Tesis Doctoral Europea / European Doctoral Thesis

CONDICIÓN FÍSICA, COMPOSICIÓN CORPORAL Y FIBROMIALGIA

PHYSICAL FITNESS, BODY COMPOSITION AND FIBROMYALGIA

DEPARTAMENTO DE EDUCACIÓN FÍSICA Y DEPORTIVA.
FACULTAD DE CIENCIAS DE LA ACTIVIDAD FÍSICA Y DEL DEPORTE.
UNIVERSIDAD DE GRANADA

VIRGINIA A. APARICIO GARCÍA-MOLINA

2011

Editor: Editorial de la Universidad de Granada
Autor: Virginia A. Aparcio García Molina
D.L.: GR 910-2012
ISBN: 978-84-694-9337-3

A mi madre

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Que la Tesis Doctoral titulada "Condición física, composición corporal y fibromialgia" que presenta Dña. **VIRGINIA A. APARICIO GARCÍA-MOLINA** al superior juicio del Tribunal que designe la Universidad de Granada, ha sido realizada bajo mi dirección durante los años 2007-2011, siendo expresión de la capacidad técnica e interpretativa de su autora en condiciones tan aventajadas que le hacen merecedora del Título de Doctor, siempre y cuando así lo considere el citado Tribunal.

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En Granada, 30 de junio de 2011

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PROYECTOS DE INVESTIGACIÓN [RESEARCH PROJECTS]

El trabajo desarrollado y los artículos que componen la presente memoria de Tesis Doctoral están basados en los siguientes proyectos de investigación:

- Evaluación y promoción de la calidad de vida relacionada con la salud para enfermos de fibromialgia. Financiación recibida por el Instituto Andaluz del Deporte. Fecha: 04/01/2008 al 04/01/2009.

- Intervención para la mejora de la calidad de vida relacionada con la salud. Financiado por la Asociación Granadina de Fibromialgia (AGRAFIM). Fecha: 18/01/2008 al 18/01/2011.

- Mejora de la calidad de vida en personas con fibromialgia a través de programas de actividad física y multidisciplinares. Financiación obtenida en la VIII convocatoria de proyectos de cooperación universitaria para el desarrollo, transferencia de conocimientos en el ámbito de la acción social y sensibilización y educación para el desarrollo. Centro de Iniciativas de Cooperación al Desarrollo. Universidad de Granada. Fecha: 3/12/2008 al 3/12/2009.

- Efectos de programas de actividad física en la calidad de vida de personas con fibromialgia (EPAFI). Fundación MAPFRE. Ayudas a la investigación 2009. Fecha: 01/01/2010 al 31/12/2010.

- Niveles de actividad física, condición física, salud y calidad de vida en población andaluza con fibromialgia: efectos del ejercicio físico y determinantes genéticos. CTCD-201000019242-TRA. Consejería de Turismo, Comercio y Deporte, Junta de Andalucía. Fecha: 01/06/2010 al 30/05/2013.

- Perfil del paciente con fibromialgia: características biomédicas, genéticas y psicosociales. Cátedra Real Madrid, Universidad Europea de Madrid. Escuela de Estudios Universitarios Real Madrid. Fecha: 30/07/2010 al 29/07/2011.

- Physical activity in women with fibromyalgia: effects on pain, health and quality of life (actividad física en mujeres con fibromialgia: efectos sobre el grado de dolor, salud y calidad de vida). DEP2010-15639. Plan Nacional I+D+i 2008-2011, Ministerio de Ciencia e Innovación. Fecha: 01/07/2010 al 30/06/2013.

LISTA DE PUBLICACIONES [LIST OF PUBLICATIONS]

La presente memoria de Tesis Doctoral está compuesta por los siguientes artículos científicos:

I. **Aparicio VA,** Ortega FB, Carbonell-Baeza A, Tercedor P, Ruiz JR, Delgado-Fernández M. Are there gender differences in quality of life and fibromyalgia symptomatology? *Submitted.*

II. **Aparicio VA,** Ortega FB, Heredia JM, Carbonell-Baeza A, Sjöström M, Delgado-Fernandez M. Handgrip strength test as a complementary tool in the assessment of fibromyalgia severity in women. Arch Phys Med Rehabil. 2011; 92(1):83-8.

III. **Aparicio VA,** Carbonell-Baeza A, Ortega FB, Ruiz JR, Heredia JM, Delgado-Fernández M. Handgrip strength in men with fibromyalgia. Clin Exp Rheumatol. 2010; 28(6 Suppl 63):S78-81.

IV. **Aparicio VA,** Carbonell-Baeza A, Ruiz JR, Aranda P, Tercedor P, Delgado-Fernández M and Ortega FB. Fitness testing as a complementary tool in the assessment and monitoring of fibromyalgia in women. Scandinavian Journal of Medicine and Science in Sports. *Second revision.*

V. **Aparicio VA,** Ortega FB, Heredia JM, Carbonell-Baeza A, Delgado-Fernández M. Análisis de la composición corporal en mujeres con fibromialgia. Reumatol Clin. 2011; (7):7-12

VI. **Aparicio VA,** Ortega FB, Carbonell-Baeza A, Gatto-Cardia C, Sjöström M, Ruiz JR, Delgado-Fernández M. Fibromyalgia key symptoms in normal weight, overweight and obese female patients. Pain Management Nursing. *In press*

VII. **Aparicio VA,** Carbonell-Baeza A, Ortega FB, Camiletti D, Ruiz JR, Delgado-Fernández M. Relationship of weight status with mental and physical health in female fibromyalgia. Obesity Facts. *In press*

VIII. **Aparicio VA,** Ortega FB, Carbonell-Baeza A, Cuevas A, Delgado-Fernández M and Ruiz JR. Anxiety, depression and fibromyalgia pain and severity in female patients. *Submitted.*

IX. **Aparicio VA,** Carbonell-Baeza A, Ortega FB, Estevez F, Ruiz JR and Delgado-Fernández M. Usefulness of tenderness to characterize fibromyalgia severity and symptomatology in women. Clin Exp Rheumatol. *In press.*

RESUMEN

La fibromialgia es una enfermedad de etiología aún desconocida, caracterizada por dolor crónico y generalizado, que presenta una elevada comorbilidad y afecta notablemente a la calidad de vida y funcionalidad de la persona.

El objetivo general de esta Tesis Doctoral ha sido analizar el potencial de los test de condición física como herramienta de ayuda al diagnóstico y seguimiento de la fibromialgia, así como la relación que existe entre el género, el nivel de condición física, la composición corporal y la calidad de vida con la sintomatología de la enfermedad.

Los principales resultados de la Tesis sugieren que: a) No se han observado diferencias consistentes que confirmen diferencias de género en calidad de vida y sintomatología de pacientes con fibromialgia. b) La fuerza de prensión manual está reducida tanto en hombres como en mujeres con fibromialgia, así como en aquellos pacientes que padecen fibromialgia severa con respecto a los que presentan fibromialgia moderada. La identificación de personas que no alcanzan los puntos de corte de fuerza de prensión manual sugeridos en la presente Tesis podría ser una herramienta complementaria útil para el médico/reumatólogo. c) La condición física en general, y particularmente, el test de los 30 segundos de levantadas en una silla, discrimina entre mujeres con fibromialgia y mujeres sanas, así como entre aquellas que padecen fibromialgia severa de la moderada. d) La obesidad es una condición frecuente entre mujeres con fibromialgia (~34%), siendo su prevalencia sustancialmente superior a los valores normativos nacionales. e) La sintomatología de las enfermas de fibromialgia con sobrepeso no difiere de las obesas, sin embargo, las pacientes con normopeso muestran menor severidad en los síntomas, lo que sugiere que mantener un peso saludable (normopeso) podría ser una forma útil de mejorar la sintomatología de la enfermedad. f) Las enfermas de fibromialgia obesas presentan mayores niveles de ansiedad y depresión, junto con una peor calidad de vida, capacidad aeróbica, equilibrio dinámico y flexibilidad que las mujeres enfermas con normopeso. g) Las pacientes con altos niveles de ansiedad y depresión muestran también un mayor dolor percibido. Además, las mujeres con mayores niveles de depresión y ansiedad presentan un mayor riesgo de padecer fibromialgia severa y/o Tipo II. h) La estimación de los puntos de dolor no discrimina entre enfermas con fibromialgia moderada y severa.

Los resultados de la presente memoria de Tesis ponen de manifiesto la utilidad de la valoración de la condición física y de la composición corporal como herramienta complementaria en el diagnóstico y seguimiento de la fibromialgia.

SUMMARY

Fibromyalgia is a disorder of unknown etiology, characterized by widespread and chronic pain, and elevated comorbidity. Fibromyalgia has a marked impact on the health-related quality of life and functional capacity of patients.

The overall objective of this Thesis has been to analyze the capacity of fitness testing for the diagnosis and monitoring of the fibromyalgia, as well as to study the relationship between gender, fitness, weight status and quality of life with fibromyalgia symptomatology.

The main findings from this Thesis suggest that: a) Our data do not support meaningful gender differences in quality of life and fibromyalgia symptomatology. b) Physical fitness in general and, particularly the 30-s chair stand test, discriminate women with fibromyalgia from those without fibromyalgia, as well as those with moderate fibromyalgia from their peers with severe fibromyalgia. c) Handgrip strength is reduced in women and men with fibromyalgia as well as in those with severe fibromyalgia compared from their peers with moderate fibromyalgia. Identification of persons who fail to meet the suggested handgrip strength standards proposed in this Thesis can be a helpful and informative tool for the clinician. f) Obesity is a common condition in women diagnosed with fibromyalgia and its prevalence (~34%) in this population is higher than the national reference values. e) Fibromyalgia symptomatology in obese patients do not differ from overweight patients, whereas normal weight patients significantly differ from either overweight and obese patients, suggesting that keeping a healthy (normal) weight might be a relevant and useful way of improving fibromyalgia symptomatology in women. f) Obese female fibromyalgia patients display higher levels of anxiety and depression and worse quality of life, cardiorespiratory fitness, dynamic balance/motor agility and upper flexibility than their normal weight peers. g) High levels of anxiety and depression are associated with higher perceived pain. Patients with higher levels of anxiety and depression present increased risk of severe or/and Type II fibromyalgia. h) Tender points count do not discriminate women with moderate fibromyalgia from those with severe fibromyalgia.

These findings highlight the usefulness of physical fitness and body composition assessment as a complementary tool in the diagnosis and monitoring of the fibromyalgia.

ABREVIATURAS [ABBREVIATIONS]

ACR	American College of Rheumatology
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
AUC	Area Under the Curve
BF	Body Fat
BMI	Body Mass Index
EULAR	European League Against Rheumatism
FIQ	Fibromyalgia Impact Questionnaire
HADS	Hospital Anxiety and Depression Scale
HGs	Handgrip Strength
NW	Normal Weight
OB	Obese
OR	Odds Ratio
OW	Over Weight
ROC	Receiver Operating Characteristic
SEM	Standard Error of the Mean
SF-36	Short-Form Health Survey 36
TPC	Tender Point Count
UW	Under Weight
VAS	Visual Analogic Scale

INTRODUCCIÓN [INTRODUCTION]

1. Characteristics of the disorder

1.1 Definition

Fibromyalgia is a disease characterised by the concurrent existence of chronic, widespread, musculoskeletal pain and multiple sites of tenderness[1]. Fibromyalgia is considered a disorder of pain regulation[2], indicated by an increased sensitivity to painful stimuli (hyperalgesia) and lowered pain threshold (allodynia)[3]. Although a hallmark of fibromyalgia is pain, fibromyalgia patients are usually poly-symptomatic[4]. In addition to pain, fibromyalgia patients' symptoms typically include fatigue, stiffness, non restorative sleep patterns or memory and cognitive difficulties[1, 4-5]. Other common symptoms are low back pain, recurrent headaches, arthritis, muscle-spasm, and balance problems[4]. The high prevalence of comorbidities among patients diagnosed with fibromyalgia[6] increases patients' needs for appropriate medical management and results in higher healthcare resource utilization compared with patients without fibromyalgia[7].

1.2 Etiology

The increased pain sensitivity in fibromyalgia is not limited to mechanical stimuli and also includes electrical, heat, and cold stimuli[8-9]. The cause for the heightened sensitivity of fibromyalgia patients is unknown, but is likely to involve abnormalities in central nervous system sensory processing[10]. Indeed, accumulating evidence suggests that fibromyalgia probably results from abnormal central pain processing rather than a dysfunction in the peripheral tissues where such pain is perceived[11]. Despite substantial research in the past decade, the pathophysiology and etiology of the disease remains unclear[7], yet recent studies indicate that gene polymorphisms in the serotoninergic, dopaminergic and catecholaminergic systems play key role in the etiology of the disease[12-13].

1.3 Prevalence

In Spain, the prevalence of fibromyalgia is ~2.4%, being more frequent in rural (~4.1%) than in urban settings (~1.7%)[14]. The clinical manifestation of fibromyalgia appears between the 40s and 50s and is more common in women than in men (~95% of the cases vs. ~5%, respectively)[14]. Studies on male fibromyalgia patients are scarce. Maybe for this reason, information regarding differences in quality of life and fibromyalgia symptoms between men and women with fibromyalgia seems to be controversial. Some studies have observed that women with fibromyalgia have more tender points, hurt all over, total number of symptoms, and irritable bowel syndrome than men with fibromyalgia[15-18]. In contrast, it has also been reported that men have a worse perception of their health, a higher percentage of psychiatric history and current mental illness, decreased physical function, lower quality of life and more impact of the disease[18-19]. Langi *et al.*[20] observed no gender differences in pain measures, but they found that men had more positive levels in psychological measures and coping strategies than women. Finally, recently Häuser *et al.*[21] found no relevant gender differences in the clinical picture of fibromyalgia and concluded that the assumption of well-established gender differences could not be supported.

Further study of gender differences in quality of life and fibromyalgia symptomatology is still needed for a better understanding of the disease. (PAPER I).

1.4 Burden

The fibromyalgia patients incur in significant direct medical care costs[22-23]. In Spain, two studies[23-24] analyzed the mean total cost per patient per year and indicated that this was up to ~10,000€. To note is that in comparison with a reference group, patients incur in an extra annual average cost of €5,010[23]. Rivera *et al.*[24] observed that 32.5% corresponded to health care costs (direct cost), and 67.5% to indirect costs (sick leave and early retirement). Both, direct and indirect costs were significantly correlated to disease severity, the degree of functional disability, the presence of depressive symptoms, the existence of comorbidities, and a younger patient age[24]. A delay in the diagnosis of the disease therefore appears to be another factor contributing to the high health care costs of fibromyalgia[24] .

1.5 Diagnosis

A major problem in fibromyalgia is the absence of a gold standard or standard criteria for the diagnosis of the disease[25]. The diagnosis of fibromyalgia is mostly based on the identification of tender points. The 1990 American College of Rheumatology (ACR) criteria for the diagnosis of fibromyalgia considers: widespread pain for more than 3 months and pain with 4 kg/cm of pressure for 11 or more of 18 tender points[1]. Application of these criteria has resulted in a diverse group of people being diagnosed with fibromyalgia[5].

Twenty years later, Wolfe *et al.* [25] presented the ACR new preliminary diagnostic criteria for fibromyalgia. The objective of this new criteria was to develop a simple, practical criteria, for clinical diagnosis of fibromyalgia in primary and specialty care and that do not require a tender point examination and to provide a severity scale for characteristic fibromyalgia symptoms[25]. This preliminary diagnostic criteria establishes 3 conditions[25]: i) Widespread Pain Index $\geq$ 7, and Symptom Severity Score $\geq$ 5, or Widespread Pain Index between 3-6 and Symptom Severity Score $\geq$ 9. ii) Symptoms have been present at a similar level for at least 3 months. iii) The patients do not have a disorder that would otherwise explain the pain.

The Widespread Pain Index is a measure of the number of painful body regions. The patients are asked to indicate in which of 19 body areas they had pain during the last week[25]. The Symptom Severity Score is the result of the symptom severity scale, a variable composed of physician rated cognitive problems, unrefreshed sleep, fatigue and somatic symptom count to measure fibromyalgia symptom severity[25].

Recently, Wolfe *et al.*[26] published a modification to the ACR 2010 criteria for their use in epidemiologic and clinical studies without the requirement for an examiner. The authors affirmed that the criteria was simple to use and administer, but there were not to be used for self-diagnosis. For that reason they also created a new fibromyalgia symptom scale to further characterize fibromyalgia severity by adding the Widespread Pain Index to the modified Severity Scale. The authors concluded that this new Symptoms Scale may have wide utility beyond the bounds of fibromyalgia, including substitution for widespread pain in epidemiological studies.

2. Physical Fitness in fibromyalgia patients

People with moderate or severe pain are likely to reduce their physical activity and thus display a deconditioned fitness status[27-29]. Physical fitness is decreased in persons with fibromyalgia compared to age-matched healthy peers[30-34], and is similar to healthy older adults[33, 35]. Panton *et al.*[33] showed that lower-body strength and functionality was similar in women with fibromyalgia compared with older healthy women, which suggest that fibromyalgia potentially enhances the risk for premature age-associated disability. Jones *et al.*[35] found that women with fibromyalgia reported difficulty on doing tasks associated with staying physically independent. In fact, several symptoms/conditions (i.e. fatigue, pain, stiffness, depression, restless legs, balance problems, dizziness/fear of falling, bladder problems) were found to be associated with physical impairment[35].

