia individuals about the importance of keeping a normal weight status to prevent an aggravation of their symptoms is necessary. Further research is needed to contrast if these results can be extrapolated to the global fibromyalgia population.

Acknowledgements

We would like to thank all the members of the CTS-545 research group involved in the field work. We also gratefully acknowledge all the study participants for their collaboration.

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