During the past decade, several studies analyzed the physical fitness level of fibromyalgia patients when compared with healthy people, especially in relation with aerobic capacity and strength. Women with fibromyalgia have significantly lower isometric force in bilateral leg extensors, unilateral knee extensors and flexors than healthy women[29]. Furthermore, several studies reported lower upper muscular strength, as measured by handgrip strength in women with fibromyalgia[30-34]. The aerobic capacity is also lower in fibromyalgia patients than in healthy adults[30]. Moreover, fibromyalgia is associated with balance problems and increased risk of falling[32, 36]. Indeed, gait parameters of women with fibromyalgia are severely impaired when compared to those of healthy women[34]. Flexibility levels in female patients are also below the average age-specific reference values for healthy women[37]. To note is that flexibility plays a key role in the capacity to carry out the activities of daily living.

A better characterization and complete description of functional capacity will improve the knowledge of the disease and the prescription of individualised exercise doses[38].

Physical Fitness Tests and Fibromyalgia Features

Due to the complex nature of the disease, the diagnosis of fibromyalgia appears to be a dynamic process that still requires the contribution of new tools that facilitate the physicians final decision[25]. Alternative simple, practical, valid and reliable clinical tools can be helpful in the clinical examination and evaluation of patients. In this context, handgrip strength is a quick and easy to perform muscular fitness test that provides useful information about overall muscular strength and could potentially be used in a clinical setting. Several studies have observed lower levels of handgrip strength in fibromyalgia patients[39-43], which could be attributed to: i) the patients with moderate or severe pain are likely to reduce their daily life physical activities and thus display a reduced muscular strength[44], ii) the fatigue and pain, characteristic of the disease, might negatively affect handgrip strength performance[39]. From a clinical point of view, it is interesting to examine the ability of the handgrip strength test to discriminate between persons with and without fibromyalgia and the relative severity of the disorder. (PAPER II).

Bush *et al.*[38] highlighted the importance of a better characterization of fibromyalgia patients' physical fitness/functional capacity levels. Mannerkopi *et al.*[45] suggested that fitness testing (especially the handgrip strength and the 6-min walking test) could be a complement to current tools used in the clinical examination when planning treatment for patients with fibromyalgia. However, most of studies were conducted in women[39-40, 45], and little is known on muscular fitness and fibromyalgia in male population. Since muscular strength, as assessed by handgrip strength, is a predictor of functional capacity, morbidity and mortality[46-47] to explore the association between handgrip strength and fibromyalgia in men is of clinical and social relevance. (PAPER III).

The inclusion of physical fitness assessment to the armamentarium currently used to the diagnosis and monitoring of fibromyalgia is clinically relevant. For that reason, is interesting to examine the ability of a set of fitness tests to discriminate between persons with and without fibromyalgia and the relative severity of the disorder. Many physical fitness tests are currently available, but it is still unknown whether there is a test that discriminates better than others between presence/absence and severe/moderate fibromyalgia. (PAPER IV).

3. Body composition/weight status and fibromyalgia

Body composition and weight status are important markers of health status and predictors of several comorbidities. Epidemiological data show that fibromyalgia patients have higher prevalence of obesity (~40%) and overweight (~30%) in multiple studies compared with healthy patients [48-52].

Studies published to date do not describe deeply body composition in fibromyalgia patients, focusing almost exclusively on the description of weight and BMI[48, 53]. Therefore, there is a vague knowledge about other relevant parameters related to body composition (*i.e.* the fat percentage or muscle mass). (PAPER V).

3.1 Weight status, pain and other key symptoms in fibromyalgia patients

Obesity can be considered an aggravating comorbid condition, affecting negatively fibromyalgia severity, global quality of life, fatigue, and physical dysfunctioning[52].

In the general population, a high BMI is associated with back pain[54 55], headache as migraine[56], and increased general pain[57]. In a recent study, overweight and obese twins were more likely to report low back pain, tension-type or migraine headache, fibromyalgia, abdominal pain, and chronic widespread pain than normal weight twins[58]. Moreover, in the longitudinal Norwegian HUNT study[59], conducted on 15,990 women, overweight and obesity was associated with a 60-70% higher risk of incident fibromyalgia, especially if they are physically inactive.

Overweight and obese fibromyalgia patients have also higher pain sensibility[48, 50, 57], increased sensitivity to tender points palpation, reduced physical functioning, lower-body flexibility, shorter sleep duration, and greater restlessness during sleep than normal weight fibromyalgia patients[49, 51, 59]. However, it is unknown whether there is a dose-response association between weight status and fibromyalgia major symptoms, particularly whether obese fibromyalgia patients have a worse symptomatology than overweight patients. (PAPER VI).

Several mechanisms have been proposed to explain ''the hidden link'', but at this time is not possible to ascertain whether obesity is cause or consequence of fibromyalgia. Among mechanisms proposed there are: reduced physical activity, sleep disturbances, depression, dysfunction of thyroid gland and dysfunction of the GH/IGF-1 axis[49-51, 53, 60-65].

Weight-loss has shown to reduce musculoskeletal pain[66]. One potential mechanism may be that a reduction of weight decrease the biomechanical stress on the load bearing joints, reducing pain responses[66]. Similarly, weight loss reduced headache frequency and severity in obese migraineurs[56]. In the intervention of Shapiro *et al.,*[67] weight loss significantly predicted a reduction in fibromyalgia-related symptoms, body satisfaction, and quality of life. Behavioural weight-loss programs, with diet changes[67-68] and involving exercise designed and adapted to this specific population[69] may 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[70], both diet and physical activity could improve fibromyalgia symptoms and reduce metabolic syndrome through decreasing obesity, dyslipidemia, hypertension, and glucose intolerance [71].

3.2 Weight status and fitness in fibromyalgia patients

In the general population, relative increases in maximal cardiorespiratory fitness and habitual physical activity have been associated with lower depressive symptomatology and greater emotional well-being[72]. In fibromyalgia patients, poor physical conditioning has been considered as one of the potential contributors of pain sensitivity[50-51].

To the best of our knowledge, the study by Okifuji *et al.*[51] is the only one examining the association between weight status and physical fitness in fibromyalgia patients. The authors observed reduced flexibility in the lower body areas, as well as reduced muscular strength in general and greater weight status [51]. Despite that, Okifuji *et al.*[51] studied the differences on some physical fitness tests between normal-weight, overweight and obese patients but they did not analyze the pairwise differences among weight status categories. (PAPER VII).

3.3 Weight status and quality of life in fibromyalgia patients

Raised BMI has been associated with increased long-term risk for depression in individuals without fibromyalgia[73]. Likewise, obesity has been associated with psychiatric disorders and suicidal behavior[74].

The study of Neumann *et al.*[50] examined the association between normal-weight, overweight and obese status and quality of life in fibromyalgia patients. The authors[50] observed no differences in a single value of quality of life computed from all the General Health Short-Form Survey (SF36) subscales. They did not analyze the pairwise differences between groups (*i.e.* normal-weight, overweight or obese). To the best of our knowledge, the differences in anxiety, depression, and quality of life indicators across weight status categories have never been studied in fibromyalgia patients. (PAPER VII).

Weight loss appears to predict a reduction in fibromyalgia-related symptoms, body satisfaction, and quality of life[67]. Behavioural weight-loss programs (diet and physical activity) designed and adapted to this specific population[67, 75] may positively influence fibromyalgia patients cardiorespiratory fitness, anxiety and depression levels and overall quality of life.

4. Pain and fibromyalgia

4.1 Anxiety, depression and pain in fibromyalgia

Chronic pain is often associated with comorbidities such as anxiety and depression, resulting in a low health-related quality of life[1, 4-5, 76]. Fibromyalgia has been found to be strongly associated with depressive and anxiety symptoms, a personal or family history of depression, and accompanying antidepressant treatment[77]. Many individuals with fibromyalgia also have comorbid psychiatric disorders, which can present diagnostic dilemmas and require additional treatment considerations to optimize patient outcomes [76]. Furthermore, Gormsen *et al.*[78] observed that patients with fibromyalgia have more mental symptoms such as depression and anxiety than patients with neuropathic pain. Moreover, associations between pain intensity and mood phenomena were only found in fibromyalgia patients. On the other hand, Jensen *et al.*[79] observed that negative mood in fibromyalgia patients can lead to a poor perception of one's physical health (and vice-versa) but do not influence the performance in clinical and experimental pain assessments.

The physical distress of fibromyalgia syndrome can increase both anxiety and depression. Current imaging studies support the idea that central effects connected with fibromyalgia syndrome relate to the processing of noxious stimulation more than affective disorder[80].

Although there are several studies investigating the extant comorbidity between depressive disorders and symptoms and fibromyalgia, data regarding the impact of anxiety and depression on fibromyalgia patients are still scarce. Little is known about pain across low, mild, moderate and severe depression and anxiety subgroups. It would be of interest to analyze how anxiety and depression influence pain and the severity of the fibromyalgia. Moreover, to date, no study has neither analyzed the relationships between high levels of anxiety and depression and the risk of severe fibromyalgia. (PAPER VIII).

4.2 Tenderness in fibromyalgia

Fibromyalgia has been traditionally associated and diagnosed based on Tender Points Count (TPC)[1], however, fibromyalgia is more than just a pain syndrome[1, 4-6]. As it has been mentioned above, after the apparent difficulty and controversy around the analysis of TPC, the ACR presented and alternative preliminary diagnostic criteria mainly based on symptoms severity[25]. To note is that this new criteria statement has newly opened the debate[81-82].

Several health-related questionnaires are often used as complementary information in the diagnosis and monitoring of fibromyalgia. From a clinical point of view, is interesting to discriminate between persons with mild or severe impairment of the disorder. One of the most used and specific questionnaires in fibromyalgia is the *Fibromyalgia Impact Questionnaire* (FIQ)[83-84]. More than 20 years after it was originally launched, the FIQ is still considered to be as one of the main tools to assess fibromyalgia simptomatology[83]. Despite this, there is no consensus (or this aspect has not been deeply explored) about FIQ cut-off points to establish different degrees of the fibromyalgia severity. Bennet *et al.*,[83] in a review performed in 2005 about the FIQ development, operating characteristics of FIQ, and its use, suggested a FIQ score ≥70 to establish severe impairment of the disease. The same author proposed a FIQ score ≥59 as cut-off point in 2009, and concluded that this new cut-off point was quite in agreement with that suggested originally[85]. In 2008, de Souza *et al.*[86] stated that pain and stiffness were universal symptoms of the fibromyalgia, but that psychological distress was a feature present only in some patients. Accordingly to this, and based on the FIQ, the authors classified the patients in fibromyalgia Type I, characterized by the lowest levels of anxiety, depressive and morning tiredness symptoms, and fibromyalgia Type II, characterized by elevated levels of anxiety, depressive symptoms, morning tiredness, pain, fatigue and stiffness. The same study was replicated by Calandre *et al.*[87] in 2010 with a larger sample of Spanish female fibromyalgia patients, and the authors concluded that the proposed fibromyalgia classification was reliable, easy to perform and should be applied in further studies.

It would be of interest to determine the ability of the TPC to estimate fibromyalgia severity and simptomatology, as well as typology. (PAPER IX).

Fibromyalgia is still a rather unknown disease. There is a need for better understanding the relationship between gender, physical fitness, body composition and fibromyalgia features.

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OBJETIVOS

General:

El objetivo general de esta memoria de Tesis Doctoral fue analizar las diferencias de género y el potencial de los test de condición física como herramienta de ayuda al diagnóstico y seguimiento de la fibromialgia, así como estudiar la relación que existe entre la composición corporal, el nivel de condición física y la calidad de vida con la sintomatología de la enfermedad.

Específicos:

- Analizar si existen diferencias de género en calidad de vida y sintomatología de la fibromialgia **(Artículo I)**.
- Determinar si la fuerza de prensión manual es útil para discriminar entre la presencia y ausencia de fibromialgia y su grado de severidad (severa vs. moderada), tanto en mujeres como en hombres **(Artículos II y III)**.
- Identificar cuáles son los componentes (y test) más importantes de la condición física para discriminar entre presencia y ausencia de fibromialgia y su grado de severidad en mujeres **(Artículo IV)**.
- Caracterizar el perfil antropométrico y de composición corporal de mujeres con fibromialgia del sur de España y compararlo con otros estudios nacionales e internacionales de similares características, así como con valores normativos de mujeres españolas **(Artículo V)**.
- Analizar la relación entre un elevado índice de masa corporal y dolor, fatiga y rigidez en mujeres con fibromialgia españolas, con especial atención a las diferencias entre enfermas con sobrepeso y obesidad **(Artículo VI).**
- Analizar la relación entre elevado índice de masa corporal con las condición física, ansiedad, depresión y calidad de vida en enfermas de fibromialgia **(Artículo VII)**.
- Analizar la relación entre distintos niveles de ansiedad y depresión y el dolor y la severidad de la fibromialgia **(Artículo VIII)**.
- Establecer la capacidad de los puntos de dolor para discriminar la severidad y sintomatología de la fibromialgia **(Artículo IX)**.

AIMS

Overall:

The overall objective of this PhD Thesis was to analyze gender differences and whether fitness testing can be used for the diagnosis and monitoring of the fibromyalgia, as well as to study the relationship between fitness, weight status and quality of life and fibromyalgia symptomatology.

Specifics:

- To analyze gender differences in quality of life and fibromyalgia symptomatology **(Paper I)**.
- To determine the ability of the handgrip strength test to discriminate between the presence and absence of fibromyalgia and fibromyalgia severity in women and men **(Paper II and III)**.
- To identify which are the most important fitness's components (and tests) from physical fitness to discriminate between presence/absence of fibromyalgia and fibromyalgia severity in women **(Paper IV)**.
- To describe the anthropometric profile and body composition of women from Southern Spain diagnosed with fibromyalgia and to compare the observed values with values from other studies conducted on fibromyalgia patients and with national reference values **(Paper V)**.
- To analyze the relationship of weight status with pain, fatigue and stiffness in Spanish female fibromyalgia patients, with special focus on the differences between overweight and obese patients **(Paper VI)**.
- To analyze the relationship of weight status with anxiety, depression, quality of life and physical fitness in female fibromyalgia **patients (Paper VII)**.
- To analyze the relationship of anxiety and depression with fibromyalgia pain and severity **(Paper VIII)**.
- To establish the capacity of Tender Points Count to discriminate fibromyalgia severity and symptomatology **(Paper IX)**.

MATERIAL Y MÉTODOS [MATERIAL AND METHODS]

La sección de material y métodos de la presente memoria de Tesis se resume en la siguiente tabla que incluye la información metodológica más relevante de los artículos que componen la memoria de Tesis.

Table 1. Summary table of the methodology used in the current Thesis.

Paper	Study desing	Participants	Main variables studied	Methods
I. Are there gender differences in quality of life and fibromyalgia symptomatology?	Case-control study	20 male FM patients 78 female FM patients	FM impact, health-related quality of life, weight, height, BMI.	BIA, anthropometry, FIQ, SF-36
II. Handgrip strength test as a complementary tool in the assessment of fibromyalgia severity in women	Case-control study.	81 female FM patients 44 control women	Muscular fitness, FM Impact, health-related quality of life, weight, height, BMI.	BIA, anthropometry, SF-36, FIQ, handgrip strength.
III. Handgrip strength in men with fibromyalgia	Case-control study	20 male FM patients 60 control men	Muscular fitness, FM Impact, weight, height, BMI.	BIA, anthropometry, FIQ, handgrip strength.
IV. Fitness testing as a complementary tool in the assessment and monitoring of fibromyalgia in women	Case-control study	94 female FM patients 66 control women	Physical fitness, FM Impact, weight, height, BMI.	30-s chair stand, handgrip strength, chair sit and reach, back scratch, blind flamingo, 8 ft up and go and 6-min walk tests, FIQ, standard pressure algometer, BIA, anthropometry.
V. Análisis de la composición corporal en mujeres con fibromialgia	Cross-sectional	104 female patients	Weight, height, waist circumference, body composition (BMI, body fat, muscle, and water)	BIA, anthropometry, FIQ

Table 1. (cont.)

Paper	Study Desing	Participants	Main variables studied	Methods
VI. Fibromyalgia key symptoms in normal weight, overweight and obese female patients	Cross-sectional	177 female patients	Tender points, algometer score, FM impact, health-related quality of life, weight, height, BMI.	BIA, anthropometry, FIQ, SF-36, standard pressure algometer
VII. Association of weight status with anxiety, depression, quality of life and physical fitness in female fibromyalgia patients.	Cross-sectional	177 female patients	Tender points, algometer score, FM impact, health-related quality of life, physical fitness, psychological outcomes, weight, height, BMI.	BIA, anthropometry, standard pressure algometer, 30-s chair stand, handgrip strength, chair sit and reach, back scratch, blind flamingo, 8 ft up and go and 6-min walk tests; FIQ, SF-36, HADS-anxiety, HADS-depression
VIII. Anxiety, depression and fibromyalgia pain and severity in female patients	Cross-sectional	127 female patients	Health-related quality of life, psychological outcomes, tender points, algometer score, weight, height, BMI.	BIA, anthropometry, standard pressure algometer, FIQ, SF-36, HADS-anxiety, HADS-depression
IX. Usefulness of tenderness to characterize fibromyalgia severity and symptomatology in women.	Cross-sectional	174 female patients	Tender points, algometer score, FM impact,	Standard pressure algometer, FIQ, BIA, anthropometry.

FM: Fibromyalgia, BIA: Bioelectrical Impedance Analysis, BMI: Body Mass Index, FIQ: Fibromyalgia Impact Questionnaire, HADS: Hospital Anxiety and Depression Scale, SF-36: Short-Form Health Survey 36.

RESULTADOS Y DISCUSIÓN [RESULTS AND DISCUSSION]

Los resultados y discusión se presentan en la forma en que han sido previamente publicados/sometidos en revistas científicas.

1. GENDER AND FIBROMYALGIA

(Paper I)

Are there gender differences in quality of life and fibromyalgia symptomatology?

Aparicio VA, Ortega FB, Carbonell-Baeza A, Tercedor P, Ruiz JR, Delgado-Fernández M.

Submitted

Are there gender differences in quality of life and fibromyalgia symptomatology?

Running Title: Gender differences in fibromyalgia

Category: Brief Communication

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ABSTRACT

We aimed to examine the differences in health-related quality of life (QoL) and fibromyalgia (FM) symptomatology between men and women. A total of 20 men (48.0±8.0 years) and 78 women (49.8±7.2 years) with FM participated in the study (age ranged 31-63). Health-related quality of life and FM impact were assessed by means of the Spanish versions of the Short-Form-36 Health Survey (SF36) and the Fibromyalgia Impact Questionnaire (FIQ), respectively. Among the eight SF36-subscales, men and women only differed in vitality (P=0.02), which was lower in women. Overall FM impact, as measured by FIQ-total score (P=0.01), and FIQ-physical impairment (P=0.02) were lower in women, whereas they presented higher values of FIQ-fatigue and morning tiredness (P=0.04). These marginal differences disappear once the analyses were adjusted for multiple comparisons. The contradictory results together with the fact that the differences were marginally significant, makes us to conclude that our data do not support sex differences in QoL and FM impact. Further research on male FM patients and with larger samples is needed to confirm or contrast these findings.

Key words: Fibromyalgia, men, women, health-related quality of life, SF36, FIQ.

INTRODUCTION

Fibromyalgia (FM) is a disease characterized by the concurrent existence of chronic, widespread musculoskeletal pain and multiple sites of tenderness [1]. Fibromyalgia symptomatology greatly differs among patients, but commonly includes pain, morning stiffness, fatigue, nonrestorative sleep, and concentration and memory difficulties [1-2]. For this reason, FM has an enormous impact on the patients' health-related quality of life (QoL) [3-4].

In Spain, the prevalence of FM is ~2.4% [5] and is dramatically more common in women than in men (~95% vs. ~5%, respectively) [5]. Studies on male FM patients are scarce. Maybe for this reason, information regarding differences in QoL and FM symptoms between men and women with FM seems to be controversial. Some studies have observed that women with FM have more tender points, hurt all over, total number of symptoms, and irritable bowel syndrome than men with FM [6-9]. In contrast, it has also been reported that men have a worse perception of their health, a higher percentage of psychiatric history and current mental illness, decreased physical function, lower QoL and more impact of the disease [9-10]. Langi et al. [11] observed no gender differences in pain measures, but they found that men had more positive levels in psychological measures and coping strategies than women. Finally, recently Häuser et al. [12] found no relevant gender differences in the clinical picture of FM and concluded that the assumption of well-established gender differences could not be supported.

The present study aimed: i. to examine the differences in QoL, as measured by SF36 between males and females FM patients. ii. to analyze gender differences in FM symptomatology.

METHODS

Study sample

The study comprised 20 men aged 48.0±8.0 years and 78 female FM patients aged 49.8±7.2 of the same age-range (31 to 63 years) who were diagnosed with FM by a rheumatologist and met the American College of Rheumatology criteria for FM [1]. Exclusion criteria included having other rheumatic diseases and/or severe somatic or psychiatric disorders, such as cancer, severe coronary disease, or schizophrenia. All participants signed a written informed consent to participate in the investigation. The study was reviewed and approved by the Ethics Committee of the "Hospital Virgen de las Nieves" (Granada, Spain).

Material and procedures

Anthropometric assessment: We used a portable eight-polar tactile-electrode impedanciometer (InBody R20, Biospace) to measure weight (kg) and body fat (%). Height (cm) was measured using a stadiometer (Seca 22, Hamburg). Body mass index (BMI) was calculated as weight (in kilograms) divided by height (in meters) squared and categorized using the international criteria.

The Spanish version of the *Short-Form-36 Health Survey* (SF36) [13] was used to assess QoL. This questionnaire is composed of 36 items, grouped into eight scales assessing eight dimensions: physical functioning, physical role, bodily pain, general health, vitality, social functioning, emotional role, mental health and general health. Each subscale score is standardized and ranges from 0±100, where 0 indicates the worst possible health status and 100 the best possible.

The Spanish version of the *Fibromyalgia Impact Questionnaire* (FIQ) [14] was used to assess the FM-related symptoms. It is composed of ten dimensions: physical impairment, overall well being, work missed and a seven items of a visual analogy scale on which the patient rates the job difficulty, pain, fatigue, morning tiredness, stiffness, anxiety and depression. All the subscales ranged from 0 to 10, where high scores indicated a higher negative impact and/or a greater severity of symptoms. A total score may be obtained after normalization of some subscales and summing the subscales. The FIQ total score range from 0 to 100, and a higher score indicates a greater impact of the disease.

Statistical analysis

The distribution of the residuals was examined in all the study variables. The FIQ variables showed a non-Normal distribution, which did not improve (became Normal) after several transformations (e.g. logarithmical and squared root transformations). Anthropometric and QoL variables showed an acceptable Normal distribution. Comparisons between sexes in anthropometrics and body composition variables were performed using one-way analysis of variance (ANOVA). Differences in weight status were analyzed using Squared-Chi tests. Comparisons in QoL were performed using one-way analysis of co-variance (ANCOVA) adjusted by age and BMI because high BMI has been associated with worse QoL [15]. Comparisons between sexes in FIQ dimensions were performed using Mann-Whitney test, as appropriate. All analyses were performed using the Statistical Package for Social Sciences (SPSS, version 16.0 for Windows; SPSS Inc., Chicago, IL), and the level of significance was set at $P<0.05$.

RESULTS

Anthropometric and body composition characteristics of the study sample, for men and women with FM, are presented in **Table 1**. Men were taller, heavier and had a lower body fat percentage than women (all $P<0.001$), while no differences were observed for

BMI and weight status categories. These findings did not change after further adjusting for age (data not shown).

Comparisons in QoL and FM impact between men and women with FM are shown in **Table 2.** Women with FM had lower SF36-vitality ($P<0.05$) than men with FM. Mean FIQ total score and physical impairment was lower for female compared to male FM patients ($P<0.05$), whereas female patients presented higher FIQ-fatigue and morning tiredness ($P<0.05$). These marginal differences disappear once the analyses were adjusted for multiple comparisons [16].

DISCUSION

Women with FM had less vitality, more fatigue and morning tiredness than men, but contrarily they had a lower overall FM impact, as measured by FIQ total score, and lower physical impairment. The contradictory results together with the fact that the differences were marginally significant, makes us to conclude that our data do not support gender differences in QoL and FM symptomatology.

Although in the last years more studies have been focus on analyzing FM features and treatment in men [17-18], they are still scarce. Perhaps for this reason, to date, only a few studies have described and compared FM symptoms and QoL between men and women.

In agreement with the study of Buskila et al. [9] we have not found important differences between sexes in QoL, as assessed by SF36, except for a lightly worse physical role and vitality in the female patients group whereas they found a worse role-emotional in men. To note is that other studies have found a worse QoL in men with FM [9-10].

In our study, FM impact, as measured by FIQ-total score, was significantly higher for male when compared to females FM patients, as reported by other studies [9-10], while others have obtained values close to significant [8, 19].

Despite the general agreement regarding global severity of the disease, we have found a notable controversy respecting the experienced fatigue by females and males with FM. Our findings concur with Yunus et al. [6], whose observed higher levels of fatigue and morning tiredness in the female FM group. However, other studies have observed higher levels of fatigue in men [9] or have failed to find differences between sexes [8, 10].

One similar Spanish study [10] analyzed the differences in sociodemographic, clinical, psychosocial and health care characteristics between men and women with FM and they observed that sociodemographic characteristics were very similar in both men and women. However, men with FM had a worse perception of their health, a higher percentage of psychiatric history and current mental illness and more impact of the disease. On the other hand, Langi et al. [11] observed no sex differences in pain measures, but they found differences regarding psychological measures and coping strategies. Women reported more psychological strains and used more adaptive coping strategies on the scales "cognitive restructuring", "perceived self-competence", "mental diversion" and "counterbalancing activities" than men. The authors concluded that women need more treatment for psychological aspects and men need assistance in pain management.

Nevertheless, concerning pain perception, sex differences appears to be low or inexistent. Except for the higher pain perception observed by Buskila et al. [9], most of the studies developed in FM patients, including ours, have not found marked differences [6, 8]. In fact, in the study of Danneker et al. [20] the authors examined sex differences in ratings and effects of recalled and experimentally-induced muscle pain in two sub-studies. In study 1, participants completed a questionnaire about recalled muscle pain. In study 2, participants described muscle pain from an exercise stimulus across 3 days by telephone. The authors concluded that there is an absence of meaningful sex differences in muscle pain ratings.

To note is the recent study of Häuser et al. [12], developed in a large sample of 885 women and 138 men. The authors observed that women reported a longer duration of chronic widespread pain and time since FM diagnosis, and men had a higher tender point count. However, there were no gender differences in age, family status, number of pain sites, or somatic and depressive symptoms. They concluded that their data did not support the thesis of Yunus [6-8], that gender differences in the clinical features of FM are well established and thus the assumption of different pathogenetic appearances in the 2 genders cannot be substantiated by the divergent study results on gender differences in FM.

Some limitations need to be mentioned. First, due to the extremely low prevalence of the FM in men, the male sample size recruited for this study was small, with the consequent low statistical power. These findings should be replicated in future studies with larger sample sizes. Second, our participants were volunteers which could have affected to the representativeness of the study sample. Third, individually tailored medication used for FM symptomatology, which unfortunately was not registered, might have potentially affected the study findings.

In conclusion, our data do not support meaningful differences in QoL and FM impact between men and women with FM. Further research on male FM patients is needed to confirm or contrast the present findings.

Acknowledgments

The authors gratefully acknowledge all the participants for their collaboration. We also acknowledge all the AGRAFIM (FM association from Granada, Spain) members involved in the field work for their efforts and great enthusiasm. This study was in part financially supported by grants from the Spanish Ministry of Education (AP-2006-03676 and EX-2008-0641) and the Ministry of Science and Innovation (BES-2009-013442, and RYC-2010-05957).

Competing Interests

The authors declare that they have no competing interests.

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Table 1: Physical characteristics of the study sample for men and women with fibromyalgia.

Variable	Sex		
	Male FM patients (n=20)	**Female FM patient (n=78)**	**P**
Age (years)	48.0 (8.0)	49.8 (7.3)	0.34
Height (m)	173.1 (6.3)	158.3 (6.2)	P<0.001
Weight (kg)	81.8 (8.9)	71.0 (13.7)	P<0.001
BMI (kg/m^2)	27.3 (2.8)	28.2 (5.2)	0.27
Fat percentage (%)	27.4 (6.5)	38.4 (7.5)	P<0.001
Weight status (%) UW/NW/OW/ OB	0/25/60/15	0/32/35/33	0.56

Values expressed as mean (standard deviation); FM, fibromyalgia; BMI, Body Mass Index; UW, underweight (BMI<18.5); NW, normal weight (BMI: 18.5-23.99); OW, overweight (BMI: 25.0-29.99); OB, obesity (BMI>30.0).

Table 2. Health-related quality of life and fibromyalgia impact of the study sample**.**

	Sex		
Data presented as M (SD) [a]	**Male FM patients (n=20)**	**Female FM patient (n=78)**	**P**
SF36			
Physical functioning	35.3 (19.5)	35.6 (17.9)	0.88
Emotional Role	30.0 (44.5)	39.9 (44.7)	0.38
Physical role	1.25 (5.60)	6.6 (21.8)	0.26
Vitality	28.3 (20.1)	18.4 (14.9)	0.02
Mental Health	43.8 (23.7)	48.4 (23.4)	0.45
Social functioning	29.9 (21.6)	40.1 (24.3)	0.08
Bodily pain	17.1 (12.3)	21.8 (16.5)	0.24
General Health	28.5 (11.0)	32.0 (16.6)	0.34
Data presented as Md (25^{th}, 75^{th} percentiles) [b]			
FIQ*			
FIQ total score	74.9 (66.4-90.7)	67.4 (56.6-75.9)	0.01
Physical impairment	6.3 (4.8-7.0)	4.4 (3.5-6.5)	0.02
Work difficulty	8.7 (6.5-9.4)	9.0 (7.0-10.0)	0.11
Pain	8.0 (6.3-9.3)	8.0 (6.0-9.0)	0.71
Fatigue	8.9 (7.3-9.4)	9.0 (8.0-10.0)	0.04
Morning tiredness	9.4 (8.2-9.5)	10.0 (8.5-10.0)	0.04
Stiffness	8.7 (7.6-9.4)	8.4 (7.0-10.0)	0.96
Anxiety	7.5 (7.0-9.0)	7.4 (5.1-10.0)	0.94
Depression	6.3 (4.8-7.0)	6.0 (3.5-8.5)	0.43

M, mean. SD, standard deviation. Md, median; FM, fibromyalgia; SF36, Short-Form-36 Health Survey; FIQ, fibromyalgia impact questionnaire; *Higher values mean more severity. P values calculated by: [a] analysis of covariance after adjusting by age and body mass index, [b] Mann-Whitney test.

II. PHYSICAL FITNESS IN PERSONS WITH FIBROMYALGIA

(Papers II, III and IV)

II

Handgrip strength test as a complementary tool in the assessment of fibromyalgia severity in women

Aparicio VA, Ortega FB, Heredia JM, Carbonell-Baeza A,
Sjöström M, Delgado-Fernández M

Arch Phys Med Rehabil

2011; 92(1):83-8.

ORIGINAL ARTICLE

Handgrip Strength Test as a Complementary Tool in the Assessment of Fibromyalgia Severity in Women

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ABSTRACT. Aparicio VA, Ortega FB, Heredia JM, Carbonell-Baeza A, Sjöström M, Delgado-Fernandez M. Handgrip strength test as a complementary tool in the assessment of fibromyalgia severity in women. Arch Phys Med Rehabil 2011; 92:83-8.

Objectives: To determine the ability of handgrip strength test to discriminate between presence and absence of fibromyalgia (FM) and FM severity in women.

Design: A case-control study.

Setting: Granada, south Spain.

Participants: Women with FM (mean age ± SD, n=81; 50.0±7y) and healthy women (mean age ± SD, n=44; 47.7±6y).

Interventions: Not applicable.

Main Outcome Measures: Handgrip strength was measured in both hands (average score was used in the analyses) by a maximal isometric test using a hand dynamometer. Patients were classed as having moderate FM if the score in the Fibromyalgia Impact Questionnaire (FIQ) was less than 70 and as having severe FM if the FIQ was 70 or greater.

Results: Handgrip strength levels were lower in patients with FM than healthy women (19.3 vs 27.9kg; $P<.001$) and in women with severe FM (FIQ≥70) compared with those with moderate FM (FIQ<70) (16.9 vs 20.2kg; $P=.02$). Receiver operating characteristic curve analyses revealed that the handgrip strength threshold that best discriminated between the presence and absence of FM was 23.1kg (area under the curve [AUC]=.88; 95% confidence interval [CI], 0.82–0.94; $P<.001$), whereas the handgrip strength threshold that best discriminate between severe and moderate FM was 16.9kg (AUC=.67; 95% CI, 0.53–0.80; $P<.05$). Logistic regression analysis showed that handgrip strength 23.1kg or less was associated with 33.8 times higher odds (95% CI, 9.4–121.5) for having FM after adjustment for age. In the FM group, handgrip strength 16.9kg or less was associated with 5.3 times higher odds (95% CI, 1.9–14.5) for having severe FM.

Conclusions: Handgrip strength is reduced in women with FM as well as those with severe FM from their peers with moderate FM. Identification of women who fail to meet the suggested standards can be a helpful and informative tool for clinician.

Key Words: Fibromyalgia; Muscle strength dynamometer; Quality of life; Rehabilitation.

FIBROMYALGIA IS A condition characterized by the concurrent existence of chronic, widespread musculoskeletal pain and multiple sites of tenderness.[1] In addition to pain and associated symptoms, activity limitations and functional impairment are common in patients with FM.[2,3] FM has an enormous impact on the patients' health-related quality of life[4,5] because it limits activities of daily life such as walking and lifting and transporting objects.[4-6]

Because of the complex nature of the disease, the assessment and monitoring of FM appears to be a dynamic process that still requires the contribution of new tools that facilitate the physicians' daily work.[7] Alternative simple, practical, valid, and reliable clinical tools can be helpful in the clinical examination and evaluation of patients.

It has been reported that muscular strength is decreased in people with FM compared with age-matched healthy peers.[8-12] Little is known, however, about the muscular strength differences between patients with moderate and severe FM. In this context, handgrip strength is a quick and easy-to-perform muscular fitness test that provides useful information about overall muscular strength and could potentially be used in a clinical setting. Several studies have observed lower levels of handgrip strength in patients with FM,[13-17] which could be attributed to the following: (1) the patients with moderate or severe pain are likely to reduce their daily life physical activities and thus display a reduced muscular strength,[18] and (2) the fatigue and pain, characteristic of the FM, might negatively affect handgrip strength performance.[13] Both causes might contribute to explaining the lower handgrip strength observed in patients with FM. On the basis of the same principles, we hypothesized that patients with severe FM would also have lower handgrip strength than those with moderate FM. From a clinical point of view, is interesting to examine the ability of the handgrip strength test to monitor the evolution of FM and discriminate between patients with moderate and severe FM.

List of Abbreviations

ANOVA	analysis of variance
AUC	area under the curve
BMI	body mass index
CI	confidence interval
FIQ	Fibromyalgia Impact Questionnaire
FM	fibromyalgia
SF-36	Medical Outcomes Study 36-Item Short-Form Health Survey
ROC	receiver operating characteristic

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Supported in part by grants from the Spanish Ministry of Education (AP-2006-03676 and EX-2008-0641), the Spanish Ministry of Science and Innovation (BES-2009-013442), and the Swedish Heart-Lung Foundation (20090635).

No commercial party having a direct financial interest in the results of the research supporting this article has or will confer a benefit on the authors or on any organization with which the authors are associated.

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0003-9993/11/9201-00639$36.00/0
doi:10.1016/j.apmr.2010.09.010

The present study aimed to determine the ability of the handgrip strength test to discriminate between the presence and absence of FM and FM severity in women. We compared handgrip strength in patients with FM than in healthy women, as well as between women with moderate and severe FM. As a contribution to the previous literature on the topic,[13-17] we used ROC curve analysis to determine the handgrip strength threshold that best discriminated between the presence and absence of FM and between severe and moderate FM in women.

METHODS

Patients and Design

This case-control study included a sample of 81 women with FM from a local association of patients with FM from Granada, Spain, with a mean age ± SD of 50.0±7.4 years. The inclusion of only women in the present study had practical reasons. In Spain,[19] as well as in the rest of the world,[1] the percentage of men among the patients with FM is extremely low, about 20 times lower than the percentage of women with FM (eg, the prevalence of men and women with FM in Spain is 0.2% and 4.2%, respectively).[19] Consequently, it is complicated to recruit enough men with FM to run properly the analyses performed in this study with women with FM.

Participants with FM were diagnosed as having FM by a rheumatologist following the American College of Rheumatology criteria.[1] Inclusion criteria for the FM group included not having other rheumatic diseases and/or severe somatic or psychiatric disorders such as cancer, severe coronary disease, or schizophrenia. In order to compare the handgrip strength levels of patients with FM with their healthy peers, we recruited (control group) 44 healthy women of a similar age (mean age ± SD, 47.7±6.4y) and geographic location from some local associations of property owners and mothers of students from the University of Granada. All patients were assessed by the same researcher to reduce interexaminer error. All the participants were informed about the study aims and methodology and signed a written informed consent to participate. The study was reviewed and approved by the Ethics Committee of the Hospital Virgen de las Nieves Granada, Spain.

Material and Procedures

Handgrip strength. Handgrip strength was assessed using a hand dynamometer with adjustable grip.[a] The subject squeezes gradually and continuously for at least 2 seconds, performing the test with the right and left hand in turn, using the optimal grip-span. Optimal grip span was calculated using the formula suggested by Ruiz et al[20]:

$$y=x/5+1.5$$

in women, with "x" the hand size and "y" the grip span. Each patient made 2 attempts with each hand, with the arm fully extended forming an angle of 30° with respect to the trunk and the palm of hand perpendicular to the shoulder line. The maximum score in kilograms for each hand was recorded, and the mean score of left and right hand was used in the analyses.

Handgrip testing in patients with FM has been performed using different dynamometers and methodologies.[11,13-16,21] Our group carried out a series of studies in young and adult people to examine the accuracy, reliability, and validity of handgrip strength testing.[22-24] Recently, we studied the criterion validity of the Jamar,[b] DynEx,[c] and TKK dynamometers using calibrated weights[24] and found that the smallest systematic bias corresponded to the TKK dynamometer (dynamometer used in this study) compared with the Jamar and DynEx dynamometers (0.49kg vs −1.92kg and −1.43kg, respectively). Moreover, among the 3 dynamometers studied, the TKK dynamometer was shown to have the most reliable results when using repeated measures with known weights. Based on these results, the TKK dynamometer was used in the current study.

Anthropometrics measurements. Height (cm) was measured using a stadiometer[d] and weight (kg) with a scale.[e] BMI was calculated as weight (kg) divided by height squared (m).

Fibromyalgia severity and quality of life assessment. Several health-related questionnaires are often used as complementary information in the diagnosis and monitoring of FM. One of the most used specific questionnaires in patients with FM is the FIQ,[25-27] followed by the SF-36, a questionnaire designed to assess health-related quality of life.[28]

We used the Spanish version[25] of the FIQ[27] to assess the FM-related symptoms and mood. FIQ assesses the components of health status that are believed to be most affected by FM. It is composed of 10 subscales: physical impairment, overall well being, work missed, and 7 items of a visual analog scale marked in 1-cm increments on which the patient rates work difficulty, pain, fatigue, morning tiredness, stiffness, anxiety, and depression. The FIQ score ranges from 0 to 100, and a higher value indicates a higher impact of the disorder.[26] Following the suggested criteria, patients with FM were classed as having moderate FM if their score in the FIQ was below 70 and as having severe FM if the FIQ score was higher than or equal to 70.[26]

The Spanish version of the SF-36 questionnaire[29] was used to assess health-related quality of life. This questionnaire is composed of 36 items grouped into 8 scales that include both physical and mental health: physical functioning, physical role, bodily pain, vitality, social functioning, emotional role, mental health, and general health. Each subscale score is standardized and ranges from 0 to 100, where 0 indicates the worst possible health status and 100 the best possible. The scores represent the percentage of the total possible score achieved.[28] The psychometric properties of the SF-36 are well characterized, and it has shown a high reliability and validity in a wide range of patient populations, including rheumatologic conditions and FM.[30]

Statistical Analysis

The distribution of the residuals was examined in base of asymmetry and kurtosis for all the study variables. The SF-36 and FIQ variables clearly showed a nonnormal distribution that did not improve (become normal) after several transformations (eg, logarithmic and square root transformations) were performed. Consequently, nonparametric statistical tests were used for FIQ and SF-36 variables.

Comparisons between women with and without FM, and between women with moderate and severe FM, for anthropometric and handgrip strength variables were performed using ANOVA. FIQ and SF-36 variables differences were analyzed using the Mann-Whitney test. Spearman correlation coefficients were used to examine the relationships of handgrip strength with SF-36 and FIQ variables.

The handgrip strength threshold that best discriminates between the presence and absence of FM, as well as between moderate and severe FM, was determined using the ROC curve. The ROC curve is a plot of all the sensitivity/specificity pairs resulting from varying the decision threshold.[31] Sensitivity was considered to be the probability to correctly identify a woman with FM (true-positive proportion). Specificity was considered to be the probability of correctly identifying a woman without FM (true-negative proportion). The false-positive proportion is based on the percentage of women without FM who were incorrectly identified as having FM. The perfect test that correctly classifies all subjects has a true-positive rate of 1 and false-positive rate of 0. Therefore, the optimal combination of true-positive rate and false-positive rate is the point closest to the perfect test (upper left corner of the graph). To identify the best threshold, the distance between the perfect test and each sensitivity and 1-specificity pair was calculated, and the pair closest to 1 was chosen. The same procedures were followed to study severe FM (vs moderate FM) and the presence of FM (vs absence of FM).

We also calculated the AUC and 95% CIs. The AUC represents the ability of the test to correctly classify subjects as having versus not having FM or having moderate versus severe FM. The values of AUC range between 1 (perfect test) and 0.5 (worthless test). Binary logistic regression was used to study further the relationship between handgrip strength and presence/absence of FM, or disease severity.

ANOVA, Spearman correlations, Mann-Whitney test, and logistic regression analyses were conducted using SPSS version 16.0 for Windows,[f] and ROC analyses were performed with the MedCalc statistical software.[g] The level of significance was set at P less than .05 for all the analyses.

RESULTS

The characteristics of the patients with FM and healthy women are presented in table 1. Handgrip strength was approximately 30% lower in patients with FM compared with their healthy peers ($P<.001$). Health-related quality of life, assessed using the SF-36 questionnaire, was significantly lower in patients than the healthy group ($P<.001$). Thirty-five percent of the patients with FM studied had severe FM (FIQ≥70). Handgrip strength was lower (~25%) in women with severe FM than in those with moderate FM ($P=.02$). Most of health-related quality of life items were significantly impaired in women with severe FM compared with those with moderate FM (table 2).

Table 1: Body Composition, Handgrip Strength and Health-Related Quality of Life (SF-36 Subscales) in Women With FM (Patients) and in Healthy Women

Outcomes	Patients (n=81)	Healthy Women (n=44)	*P*
Mean ± SD*			
Age (y)	50.0±7.4	47.7±6.4	.087
Height (m)	158.2±6.2	157.1±4.9	.301
Weight (kg)	70.8±13.8	67.6±13.7	.234
BMI (kg/m²)	28.2±5.2	27.4±5.4	.448
Handgrip strength (kg)†	19.3±6.5	27.9±4.1	<.001
Median (25th–75th percentiles)‡			
SF-36			
Physical functioning	34 (25–45)	90 (75–95)	<.001
Emotional role	100 (0–100)	100 (67–100)	<.001
Physical role	0 (0–0)	100 (75–100)	<.001
Vitality	15 (5–30)	60 (53–75)	<.001
Mental health	48 (28–68)	72 (60–84)	<.001
Social functioning	34 (23–58)	90 (75–100)	<.001
Bodily pain	23 (10–33)	70 (58–100)	<.001
General health	30 (20–45)	65 (50–75)	<.001
Total score FIQ	67 (56–76)	NA	NA

Abbreviation: NA, not applicable.
**P* values calculated by ANOVA.
†Average of right-hand and left-hand scores.
‡*P* values calculated by Mann-Whitney test.

Table 2: Handgrip Strength and Health-Related Quality of Life (SF-36 Subscales) in Women With Moderate (FIQ<70) and Severe (FIQ≥70) FM

Outcomes	Moderate FM (n=53)	Severe FM (n=28)	*P*
Mean ± SD*			
Age (y)	50.1±8.1	49.8±6.1	.882
Height (m)	158.9±5.4	156.9±7.5	.174
Weight (kg)	70.4±14.3	71.4±12.8	.765
BMI (kg/m²)	27.8±5.4	29.0±4.8	.325
Handgrip strength (kg)†	20.5±6.2	16.9±6.5	.022
Median (25th–75th percentiles)‡			
SF-36			
Physical functioning	40 (30–55)	25 (15–35)	.000
Emotional role	67 (0–100)	0 (0–67)	.044
Physical role	0 (0–0)	0 (0–0)	.431
Vitality	20 (10–33)	10 (5–25)	.059
Mental health	56 (44–72)	28 (16–48)	.000
Social functioning	45 (31–68)	25 (10–43)	.001
Bodily pain	23 (13–45)	10 (0–23)	.001
General health	34 (22–50)	22.5 (15–35)	.002

**P* values calculated by ANOVA.
†Average of right-hand and left-hand scores.
‡*P* values calculated by Mann-Whitney test.

Spearman correlations between handgrip strength and SF-36 or FIQ subscales are shown in table 3. Handgrip strength was positively associated with FIQ subscales concerning pain ($P<.001$), fatigue, morning tiredness, and job difficulty ($P<.05$). Handgrip strength was positively associated with a global score of FIQ ($P<.05$). Handgrip strength was also positively associated with physical functioning and vitality ($P<.05$). In healthy women, handgrip strength was not significantly associated with any SF-36 subscale.

Table 3: Spearman Correlations Between Handgrip Strength and SF-36 and FIQ Questionnaires Subscales

	Patients (n=81)		Healthy Women (n=44)	
Variable	Spearman Correlation	*P*	Spearman Correlation	*P*
SF-36				
Physical functioning	.321	.004	.169	.278
Emotional role	.152	.179	.065	.676
Physical role	−.011	.923	.100	.525
Vitality	.339	.002	.176	.260
Mental health	.167	.139	.114	.465
Social functioning	.155	.170	.086	.581
Bodily pain	.206	.067	.286	.063
General health	.166	.145	.270	.079
FIQ				
Physical impairment	−.119	.369	NA	NA
Job difficulty	−.317	.014	NA	NA
Pain	−.464	.000	NA	NA
Fatigue	−.270	.016	NA	NA
Morning tiredness	−.248	.026	NA	NA
Stiffness	−.191	.089	NA	NA
Anxiety	−.147	.192	NA	NA
Depression	−.166	.141	NA	NA
Total score FIQ	−.312	.050	NA	NA

Abbreviation: NA, not applicable.

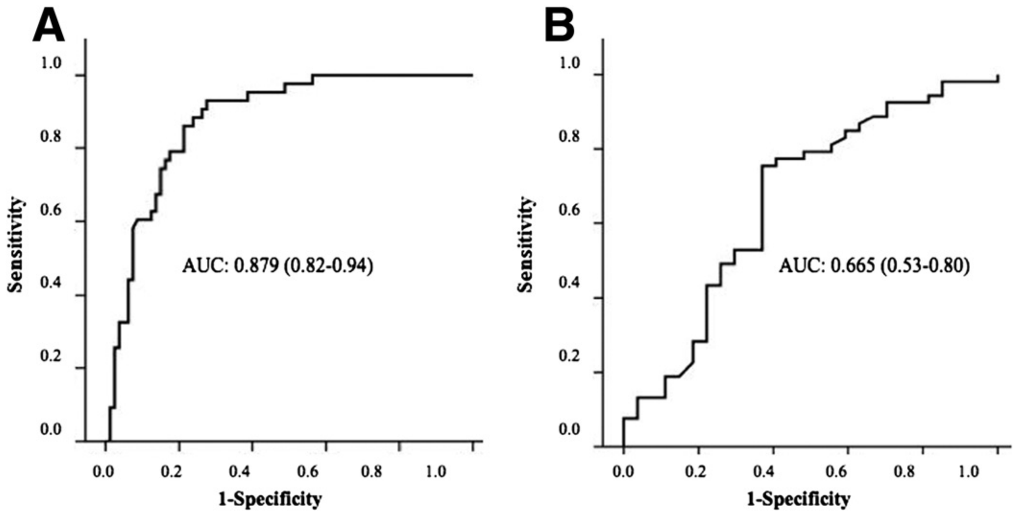

Fig 1. ROC curve summarizing the potential of handgrip strength to identify presence/absence of FM (patients with FM vs healthy women) (A) or severe/moderate FM (FIQ≥70 vs <70) (B) in women. AUC (95% CI).

The ROC analysis showed that handgrip strength (average left hand and right hand maximum scores) was able to discriminate between the presence and absence of FM (AUC=.88; 95% CI, .82–.94; $P<.001$) (fig 1A) and between severe and moderate FM (AUC=.67; 95% CI, .53–.80; $P=.016$) (fig 1B). The optimal pair of true-positive and false-positive rates that discriminated between the presence and absence of FM was 23.1kg, whereas the threshold to discriminate between severe and moderate FM was 16.9kg.

Handgrip strength values 23.1kg or less were associated with an increased odds ratio (OR) for having FM (OR=33.8; 95% CI, 9.4–121.5). In the FM group, handgrip strength values 16.9kg or less were associated with an increased OR of having severe FM (OR=5.3; 95% CI, 1.9–14.5) (table 4).

DISCUSSION

Handgrip strength is reduced in women with FM compared with healthy age-matched women, as well as in patients with severe FM compared with those with moderate FM. Moreover, handgrip strength is inversely related with FM severity and symptomatology in women. Our results also suggest that the handgrip strength test is able to discriminate between the presence and absence of FM and between moderate and severe FM in women. The handgrip strength (average score of both hands) discriminating thresholds for that purpose were 23kg for the presence of FM (vs absence of FM) and 17kg for severe FM (vs moderate FM). Although the present findings should be replicated in future studies in different age, sex, and ethnic groups, these results are promising and indicate that this test could be used as a complementary tool in the assessment and monitoring of FM.

We observed that patients with FM have lower muscular strength and worse health-related quality of life, as measured by the handgrip strength test and SF-36 questionnaire, respectively, than healthy women. These findings concur with other studies that reported lower levels of handgrip strength in patients with FM.[13-17] Nordenskiöld and Grimby[13] assessed handgrip strength in 14 Swedish patients with FM and 18 healthy women using the Grippit instrument.[h] They observed that handgrip strength was reduced up to 40% in patients with FM compared with the healthy women group. Sahin et al[14] studied 41 women from Turkey with FM and compared them with 40 age-matched and BMI-matched healthy women. They observed significantly lower level of handgrip strength (measured with the Jamar dynamometer) in the FM group. Mengshoel et al[16] also obtained significantly lower handgrip strength levels in 26 patients with FM compared with the control group. Maquet et al[15] compared handgrip strength between 16 patients with FM and 85 healthy women with a Colin dynamometer[i] and observed 39% lower handgrip strength values. Collectively, these findings indicate that handgrip strength is impaired in women with FM. Both pain and fatigue are common characteristics in patients with FM and may lead to avoidance of certain activities that enhance lean mass tissue and muscular strength. Nordenskiöld and Grimby[13] suggested that fatigue, pain, and other factors of central origin could play a role in this reduced handgrip strength in FM.

Table 4: Binary Logistic Regression Statistics Testing the Predictive Capacity of the Handgrip Strength's Thresholds Derived From the ROC Analysis for Presence/Absence of FM and FM Severity

	Cutoff Point (kg)	Se (%)	Sp (%)	Unadjusted Model		Model Adjusted by Age	
				OR[†]	95% CI	OR[†]	95% CI
Presence/ absence of FM	≤23.1	72.5	90.7	35.2	9.9–125.4	33.8	9.4–121.5
Severe FM*	≤16.9	63.0	75.5	5.2	1.9–14.2	5.3	1.9–14.5

Abbreviations: Se, sensitivity; Sp, specificity; OR, odds ratio.
*Severe FM was defined as FIQ≥70.
[†]High handgrip strength was used as reference.

Despite that most of investigations in which handgrip strength has been measured reported lower levels of handgrip strength in patients with FM than in healthy women,[13-17] a couple of studies performed in American women (n=29 and n=12, FM and control groups, respectively)[11] and in Finish women (n=23 and n=11, FM and control groups, respectively)[21] did not find significant differences between groups. Of note, most of the previous studies, with exceptions,[2] had rather small sample sizes, which highlights the contribution of the present study to the current knowledge in this field. Other studies also found differences in muscle strength between patients with FM and healthy women using other muscular tests.[2,11,15,17,21,32]

Our data indicate that women with severe FM have lower handgrip strength and worse health-related quality of life than women with moderate FM. Henriksen et al[32] reported no differences between muscular strength levels, as measured by isokinetic knee extension and flexion, and FM symptomatology in 840 patients with FM from Denmark. In contrast, Mannerkorpi et al[2] observed that higher levels of handgrip strength were related to higher physical function and lower pain in 69 patients with FM from Sweden. Our data also suggest that higher levels of handgrip strength are related to healthier levels in SF-36 subscales, particularly physical functioning and vitality, and with better levels in most of the FIQ subscales. In fact, a recent intervention study showed that muscle strength gains predicted better postural balance and physical and mental health, as assessed by the SF-36 questionnaire, in patients with FM.[33]

One study has showed that fear of pain and activity in patients with chronic pain is associated with poor physical performance on behavioral tasks even when controlling for physical pathology, especially in chronic low back pain.[34] Consequently, fear of pain when performing the handgrip strength test could be a potential confounder. However, Turk et al[34] did not find significant differences in handgrip strength scores attending to high or low fear of pain, which strengthens the usefulness of handgrip strength testing in patients with FM. Further research attending to other types of potential confounders would be necessary in order to establish handgrip strength as an objective tool. In this sense, future studies should analyze the influence of coping styles, fear of movement, or catastrophizing when performing this type of physical fitness test in patients with FM.

To our knowledge, the capacity of handgrip strength to discriminate between the presence/absence of FM and to establish the severity of FM has not been previously explored. The current statistical approach used, ROC analysis, has a particular clinical interest.

Study Limitations

The present study has several limitations that need to be mentioned. The study was conducted in women; much research on muscular strength in men with FM is needed. Future studies should provide age-specific handgrip strength cutoffs for discriminating the presence/absence of FM and FM severity. Further, the present study does not allow us to test how responsive the handgrip strength test is to physical and pharmacologic interventions. Future studies should examine the sensibility of handgrip strength test to detect changes in symptomatology after an intervention or pharmacologic treatment. Additionally, it would be of interest to study handgrip strength in other diseases related to pain such as arthritis rheumatoid, lupus, chronic fatigue syndrome, etc.

CONCLUSIONS

In the present pilot study, developed in a relatively small sample size, handgrip strength was reduced in women with FM and was inversely related to FM severity and symptomatology. The fact that the handgrip strength test was able to discriminate between the presence and absence of FM and between moderate and severe FM in women suggests that this test could be used as a complementary tool in the monitoring of FM. Furthermore, handgrip strength is relatively cheap, easy to perform, and not time–consuming, which makes its use in clinical settings feasible.

Acknowledgments: We also acknowledge all the Asociación Granadina de Fibromialgia (FM association from Granada, Spain) members involved in the field work for their efforts and great enthusiasm. We thank Jonatan R. Ruiz, Ph.D., for the thorough review and constructive comments given to this article.

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Suppliers

a. TKK 5101 Grip D; Takey, Tokyo, Japan.
b. Jamar, Smith and Nephew, Memphis, TN.
c. NexGen Ergonomics Inc.m http://www.nexgenergo.com.
d. Hamburg, Germany.
e. Biospace, Seoul, Korea.
f. SPSS, Chicago, IL.
g. MedCalc Software, Mariakerke, Belgium.
h. AB Detektor, Göteborg, Sweden.
i. Adult, Graduated in Kg.

III

Handgrip strength in men with fibromyalgia

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Clin Exp Rheumatol.

2010; 28(6 Suppl 63):S78-81.

Handgrip strength in men with fibromyalgia

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This study was in part financially supported by the Andalusia Institute of Sport, the Association of Fibromyalgia Patients of Granada (AGRAFIM), the Center of Initiatives for Cooperation and Development of the University of Granada (CICODE) and grants from the Spanish Ministry of Education (AP-2006-03676 and EX-2008-0641), Spanish Ministry of Science and Innovation (BES-2009-013442), the Swedish Council for Working Life and Social Research (FAS), and the Swedish Heart-Lung Foundation (20090635).

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Received on June 22, 2010; accepted in revised form on October 11, 2010.

Clin Exp Rheumatol 2010; 28 (Suppl. 63): S78-S81.

Key words: fibromyalgia, men, handgrip strength, FIQ

Competing interests: none declared.

ABSTRACT

Objective. *To examine the association of muscular strength, as measured by handgrip strength test (HGs), with the presence/absence of fibromyalgia (FM) and FM severity in men.*

Methods. *A total of 20 men (age, (mean age±standard deviation) of 48.0±8.0 years) with FM and 60 healthy subjects (age, 49.5±7.3 years) participated in the study. The HGs was measured by a maximal isometric test using a dynamometer with adjustable grip in both hands, and the average score was used in the analysis. All FM patients completed the Spanish version of the Fibromyalgia Impact Questionnaire (FIQ). Patients were classified as having moderate FM if the FIQ was <70 and as having severe FM if the FIQ was ≥70.*

Results. *HGs was ~17% lower in FM patients compared to healthy men (p=0.005) and ~27% lower in men with severe FM compared to those with moderate FM (p=0.03). Age-adjusted logistic regression models showed that 1 kilogram increment in HGs was associated with an 8% reduced risk of having FM (OR=0.92, 95% CI: 0.86-0.97, p=0.002). In the FM group, 1 kilogram increment in HGs was associated with a 13% reduced risk for having severe FM (OR=0.87, 95% CI: 0.76-0.99, p=0.04). HGs was negatively associated with pain, fatigue, stiffness and with the total score from the FIQ (all p<0.05).*

Conclusion. *HGs is reduced in male FM patients and is inversely related to FM severity and symptomatology. HGs testing could be used as a complementary tool in the assessment and monitoring of FM. Further research on male FM patients is needed to confirm or contrast these findings.*

Introduction

Fibromyalgia (FM) is a disorder characterised by the concurrent existence of chronic, widespread musculoskeletal pain and multiple sites of tenderness (1). FM symptomatology greatly differs among patients, but commonly includes pain, morning stiffness, fatigue, insomnia-related symptoms, and concentration and memory difficulties (1-3). FM has an enormous impact on the quality of life of patients (4), and the mental health of patients with FM has been suggested to be worse than that from other diseases characterised by pain such as rheumatoid arthritis (5). In Spain, the prevalence of FM is ~2.4% (6) and is dramatically more common in women (~4.2%) than in men (~0.2%) (6). However, there is a greater proportion of men diagnosed with FM on sick leave, compared to women with the same diagnosis (7). Men also have a worse perception of their health, a higher percentage of psychiatric history and current mental illness, and more impact from the disease (7). Men with FM report more severe symptoms than women, decreased physical function, and lower quality of life (7-8).

Muscular strength, as assessed by handgrip strength (HGs), is a predictor of functional capacity, morbidity and mortality (9-10). HGs is a quick and easy muscular fitness test that provides useful information about overall muscular strength. Several studies have observed lower muscular strength, as measured by HGs, in female FM patients compared with healthy women (11-12). Mannerkopi *et al*. (13) suggested that muscular fitness testing (specially the HGs test) could be a complementary tool to be used in clinical settings when planning treatment for FM patients. However, most of studies were conducted in women (11-13), and little is known about muscular fitness and FM in the male population. Since muscular fitness is a good marker of functional capacity and health, to explore the association between HGs and FM in men is of clinical and social relevance.

The present study aimed to examine the associations of muscular strength, as measured by HGs, with the presence/absence of FM and FM severity in men.

Methods

Study sample

The study comprised 20 men aged (mean±standard deviation) 48.0±8.0 years (range: 37 to 63 years) who were diagnosed with FM by a rheumatologist and met the American College of Rheumatology criteria for FM (1). Exclusion criteria included having other rheumatic diseases and/or severe somatic or psychiatric disorders, such as cancer, severe coronary disease, or schizophrenia. A group of 60 healthy aged-matched men (mean 49.5±7.3 years) also volunteered to participate in the study. All participants signed a written informed consent to participate in the investigation. The study was reviewed and approved by the Ethics Committee of the "Hospital Virgen de las Nieves" (Granada, Spain).

Material and procedures

Handgrip strength was assessed using a hand dynamometer with adjustable grip (TKK 5101 Grip D; Takey, Tokio Japan). The participant squeezes gradually and continuously for at least two seconds, performing the test with the right and left hand in turn, using the optimal grip-span. Optimal grip span was set at 5.5cm, according to Ruiz-Ruiz *et al.*(14). Each patient performed two attempts with each hand, with the arm fully extended, forming an angle of 30° with respect to the trunk. The maximum score in kilograms for each hand was recorded and the mean score of left and right hand was used in the analyses.

Anthropometric assessment

Weight (kg) and height (cm) were measured using standard procedures and body mass index (BMI) was calculated as weight (in kilograms) divided by height (in meters) squared and categorised using the international criteria: underweight (<18.5kg/m^2), normal weight (18.5–24.99kg/m^2), overweight (25.0–29.99kg/m^2) and obese (≥30.0kg/m^2).

Table I. Physical characteristics of the study sample**.**

	Presence/absence of FM			FM severity		
	Healthy men (n=60)	FM patients (n=20)	*p*	Moderate FM (n=7)	Severe FM (n=13)	*p*
Age (years)	49.5 (7.3)	48.0 (8.0)	0.45	46.0 (8.7)	49.1 (7.8)	0.43
Height (m)	173.6 (6.5)	173.1 (6.3)	0.69	172.9 (4.4)	173.3 (7.0)	0.90
Weight (kg)	81.0 (13.6)	81.8 (8.9)	0.85	83.2 (4.5)	81.9 (10.7)	0.61
BMI (kg/m^2)	26.8 (3.5)	27.3 (2.8)	0.60	27.9 (2.3)	26.9 (3.1)	0.50
Weight status (%) UW/NW/OW/OB	0/30/58/12	0/25/60/15	0.87	0/31/54/15	0/15/71/14	0.69

Values are means (standard deviation), unless otherwise stated.
FM: fibromyalgia; BMI, Body Mass Index; UW, underweight (BMI<18.5kg/m^2); NW, normal weight (BMI: 18.5–24.99kg/m^2); OW, overweight (BMI: 25.0–29.99 kg/m^2); OB, obese (BMI>30.0kg/m^2).

The Spanish version of the Fibromyalgia Impact Questionnaire (FIQ) was used to assess FM-related symptoms and mood (15). The FIQ assesses the components of health status that are believed to be most affected by FM. It is composed of ten dimensions: physical impairment, overall well being, work missed and seven items using a visual analogue scale in which the patient rates job difficulty, pain, fatigue, morning tiredness, stiffness, anxiety and depression. The FIQ score ranges from 0 to 100 with a higher value indicating a greater impact of the disorder. The FM patients were classified as having moderate FM if their score in the FIQ was below 70 and as having severe FM if the FIQ was greater or equal to 70 (16).

Statistical analysis

The distribution of the data was examined for all study variables. The FIQ variables showed a non-normal distribution which could not be normalised after several transformations (*e.g.* logarithmical and squared root transformations). Anthropometric parameters and HGs showed an acceptable normal distribution. Comparisons between men with and without FM, and between men with moderate and severe FM were performed using *t*-tests or Chi-squared tests, as appropriate. Binary logistic regression was used to further study the relationship between HGs and presence/absence of FM, or FM severity (moderate and severe), after adjustment for age. Spearman correlation coefficients were used to examine the relationships of HGs with FIQ dimensions. All analyses were performed using the Statistical Package for Social Sciences (SPSS, version 16.0 for Windows; SPSS Inc., Chicago, IL), and the level of significance was set at 0.05.

Results

Physical characteristics of the study sample stratified by presence/absence of FM and FM severity are presented in Table I. No differences were observed in age, weight, height, BMI or weight status categories among the study groups. HGs was ~17% lower in FM patients than in their healthy peers (32.9±10.4kg *vs.* 39.8±8.9kg, p=0.005) and ~27% lower in men with severe FM than in those with moderate FM (29.2±8.7kg *vs.* 39.8±10.4kg, p=0.03) (Fig. 1). Similar HGs levels were observed in healthy men and patients with moderate FM. In the FM group, the mean total score of FIQ was 74.7(15.2) and 65% of the patients had severe FM (FIQ≥70) (data not shown). The findings did not change after further adjusting for age and anthropometric variables.

Spearman correlations between HGs and FIQ dimensions are shown in Table II. HGs was negatively associated with the FIQ dimensions of pain (p=0.03), fatigue (p=0.02), stiffness (p=0.05) and the total score on the FIQ (p=0.01).

Binary logistic regression analyses (data not shown), indicated that 1 kilogram increment in HGs was associated with an 8% reduced risk of having FM (OR=0.92, 95% CI: 0.86–0.97, p=0.002). In the FM group, 1 kilogram increment in HGs was associated with a 13% reduced risk for having severe FM (OR=0.87, 95% CI: 0.76-0.99, p=0.04).

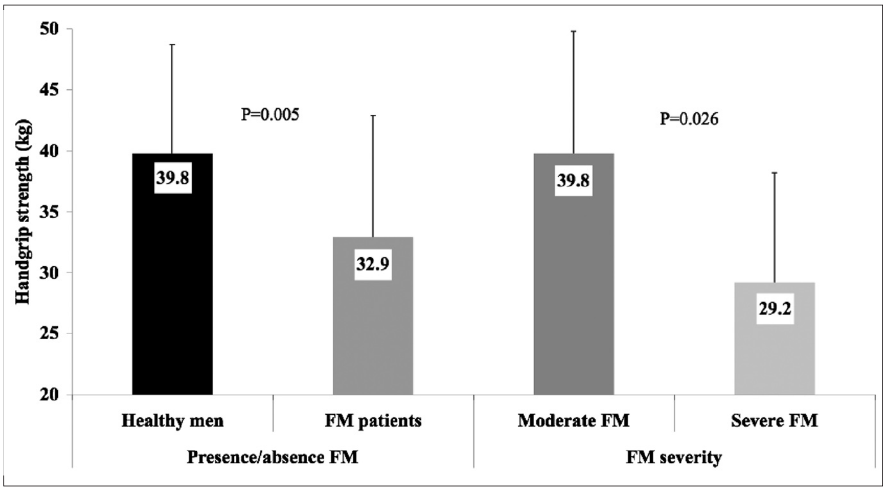

Fig. 1. Handgrip strength (mean value of both hands in kilograms) in men with or without fibromyalgia (FM), and in men with moderate (Fibromyalgia Impact Questionnaire, FIQ<70) or severe (FIQ≥70) FM.

Table II. Spearman correlations (rho) of handgrip strength with Fibromyalgia Impact Questionnaire (FIQ) dimensions and FIQ total score in male fibromyalgia patients (n=20).

	Handgrip strength	
	rho	*p*
Physical impairment	-0.31	0.19
Job difficulty	-0.44	0.08
Pain	-0.48	0.03
Fatigue	-0.51	0.02
Morning tiredness	-0.28	0.24
Stiffness	-0.45	0.05
Anxiety	-0.40	0.09
Depression	-0.40	0.09
Total score FIQ	-0.55	0.01

Discussion

The present study shows that HGs is reduced in male FM patients compared to healthy men and in patients with severe FM compared to those with moderate FM. Of note is that the level of HGs in healthy men and patients with moderate FM were similar, so the lower HGs levels observed in the FM patients compared to the healthy group was due to the very low level of HGs in severe FM patients. Furthermore, HGs in male FM patients was inversely related to FM symptomatology, particularly pain, stiffness, fatigue and total FM impact score. The risk of having FM was reduced by 8% with every kilogram increment in HGs. Likewise, the risk of severe FM, compared with moderate FM, was reduced by 13% with every kilogram increment in HGs. To the best of our knowledge, the relationship of HGs with presence/absence of FM and FM severity in men has not been previously explored. Although these findings should be replicated in future studies with larger sample sizes and in different age groups and ethnicities, the present findings are promising and support the usefulness of HGs testing as complementary information in the diagnosis of FM and degree of severity of the disorder in men.

Since we did not find any studies examining muscular fitness in men with FM, we can only compare our results with those from other studies conducted in female FM patients. Our findings concur with other studies that reported lower levels of HGs in female FM patients (11-12) compared to healthy women. Nordenskiöldl and Grimby (11) assessed HGs in 14 Swedish FM patients and 18 healthy women using the "Grippit instrument". They observed that HGs was 40% lower in FM patients compared to healthy women. Sahin *et al.* (12) studied 41 Turkish women with FM and compared them with 40 age- and BMI-matched healthy females, and observed significantly lower values of HGs (measured with Jamar dynamometer) in the FM group. Most of the investigations reported lower levels of HGs in female FM patients than in healthy women (11-12), and only one study failed to find significant differences between groups (17).

A major finding of the present study is that men with severe FM have lower HGs than men with moderate FM. Henriksen *et al.* (18) reported no associations between muscular strength levels, as measured by isokinetic knee extension and flexion, and FM symptomatology in 840 female FM patients from Denmark. In contrast, Mannerkorpi *et al.* (13) observed that higher levels of HGs were related to higher physical functioning and lower pain in 69 female FM patients from Sweden. Our data also suggest that high levels of HGs in male FM patients are related to more favourable levels of pain, fatigue, morning stiffness and total FM impact score.

The cut-off point from FIQ (*i.e.* ≥70) has been suggested in the field of FM to differentiate between moderately and severely afflicted FM patients (16). However, such cut-off point should be validated using different methods to assess the severity of FM. The present study, performed in a relatively small sample of men with FM, should stimulate further research on this topic, particularly in male FM patients.

Conclusion

The fact that HGs is reduced in male FM patients and is inversely related with FM severity, suggests that HGs testing could be used as a complementary tool in the assessment and monitoring of FM. HGs assessment is relatively cheap, easy to perform and low-time consuming which makes its use in the clinical setting feasible. Further research on male FM patients is needed to confirm or contrast the present findings.

Acknowledgments

The authors gratefully acknowledge all the participants for their collaboration. We also acknowledge all the AGRAFIM (FM association from Granada, Spain) members involved in the field work for their efforts and great enthusiasm.

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Fitness testing as a complementary tool in the assessment and monitoring of fibromyalgia in women

IV

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Scandinavian Journal of Medicine and Science in Sports

Second revision

Fitness testing as a discriminative tool for the diagnosis and monitoring of fibromyalgia

Category: full length article

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Running head: Fitness testing and fibromyalgia severity

ABSTRACT

We aimed to determine the ability of a set of physical fitness tests to discriminate between presence/absence of FM and moderate/severe FM. The sample comprised 94 female FM patients (52±8 years) and 66 healthy women (54±6 years). We assessed physical fitness by means of the 30-s chair stand, handgrip strength, chair sit&reach, back scratch, blind flamingo, 8-feet up&go and 6-min walking tests. Patients were classified as having moderate FM if the score in the Fibromyalgia Impact Questionnaire (FIQ) was <70 and as having severe FM if the FIQ was ≥70. FM patients and patients with severe FM performed worse in most of the fitness tests studied (P<0.001). Except the back scratch test, all the tests were able to discriminate between presence and absence of FM (area under the curve (AUC)=0.66 to 0.92; P≤0.001), and 4 tests also discriminated FM severity (AUC=0.62 to 0.66; P≤0.05). The 30-s chair stand test showed the highest ability to discriminate FM presence and severity (AUC=0.92, P<0.001; and AUC=0.66, P=0.008, respectively), being the corresponding discriminating cut-offs 9 and 6 repetitions, respectively. Physical fitness in general, and particularly the 30-s chair stand test, is able to discriminate between women with FM from those without FM, as well as between those with moderate FM from their peers with severe FM.

Key-words: fibromyalgia severity; physical fitness; FIQ; women.

INTRODUCTION

Fibromyalgia (FM) is considered a disorder of pain regulation (Sarzi-Puttini et al. 2008), indicated by an increased sensitivity to painful stimuli (hyperalgesia) and lowered pain threshold (allodynia)(Mork et al. 2010). Additional to the pain, FM patients' symptoms typically include fatigue, stiffness, non restorative sleep patterns or memory and cognitive difficulties (Bennett et al. 2007; Wilson et al. 2009; Wolfe et al. 1990). Other common symptoms include low back pain, recurrent headaches, arthritis, muscle-spasm, and balance problems (Bennett, Jones 2007). The prevalence of comorbidities among patients diagnosed with FM is very high (Wolfe et al. 2010), which increases patients' needs for appropriate medical management and results in higher healthcare resource utilization compared with patients without FM (Lachaine et al. 2010). In Spain, the prevalence of FM is ~2.4% (Mas et al. 2008) and is more common in women (~4.2%) than in men (~0.2%) (Mas, Carmona 2008).

Fibromyalgia has an enormous impact on the patients' health-related quality of life (Gormsen et al. 2009; Verbunt et al. 2008), since it limits activities of daily life as walking, raising and transporting objects (Gormsen, Rosenberg 2009; Henriksson et al. 1992; Verbunt, Pernot 2008). Patients with moderate or severe pain are likely to reduce their physical activity and thus display a deconditioned fitness status (Sañudo B. 2008). Physical fitness is decreased in people with FM compared to age-matched healthy peers (Heredia Jimenez et al. 2009; Jones et al. 2009; Panton et al. 2006; Valim et al. 2002; Valkeinen et al. 2008), and is similar to healthy older adults (Jones et al. 2008; Panton, Kingsley 2006).

Bush et al. (2007) highlighted the importance of a better characterization of FM patients' physical fitness/functional capacity levels. Mannerkopi et al. (2006) suggested that fitness testing (particularly handgrip strength and 6-min walking test) could be a complement to current tools used in the clinical examination when planning treatment for patients with FM. In fact, in a previous pilot study, our group has analyzed the ability of handgrip strength test to discriminate between presence and absence of fibromyalgia FM and FM severity in women and we have concluded that handgrip strength test may be a helpful and informative tool for clinicians (Aparicio et al. 2011).

Due to the complex nature of the syndrome, the diagnosis of FM appears to be a dynamic process that still requires the contribution of new tools that facilitate the physicians final decision (Wolfe et al. 2010). In fact, after the apparent difficulty of the analysis of tender points by some physicians, the American College of Rheumatology has recently presented and alternative preliminary diagnostic criteria mainly based on symptom severity (Wolfe, Clauw 2010). Alternative simple, practical, valid and reliable clinical tools can be helpful in the clinical examination and evaluation of patients. From a clinical point of view, is interesting to examine the ability of the fitness tests to discriminate between persons with and without FM and the relative severity of the disorder. Many physical fitness tests are currently available, but is unknown, to our knowledge, whether there is a test that discriminates better than others between presence and the severity of FM.

The present study aimed to determine the ability of a set of physical fitness tests to discriminate between presence/absence of FM and between moderate/severe FM in women by using receiver operating characteristic (ROC) curve analysis.

MATERIAL AND METHODS

Study sample and design

The study sample comprised 94 women aged 52.0±8 years old, diagnosed as having FM by a rheumatologist following the American College of Rheumatology criteria (Wolfe, Smythe 1990) and a group of 66 healthy women of similar age (53.8±6 years old) and region, who participated in the study as control group. Both groups were informed about the study aims and methodology and signed a written informed consent to participate. Inclusion criteria were not to have other rheumatic diseases and/or severe somatic or psychiatric disorders, such as cancer, severe coronary disease, or schizophrenia. In the FM patients group, all the tests were carried out on two separate days, with at least 48 hours between each session. This was done in order to prevent fatigue and flare-ups (acute exacerbation of symptoms). Due to the fact that the order of testing could have an influence on performance in subsequent tests such as increased flexibility in the back scratch test if preceded by others which raise body temperature, or alternatively fatigue effects, tests were performed in a standardized order for all the patients. The assessment of the tender-points count, 30-s blind flamingo and 30-s chair stand tests, in that order, were completed on the first visit. Anthropometry, chair sit&reach, back scratch, 8-feet up&go, handgrip strength and 6-min walking tests, in that order, were assessed on the second day. Since isometric contractions may reduce pressure pain threshold (Staud et al. 2005), handgrip strength test was assessed on the second day.

The healthy women group performed all the tests in the same day. In order to achieve the same statistical power in every test, we included only those subjects who had valid data in all physical fitness tests. All patients were assessed by the same research group in order to reduce inter-examiner error. The study was reviewed and approved by the Ethics Committee of the "Hospital Virgen de las Nieves" (Granada, Spain).

Material and procedures

Tenderness

We assessed 18 tender points according to the American College of Rheumatology criteria (Wolfe, Smythe 1990) for classification of FM using a standard pressure algometer (FPK 20; Effegi, Alfonsine, Italy). Total tender point count was recorded for each patient. An *algometer score* was calculated as the sum of the minimum pain-pressure values obtained for each tender point.

Anthropometrics measurements

Height (cm) was measured using a stadiometer (Seca 22, Hamburg, Germany) and weight (kg) with a scale (InBody 720, Biospace, Seoul, Korea). Body mass index (BMI) was calculated as weight (in kilograms) divided by height squared (in meters).

Physical fitness testing

The Functional Senior Fitness Test battery was used because it is relatively easy to administer and score, requires minimal equipment and space and is safe (Rikli & Jones 1999). It has shown no ceiling and floor effects, which is a relevant aspect for this study due to the heterogeneity of FM patients (Wilson, Robinson 2009). Therefore, the tests used are feasible to be performed in clinical and community settings (Carbonell-Baeza et al. 2010). Additionally, we also measured the handgrip strength and blind flamingo test, which are also commonly used in FM patients (Carbonell-Baeza, Aparicio 2010; Tomas-Carus et al. 2007). Muscular strength, as assessed with handgrip strength is a predictor of functional capacity, morbidity and mortality (Bohannon 2008; Metter et al. 2002). Moreover, handgrip strength is a quick and easy to perform muscular fitness test that provides useful information about overall muscular strength. On the other hand, the blind flamingo test in 30 seconds is the most commonly used, easily replicable and cheap balance test employed in FM patients.

The main physical fitness components studied were:

Lower-body muscular strength. The "30-s chair stand test" involves counting the number of times within 30 seconds that an individual can rise to a full stand from a seated position with back straight and feet flat on the floor, without pushing off with the arms. The arms were crossed at the chest level. The patients were asked to perform at natural pace as it has been described by Agarwal & Kiely (2006) and they carried out 1 trial after familiarization.

Upper-body muscular strength: Handgrip strength was assessed using a hand dynamometer with adjustable grip (TKK 5101 Grip D; Takey, Tokio Japan). Optimal grip span was calculated using the formula suggested by Ruiz-Ruiz et al. (2002): $y = x/5 + 1.5$ in women; being "x" the hand size, and "y" the grip length. Each patient, standing, performed two attempts with each hand, with the arm fully extended, forming an angle of 30° with respect to the trunk. The maximum score in kilograms for each hand was recorded and the mean score of left and right hand was used in the analyses.

Lower-body flexibility. In the "chair sit&reach test", the patient seated with one leg extended, slowly bends forward sliding the hands down the extended leg in an attempt to touch (or pass) the toes. The number of centimeters short of reaching the toe (minus score) or reaching beyond it (plus score) was recorded (Rikli & Jones 1999). Two trials with each leg were performed, after a familiarization trial, and the best value of each leg was registered, the average of both legs was used in the analysis.

Upper-body flexibility. The "back scratch test", a measure of overall shoulder range of motion, involves measuring the distance between (or overlap of) the middle fingers behind the back with a ruler (Rikli & Jones 1999). This test was assessed twice, after a familiarization trial, alternately with both hands, and the best value was registered. The average of both hands was used in the analysis.

Static balance. It was assessed with the "blind flamingo test", in which the patient (barefoot) stood on one leg while the other leg was flexed at knee level and held at the ankle by the hand of the same side of the body with eyes closed (Rodriguez et al. 1998).

The number of trials needed to complete 30 seconds of the static position is recorded, and the chronometer is stopped whenever the patient did not comply with the protocol conditions. One trial was performed for each leg and the average of both values was selected for the analysis.

Motor agility/dynamic balance. The "8-feet up&go test" involves standing up from a chair, walking 8-feet (2.44 meters) to and around a cone, and returning to the chair in the shortest possible time (Rikli & Jones 1999). The best time of two trials in seconds was recorded and used in the analysis.

Aerobic endurance/cardiorespiratory fitness. The "6-min walking test" involves determining the maximum distance (meters) that can be walked in 6 minutes along a 45.7 meters rectangular course (Pankoff et al. 2000; Rikli & Jones 1999).

All fitness tests developed in the present study have been validated elsewhere (Agarwal & Kiely 2006; Espana-Romero et al. 2010; Pankoff, Overend 2000; Rikli & Jones 1999; Rodriguez, Gusi 1998; Ruiz-Ruiz et al. 2002).

Fibromyalgia Impact

Several health-related questionnaires are often used as complementary information in the diagnosis and monitoring of FM. We used the Spanish version (Rivera & Gonzalez 2004) of the *Fibromyalgia Impact Questionnaire* (FIQ) (Burckhardt et al. 1991) to assess the FM-related symptoms. FIQ assesses the components of health status that are believed to be most affected by FM. It is composed of ten dimensions: physical impairment, overall well being, work missed and a seven items of a visual analogy scale (VAS) marked in 1-cm increments on which the patient rates the job difficulty, pain, fatigue, morning tiredness, stiffness, anxiety and depression. The FIQ total score ranges from 0 to 100 and a higher value indicates a higher impact of the disorder (Bennett 2005). Patients were classed as having moderate FM if the score in the FIQ score was <70 and as having severe FM if the FIQ score was ≥70, as previously suggested (Bennett 2005).

Statistical analysis

All analyses were performed using the Statistical Package for Social Sciences (SPSS, version 16.0 for Windows; SPSS Inc., Chicago, IL), and the level of significance was set at 0.05.

The distribution of the residuals was examined in all the study variables. The FIQ variables showed a non-Normal distribution, which did not improve (became Normal) after several transformations (e.g. logarithmical and squared root transformations were performed). Anthropometric and fitness parameters showed an acceptable Normal distribution. Comparisons between women with FM and the healthy group, and between women with moderate and severe FM, were performed using one-way analysis of variance. The relationships between all fitness tests and FIQ, algometer score and number of tender points were analyzed by Spearman correlations.

The fitness test thresholds that best discriminated between presence and absence of FM, as well as between moderate and severe FM, were determined using receiver operating characteristic (ROC) curve analysis. ROC curve is a plot of all the sensitivity/specificity pairs resulting from varying the decision threshold (Zweig & Campbell 1993). Sensitivity was considered as the probability to correctly identify a woman with FM (true-positive proportion). Specificity was considered to be the probability of correctly identifying a woman without FM (true-negative proportion). The same applies to severe FM (vs. moderate FM). The perfect test that correctly classifies all women has a true-positive rate of 1 and false-positive rate (1-specifity) of 0. Therefore, the optimal combination of true-positive rate and false-positive rate is the point closest to the perfect test (upper left corner of the graph). To identify the best threshold, the distance between the perfect test and each sensitivity and 1-specificity pair was calculated, and, then, the pair closest to 1 was chosen.

We also calculated the area under the curve (AUC) and 95% confidence intervals (CI). The AUC represents the ability of the specific fitness test to correctly classify subjects as having vs. not having FM or having moderate vs. severe FM. The values of AUC range between 1 (perfect test) to 0.5 (non-information test). Binary logistic regression was used to further study the relationship between fitness testing and presence/absence of FM, or disease severity, after adjustment for age and BMI.

RESULTS

The characteristics of the participants are presented in **Table 1**. FM patients performed worse in all the fitness tests compared to their healthy peers ($P<0.001$), except for the back scratch test ($P=0.177$). Forty-six percent of the FM patients studied had severe FM (FIQ≥70). Patients with severe FM performed worse in most of the fitness tests compared to moderate FM group, but these differences were only significant for the 30-s chair stand, handgrip strength, 30-s chair stand sit&reach and back scratch tests (all $P<0.05$).

Spearman correlations between fitness tests and FIQ total score, VAS dimensions and physical impairment are shown in **Table 2**. Most of fitness tests were correlated with total score of FIQ, and with FIQ-pain, job difficulty and depression dimensions. Among the fitness tests studied, the 30-s chair stand and the back scratch tests were those that obtained a larger number of correlations with better scores of FIQ, both total and dimensions. The 30-s chair stand test, followed by the 6-min walking test, were the only tests that correlated with the total number of tender points ($P<0.01$). The 30-s chair stand test additionally correlated with algometer score ($P<0.01$).

Table 3 shows, ordered by level of significance, the capacity of each fitness test to discriminate between presence and absence of FM and between severe and moderate FM. The ROC analysis showed that all the tests studied, except for the back scratch test, were able to discriminate between presence and absence of FM (AUC ranged from 0.66 to 0.92; P≤0.001) **(Figure 1, Panel A)**. Furthermore, the 30-s chair stand, chair sit&reach, handgrip strength and back scratch tests were able to discriminate between severe and moderate FM (AUC ranged from 0.62 to 0.66; P≤0.05) **(Figure 1, Panel B)**. Among the fitness tests studied, the 30-s chair stand test showed the greatest potential to discriminate both FM presence and severity, followed by the handgrip strength and chair sit&reach test (Figure 1).

Regarding the Panton et al. (2006) study, lower extremity strength differences between FM and age matched controls were exacerbated when force production was adjusted for weight/height. On this basis we additionally analyzed ROC curves for presence/absence and moderate/severe FM for handgrip strength/kg to examine if sensitivity/specificity was improved over handgrip strength (data not shown). Differences in handgrip strength/kg between healthy women and FM patients was P<0.001. Areas under the curve were 0.865; P<0.001 and AUC=0.647; P=0.001 for presence/absence of FM and moderate/severe FM, respectively.

Table 4 shows the cut-off points, odds ratios (OR) and 95% of Confidence Interval (CI) between tests to identifying FM presence and severity. The optimal cut-off to discriminate between presence vs. absence of FM for the 30-s chair stand test was 9.0 repetitions, whereas the corresponding threshold to discriminate between severe vs. moderate FM was 6 repetitions. A 30-s chair stand test score ≤9 repetitions was associated with an increased odds ratio (OR) of having FM (OR=53.5; 95% CI: 12.2–

233.9). In the FM group, a 30-s chair stand test score ≤6.0 repetitions was associated with an increased odd of having severe FM (OR= 3.0; 95% CI: 1.1–13.3). Due to the fact that BMI differed between the FM and the control group, we additionally controlled for BMI in the models. The associations were similar and in some cases slightly stronger **(Table 4)**.

DISCUSSION

The findings of the present study shows that physical fitness is reduced in women with FM compared to healthy age- and region-matched women, as well as in patients with severe FM compared to those with moderate FM. We observed that most of the physical fitness tests are inversely related with FM symptomatology in women, especially with pain. Our results also suggest that the 30-s chair stand, 8-feet up&go, handgrip strength, chair sit&reach, 30-s blind flamingo and 6-min walking tests were able to discriminate between presence and absence of FM; and that the 30-s chair stand, chair sit&reach, handgrip strength and back scratch tests were able to discriminate between moderate and severe FM in women. Among the fitness tests studied, the 30-s chair stand test showed the highest ability to discriminate between presence vs. absence of FM and FM severity. A 30-s chair stand test score <9 repetitions was associated with 53 times more risk of having FM. In the FM group, 30-s chair stand test scores <6 repetitions were associated with 3 times more risk of having severe FM. To the best of our knowledge, the ability of fitness tests to discriminate between presence/absence of FM and the severity of FM has not been previously explored. The high AUC values observed in this study show more discriminatory ability of these tests for identifying presence of FM than for identifying severe FM. Although the sample size is larger than in previous studies in this field, it is still relatively small and thus, interpretation of the present results should be taken cautiously.

We observed that FM patients performed worse than healthy women in all the physical fitness tests, except in upper body flexibility measured by the back scratch test. Mannerkorpi et al. (1994) compared measures of functional capacity between FM patients and healthy adults and the FM group had significantly lower physical functioning scores on all variables. The levels of handgrip strength in FM patients observed in the present study are clearly lower than the healthy women and than those normative values from healthy female age-matched population (Budziareck et al. 2008; Schlussel et al. 2008). These findings concur with other studies that reported lower levels of handgrip strength in male and female FM patients (Aparicio et al. 2010; Aparicio, Ortega 2011; Dombernowsky et al. 2008; Nordenskiold & Grimby 1993; Sahin et al. 2004). Staud et al. (2005) did not find differences in handgrip between FM patients and healthy women whereas Valkeinen et al. (2008) found lower isometric strength in lower limbs but not in trunk and upper limbs in postmenopausal FM patients versus healthy women.

Panton et al. (2006) showed that lower-body strength and functionality were similar in women with FM and older healthy women, which suggest that FM potentially enhance the risk for premature age-associated disability. Comparing data from this survey with the functional capacity levels of community-residing older women aged 60–94 years (n=5,048) (Rikli & Jones 1999), our median values (percentile 50) on the majority of the fitness tests are approximately in the 50^{th} percentile in women aged 85-89 years. This suggests that FM patients have an aged functional capacity. Those data are worrying and support the findings of Panton et al. (2006) with regard to the high risk of disability in women with FM. Furthermore, Jones et al. (2008) reported that women with FM have difficulties on doing tasks that require physically independence.

Our data indicate that women with severe FM have lower physical fitness than women with moderate FM. In the present study, we have found a positive relationship between better fitness tests scores and lower global score of FIQ, and pain and depression dimensions. Furthermore, the 30-s chair stand test was additionally correlated with tender points and algometer score. Henriksen et al. (2009) reported no differences between muscular strength levels, as measured by isokinetic knee extension and flexion, and FM symptomatology in 840 FM patients from Denmark. They also analyzed the association between lower extremity strength and tender point count and did not find significant correlations. In contrast, Mannerkorpi et al. (2006) observed that better fitness tests scores were related to higher physical functioning and lower pain in 69 FM patients from Sweden. Other studies (Ayan et al. 2007; Mannerkorpi, Svantesson 2006; Valim, Oliveira 2002) analyzed the relationship between physical performance and pain, measured with FIQ. They found no correlation between anaerobic threshold (Valim, Oliveira 2002) and FIQ, whereas 6-min walking, chair rising and handgrip strength tests showed a fair relationship with the physical functioning subscale from General Health Short Form Questionnaire (SF-36) (Ayan, Martin 2007; Mannerkorpi, Svantesson 2006) and a moderate relationship with pain dimension from the FIQ (Mannerkorpi, Svantesson 2006). There is a need of future studies to confirm the associations between functional capacity and pain and FM symptoms. In fact, an intervention study showed that muscle strength gains predicted better postural balance and physical and mental health, as assessed by SF-36, in FM patients (Tomas-Carus et al. 2009).

It should be mentioned that relationship observed between fitness testing and fatigue (as measured by FIQ) was unexpectedly low, which does not concur with other authors that suggested that the low fitness performance characteristic in FM women might be due to pain as well as fatigue (Nordenskiold & Grimby 1993).

Lower-limbs muscular strength, as measured by the 30-s chair stand test has shown to be a useful tool in the present study. This test has shown excellent test-retest reliability and demonstrated construct validity in patients with idiopathic inflammatory myositis, as reported by Agarwal & Kiely (2006). Furthermore, because of its responsiveness to changes in disease activity, authors suggest the use of this test in clinical practice, which offers physiological and practical advantages over existing tests of muscle function.

Limitations and strengths

Limitations: First, our participants were volunteers and may have been in a better physical condition than average FM patients. Second, individually tailored medication used for FM symptoms may have had some limiting effects on physical performance, e.g. certain cardiovascular drugs are associated with reduced grip strength in older people (Ashfield et al. 2010)). Third, the present study was carried out only in women, and, future studies should replicated this study in men with FM. Fourth, physical activity levels of the patients were not registered. Fifth, the present study does not allow us to test how responsive one test is to physical and pharmacological interventions. Future studies should examine the sensibility of these tests to detect changes in symptomatology after an intervention or pharmacological treatment. Furthermore, it would be of interest to replicate the same study design in other diseases related to pain such as arthritis rheumatoid, lupus, chronic fatigue syndrome, etc. Finally, the difference between the FM patients and healthy controls in terms of the time at which tests were performed (two sessions versus single session) might be acting as a possible confounder variable.

Strengths: Compared to most of previous literature (Ayan, Martin 2007; Mannerkorpi, Burckhardt 1994; Mannerkorpi, Svantesson 2006; Valim, Oliveira 2002; Valkeinen, Hakkinen 2008), the present study involves a relatively large sample (nearly a hundred FM patients). Moreover, this is one of the few studies examining a large range of functional capacity parameters in FM patients in a single report, which allows us to make comparisons between tests and to identify which test/capacity might be more useful from a clinical point of view. Finally, the current statistical approach used, i.e. ROC analysis, has a particular clinical interest, since provide cut-off values that the physicians can use for a better interpretation of the evaluations.

Clinical Implications

The inclusion of physical fitness assessment to the armamentarium currently used to the diagnosis and monitoring of FM is clinically relevant. Particularly, the lower-limbs muscular strength, as measured by the 30-s chair stand test could be used as a complementary tool in the assessment and monitoring of FM in women, since has shown a large capacity to discriminate between the presence/absence of FM, as well as between moderate/severe FM.

From a clinical point of view, for instance, the probability of having FM if the patient performs more than 9 repetitions would be low and thus, it would be of help in the final diagnosis decision. Furthermore, usually is necessary to test different pharmacology until to find the most appropriated for each patient. Improves in this test might mean a better response to this pharmacology.

This fitness test has a great potential in a clinical setting for several reasons: First, a chair and a stopwatch is all the equipment need to perform this test, so it is extremely cheap. Second, the time needed to perform the test is 30 seconds, which is a fundamental issue for clinicians who are usually under time constrains. Third, other tests, such as the 6-min walking test, require larger spaces, while the 30-s chair stand test can be performed in any room without any special requirement. Forth, the procedures for this test are simple and do not require any particular training.

PERSPECTIVES

Physical fitness is reduced in female FM patients and is inversely related with FM severity and symptomatology. We observed that physical fitness in general, and particularly lower-limbs muscular strength, as measured by the 30-s chair stand test, discriminate women with FM from those without FM, as well as those with moderate FM from their peers with severe FM. Identification of women who fail to meet the suggested standards can be a helpful and informative tool for clinician. The 30-s chair stand test provides useful information and is relatively cheap, easy to perform, and low-time consuming which makes its use in clinical settings feasible.

Acknowledgements

The authors gratefully acknowledge all the participants for their collaboration. We also acknowledge all the AGRAFIM (FM association from Granada, Spain) members involved in the field work for their efforts and great enthusiasm. This study was in part financially supported by AGRAFIM and grants from the Spanish Ministry of Education (AP-2006-03676 and EX-2008-0641), the Swedish Council for Working Life and Social Research (FAS) and the Ministry of Science and Innovation (BES-2009-013442, RYC-2010-05957).

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Table 1: Characteristics of the study sample by presence/absence of fibromyalgia (FM) and FM severity, after adjustment by age.

	Presence/absence of FM			FM severity*		
	Healthy women (n=66)	**FM patients (n=94)**	**P**	**Moderate FM (n=49)**	**Severe FM (n=45)**	**P**
Age (years)	53.8(5.8)	52.0(7.5)	0.107	52.9(1.1)	51.0(1.2)	0.239
Years since clinical diagnosis: >5 (%)	-	48.8	-	49.2	50.8	0.584
Height (m)	155.5(0.6)	156.9(0.5)	0.081	157.5(0.7)	156.8(0.7)	0.482
Weight (kg)	70.5(1.6)	69.6(1.3)	0.668	68.4(2.0)	70.7(2.1)	0.428
Body Mass Index (kg/m^2)	30.2(0.7)	28.2(0.6)	0.028	27.3(0.8)	28.8(0.8)	0.175
30-s chair stand test (rep.)	13.7(0.4)	7.4(0.3)	<0.001	8.2(0.4)	6.6(0.4)	0.004
Handgrip strength test (kg)	25.3(0.8)	17.5(0.6)	<0.001	18.9(1.0)	15.7(1.0)	0.026
Chair sit&reach test (cm)	1.7(1.6)	-9.5(1.3)	<0.001	-5.6(2.1)	-13.6(2.2)	0.009
Back scratch test (cm)	-6.0(1.2)	-8.1(1.0)	0.177	-5.7(1.6)	-10.4(1.7)	0.042
8-feet up&go test (s) #	5.9(0.2)	7.9(0.2)	<0.001	7.7(0.3)	8.2(0.3)	0.192
30-s blind flamingo test (failures) #	6.6(0.6)	10.2(0.5)	<0.001	10.3(0.8)	10.0(0.8)	0.774
6-min walking test (meters)	503.1(9.0)	457.7(7.6)	<0.001	467.2(12.5)	448.1(13.1)	0.294
FIQ	-	66.4(1.4)	-	56.1(1.2)	77.7(1.3)	<0.001
Algometer score	-	51.2(1.7)	-	53.3(2.4)	49.4(2.5)	0.279
Number of tender points	-	16.2(0.3)	-	15.8(0.5)	16.7(0.5)	0.217

Values expressed as mean(standard error); FIQ, Fibromyalgia Impact Questionnaire; *Severe FM was defined as FIQ≥70 points. # Lower scores indicate better performance.

Table 2. Spearman correlations between fitness testing, Fibromyalgia Impact Questionnaire (FIQ) and pain.

	Chair stand	**Handgrip strength**	**Chair sit&reach**	**Back scratch**	**8-feet up&go test #**	**30-s blind flamingo #**	**6-min walking test**
FIQ total score	-0.344†	-0.273†	-0.336†	-0.311†	0.287†	-0.014	-0.183
Job difficulty	-0.373†	-0.165	-0.070	-0.369†	0.338*	0.401†	-0.245
Pain	-0.274*	-0.445‡	-0.395‡	-0.389‡	0.132	0.150	-0.242*
Fatigue	-0.123	-0.206	-0.108	-0.250*	0.127	0.087	-0.180
Morning tiredness	-0.033	-0.055	-0.057	-0.146	0.143	0.040	-0.167
Stiffness	-0.094	-0.093	-0.150	-0.237*	-0.020	-0.085	-0.063
Anxiety	-0.171	-0.190	-0.255*	-0.244*	0.268*	-0.119	-0.067
Depression	-0.366‡	-0.256*	-0.158	-0.294†	0.328†	0.075	-0.231*
Physical impairment	-0.244*	-0.197	-0.082	-0.148	0.065	0.329†	-0.291†
Algometer score	0.363†	-0.045	0.061	0.016	-0.082	-0.113	0.188
Number of tender points	-0.327†	-0.007	-0.071	-0.097	0.113	0.073	-0.213*

* P<0.05, † P< 0.01, ‡ P<0.001; # Lower scores indicates better performance.

Table 3. Ability (ROC analysis) of different fitness tests to discriminate between presence/absence of fibromyalgia (FM) and moderate/severe FM.

	AUC (standard error)	95% CI	P
Presence/absence FM			
30-s chair stand test	0.916 (0.02)	0.875-0.957	<0.001
8-feet up&go test #	0.840 (0.03)	0.777-0.904	<0.001
Handgrip strength test	0.801 (0.04)	0.734-0.869	<0.001
Chair sit&reach test	0.727 (0.04)	0.648-0.807	<0.001
30-s blind flamingo test #	0.707 (0.04)	0.626-0.788	<0.001
6-min walking test	0.658 (0.04)	0.574-0.741	0.001
Back scratch test	0.547 (0.05)	0.458-0.637	0.309
FM severity*			
30-s chair stand test	0.664 (0.06)	0.549-0.779	0.008
Chair sit&reach test	0.646 (0.06)	0.531-0.761	0.017
Handgrip strength test	0.638 (0.06)	0.523-0.753	0.024
Back scratch test	0.619 (0.06)	0.501-0.736	0.053
8-feet up&go test #	0.576 (0.06)	0.457-0.696	0.214
6-min walking test	0.548 (0.06)	0.427-0.668	0.438
30-s blind flamingo test #	0.504 (0.06)	0.383-0.625	0.945

* Severe FM was defined as Fibromyalgia Impact Questionnaire ≥70 points; AUC, area under de curve. # These tests were inverted for this analysis, so that higher scores indicated better performance, as it is the case for the rest of tests.

Table 4. Binary logistic regression statistics testing the predictive capacity of the fitness testing thresholds derived from the ROC analysis for presence/absence of fibromyalgia (FM) and FM severity.

					Low fitness (based on the cut-off)			
					Adjusted by age		Adjusted by age and BMI	
	Fitness test	**Cut-off point**	**Se (%)**	**Sp (%)**	**OR†**	**95% CI**	**OR†**	**95% CI**
Presence / absence of FM	30-s chair stand test (rep)	≤ 9.0	76.6	89.4	53.5	12.2-233.9	63.7	13.8-294.4
	8-feet up&go test (s) #	≥ 6.5	78.7	78.8	5.8	0.7-50.8	5.6	0.6-49.6
	Handgrip strength test (kg)	≤ 18.5	56.4	90.9	9.6	4.2-22.2	9.7	4.1-22.8
	Chair sit&reach test (cm)	≤ -4.6	80.9	59.1	5.2	2.6-10.4	5.9	2.8-12.3
	30-s blind flamingo test (failures) #	≥ 9.0	51.1	83.3	3.8	1.6-8.8	4.6	1.9-11.0
	6-min walking test (m)	≤ 438.7	45.7	86.4	5.8	2.5-13.3	6.7	2.8-16.0
FM severity*	30-s chair stand test (rep)	≤ 6.0	59.5	72.9	3.0	1.1-7.6	2.9	1.1-7.6
	Chair sit&reach test (cm)	≤ -12.5	59.5	66.7	3.5	1.5-8.6	3.5	1.4-8.5
	Handgrip strength test (kg)	≤ 17.5	71.4	56.2	2.7	1.1-6.5	2.9	1.2-7.0
	Back scratch test (cm)	≤ -16.0	38.1	83.3	3.1	1.2-7.9	2.8	1.0-7.6

*Severe FM was defined as Fibromyalgia Impact Questionnaire ≥70 points; BMI, body mass index; # In these tests, a score above the threshold indicates a lower fitness, opposite to the rest of the tests; Se, sensitivity; Sp, specificity.
†High fitness was used as reference.

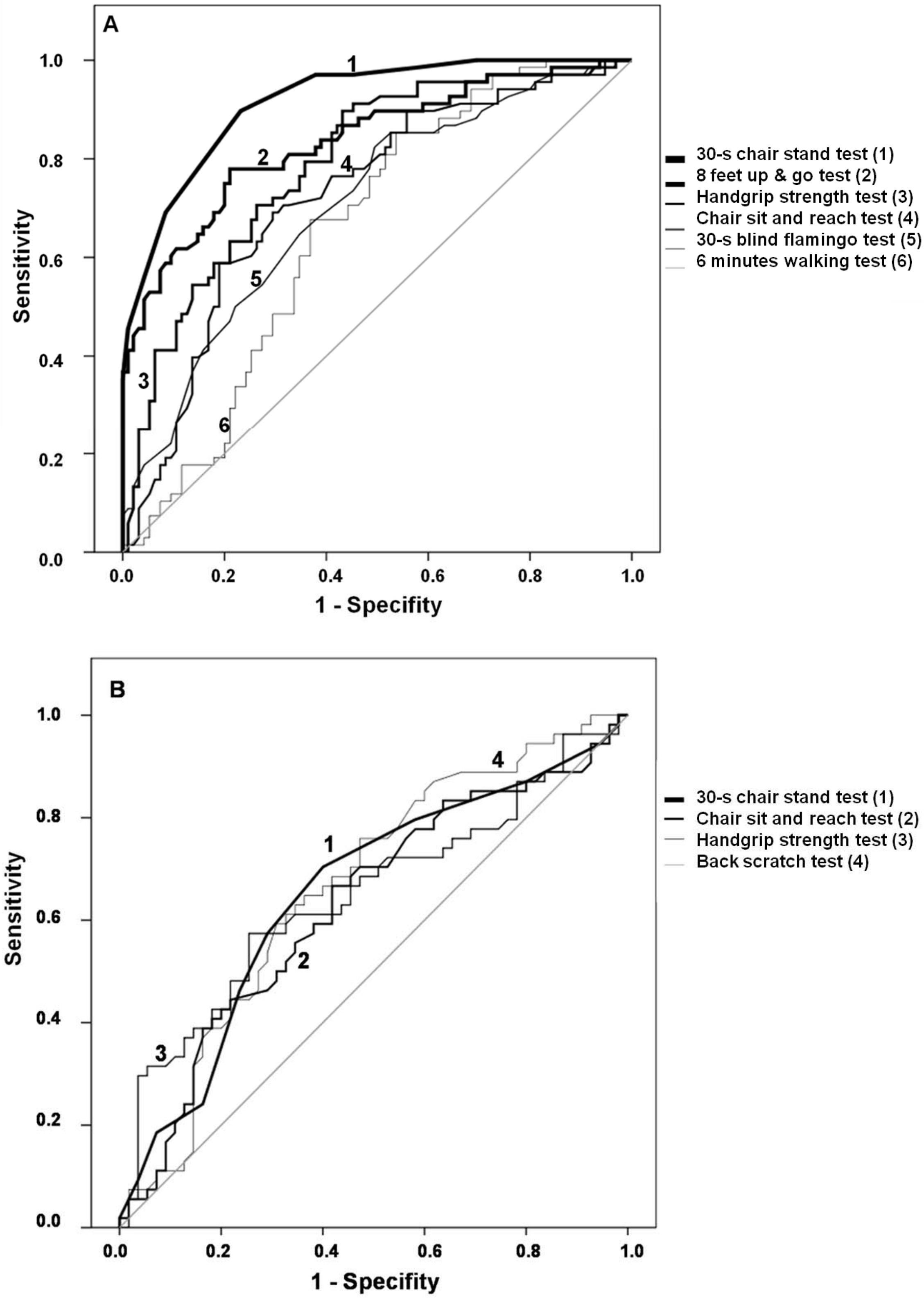

Figure 1. ROC curve summarizing the potential of fitness testing to identify presence/absence of fibromyalgia (fibromyalgia patients vs. healthy women), (Panel A) or severe/moderate fibromyalgia (Fibromyalgia Impact Questionnaire ≥70 vs. <70), (Panel B) in women; 8-feet up&go and 30-s blind flamingo tests were inverted for this analysis, so that higher scores indicated better performance, as it is the case for the rest of tests.

3. BODY COMPOSITION AND OTHER FACTORS AFFECTING FIBROMYALGIA

(Papers V, VI, VII)

Análisis de la composición corporal en mujeres con fibromialgia

V

Aparicio VA, Ortega FB, Heredia JM, Carbonell-Baeza A, Delgado-Fernández M

Reumatol Clin

2011; (7):7-12.

Reumatol Clin. 2011;7(1):7–12

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Original

Análisis de la composición corporal en mujeres con fibromialgia

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INFORMACIÓN DEL ARTÍCULO

Historia del artículo:
Recibido el 13 de enero de 2010
Aceptado el 7 de mayo de 2010
On-line el 17 Deciembre 2010

Palabras clave:
Fibromialgia
Composición corporal
Bioimpedancia
Obesidad

R E S U M E N

Objetivos: Caracterizar el perfil antropométrico y de composición corporal de mujeres con fibromialgia (FM) del sur de España y compararlo con otros estudios nacionales e internacionales de similares características, así como con valores normativos de mujeres españolas.
Materiales y métodos: Se ha analizado la composición corporal de 104 mujeres diagnosticadas de FM mediante un bioimpedanciómetro de 8 electrodos. La fiabilidad de la medida fue estudiada en una submuestra seleccionada aleatoriamente (n = 28). El estudio de fiabilidad mostró un error sistemático test vs re-test cercano a cero en la mayoría de los parámetros estudiados.
Resultados: Las mujeres con FM estudiadas tuvieron un peso promedio de 71,3 ± 13,4 kg, 158,1 ± 6 cm de altura, 28,6 ± 5,1 kg/m^2 de índice de masa corporal, 38,6 ± 7,6% de porcentaje graso, 31,6 ± 3,8 l de agua corporal total y 23,4 ± 3,0 kg de masa muscular. En general, no se observan diferencias importantes en peso e índice de masa corporal, tanto entre las mujeres con FM estudiadas y enfermas procedentes de otros estudios nacionales o europeos, como en comparación con los valores de referencia andaluces o nacionales. Sin embargo, la prevalencia de obesidad en el grupo de mujeres con FM fue del 33,7%, un valor superior a la prevalencia de obesidad nacional en mujeres de igual rango de edad (i.e. 26,4%).
Conclusiones: Los resultados sugieren que la obesidad es una condición frecuente entre mujeres con FM, siendo su prevalencia sustancialmente superior a los valores normativos nacionales. Este estudio presenta información detallada sobre la composición corporal de mujeres con FM.

Analysis of the body composition of Spanish women with fibromyalgia

Keywords:
Fibromyalgia
Body composition
Bioimpedance
Obesity

A B S T R A C T

Objectives: To describe the anthropometric profile and body composition of women from Southern Spain diagnosed with fibromyalgia (FM) and to compare the observed values with values from other studies conducted on FM patients and with national reference values.
Materials and methods: The body composition of 104 women diagnosed with FM was assessed using an eight-electrode impedance meter. The reliability of the body composition measurement was tested in a randomly selected sub-sample (n = 28). The reliability study showed a test-retest systematic error close to zero in most of the parameters studied.
Results: The women with FM who were studied had a mean weight of 71.3 ± 13.4 kg, height of 158 ± 6 cm, body mass index of 28.6 ± 5.1 kg/m^2, body fat mass of 38.6 ± 7.6%, total body water of 31.6 ± 3.8 l and muscle mass of 23.4 ± 3.0 kg. In general, there were no substantial differences in weight and body mass index between women with FM and those analyzed in other Spanish and European studies involving FM patients, nor when they were compared with regional or national reference values. However, the prevalence of obesity in the women with FM under study was 33.7%, a higher figure than that from the national reference data for obesity in similarly aged women (i.e. 26,4%).
Conclusions: The results suggest that obesity is a common condition in women diagnosed with FM, its prevalence in this population being higher than the national reference values. This study provides detailed information about the body composition characteristics of women with FM.

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doi:10.1016/j.reuma.2010.05.006

Introducción

La fibromialgia (FM) es una enfermedad caracterizada por un desorden en la regulación del dolor, de etiología desconocida[1]. La FM se asocia con la existencia concurrente de dolor músculo-esquelético crónico generalizado y que presenta una marcada hipersensibilidad en múltiples puntos predefinidos *(tender points)*[2]. Se relaciona con una gran variedad de síntomas, entre los que destacan la fatiga persistente, el sueño no reparador, la rigidez generalizada, especialmente matutina o postreposo, síntomas ansioso-depresivos y dificultades cognitivas[2,3]. Los enfermos de FM presentan una menor capacidad funcional, lo que limita sus actividades cotidianas, y una menor calidad de vida relacionada con la salud con respecto a grupos control del mismo sexo y edad[4], lo que incurre en un considerable aumento en el gasto sanitario público anual por cada paciente[5].

La prevalencia de FM en España en el año 2000 era del 2,4% según los resultados del estudio EPISER[4]. Su frecuencia es mayor en mujeres (4,2%) que en hombres (0,2%), y en el ámbito rural (4,1%) frente al urbano (1,7%)[4]. Las manifestaciones clínicas de la FM suelen aparecer en torno a las décadas de los cuarenta y los cincuenta años[4], por esta razón podríamos afirmar que la mayoría de estas pacientes son peri-menopáusicas. La composición corporal en este periodo se caracteriza por un incremento del tejido graso, especialmente de la grasa abdominal, seguramente como consecuencia de la pérdida de estrógenos y el descenso en los niveles de actividad física[6,7]. Este fenómeno ha sido relacionado con gran número de complicaciones metabólicas, tales como dislipidemia, resistencia a la insulina, hipertensión e incremento de enfermedades coronarias[8].

En el estudio de Yunus et al (2002) con mujeres americanas, la prevalencia de sobrepeso-obesidad entre las mujeres con FM fue superior al de la población normal (61 vs 38%, respectivamente, con un porcentaje de obesas del 32,2%)[9]. En cambio, en un reciente estudio israelí, el porcentaje de obesas ascendía al 45%[10], llegando a ser en otro reciente estudio del 50%[11]. Resulta difícil determinar si un elevado índice de masa corporal (IMC) y/u obesidad es o no una característica inherente a esta enfermedad a partir de estos trabajos en concreto, puesto que el estilo de vida y las características específicas de cada país hacen que la asociación FM e IMC/obesidad pueda variar entre estudios y áreas geográficas.

Por otra parte, los estudios publicados hasta la fecha, tanto del ámbito nacional como internacional, no describen en profundidad la composición corporal de estas enfermas, centrándose casi exclusivamente en la descripción del peso y el IMC[9,12,13], por lo que existe un vago conocimiento acerca de otros parámetros de relevancia relacionados con la composición corporal en esta población de estudio (por ejemplo del porcentaje graso o la masa muscular).

El presente estudio pretende caracterizar el perfil antropométrico y de composición corporal de mujeres con FM del sur de España y compararlo con otros estudios nacionales e internacionales de similares características, así como con valores normativos de mujeres españolas.

Material y métodos

Muestra y diseño del estudio

Contactamos con un total de 160 mujeres, miembros de la asociación de enfermos de FM de la provincia de Granada (AGRAFIM), a través de correo electrónico, carta, carteles informativos en la sede y teléfono, donde se les informaba del protocolo de evaluación y las características y objetivos del estudio. Finalmente, 110 mujeres consintieron por escrito participar voluntariamente en nuestro estudio y permitir la explotación de los datos resultantes por parte del personal investigador. Los criterios de inclusión en el estudio fueron los siguientes: 1) cumplir con el criterio de diagnóstico del Colegio Americano de Reumatología: dolor generalizado durante más de 3 meses y dolor a la palpación a una presión de 4 kg/cm en 11 o más de los 18 puntos de dolor[2]; 2) no presentar otra enfermedad severa o patología psiquiátrica, tales como infarto de miocardio o esquizofrenia[2]. A partir de estos criterios de inclusión, tanto las mujeres con FM primaria (cuando la FM se presenta como única alteración), como aquellas con FM secundaria (cuando la FM se presenta conjuntamente con otras enfermedades) fueron incluidas en el estudio. Las pacientes llevaban una media de 16,5 ± 10,4 años padeciendo la sintomatología y habían sido diagnosticadas positivamente de FM desde hacía una media de 6,5 ± 3,9 años. El protocolo de evaluación llevado a cabo fue aprobado por el Comité Ético de Ensayos Clínicos del Hospital Virgen de las Nieves.

Las mediciones se realizaron en un laboratorio de análisis de la condición física y salud de la Facultad de Ciencias de la Actividad Física y del Deporte de la Universidad de Granada. Teniendo presente la sintomatología de la enfermedad y la consecuente rigidez matutina[2], todos los tests de determinación de composición corporal tuvieron lugar de 12:00 a 14:00 h de lunes a jueves durante dos meses consecutivos en los que las condiciones ambientales no se vieron alteradas. Tras estimarse los puntos de dolor de cada paciente por parte de una fisioterapeuta, 6 mujeres fueron excluidas del estudio por no alcanzar al menos 11 de los 18 puntos, por lo que la muestra final quedó establecida en 104 mujeres.

Determinación de la composición corporal

La composición corporal de las pacientes fue analizada mediante un impedanciómetro táctil de 8 electrodos a frecuencias de 5, 50, 250 y 500 kHz (InBody 720, Biospace, Seoul, Korea). Este impedanciómetro ofrece validez tanto para las medidas corporales totales como por segmentos y ha sido validado en estudios que lo han comparado con otras técnicas de composición corporal de referencia[14,15]. Además, se ha probado su validez a la hora de analizar la composición corporal en sujetos obesos[15]. Esto resulta de especial interés de cara a su uso en la presente población de estudio, pues el porcentaje de obesidad en mujeres peri-menopáusicas es elevado. En todos los casos, la medición se realizó transcurridas al menos dos horas del último almuerzo, liberadas de ropa y objetos metálicos y habiendo permanecido en bipedestación un mínimo de 5 minutos previos al test. Con el objetivo de cumplir de forma estricta con las recomendaciones del fabricante se siguieron otras instrucciones adicionales, tales como no haberse dado una ducha ni realizado ejercicio físico intenso en horas previas al test o haber ingerido importantes cantidades de líquido en la hora previa. Las variables analizadas han sido: altura (cm), peso corporal total (kg), IMC (kg/m^2), masa grasa (kg), porcentaje graso (%), agua corporal total (l), agua intracelular (l), agua extracelular (l), contenido proteico (kg), masa muscular esquelética (kg), contenido mineral (kg), peso libre de grasa (kg), masa grasa del brazo derecho (kg), masa grasa del brazo izquierdo (kg), masa grasa del tronco (kg), masa grasa de la pierna derecha (kg), masa grasa de la pierna izquierda (kg), edema total (agua extracelular/agua corporal total) (l), edema del brazo derecho (l), edema del brazo izquierdo (l), edema del tronco (l), edema de la pierna derecha (l), edema de la pierna izquierda (l) y tasa metabólica basal (kcal). El IMC es el cociente resultante tras dividir el peso en kilogramos por el cuadrado de la altura en metros. Las recomendaciones de la Organización Mundial de la Salud[16] han sido empleadas para establecer los criterios clasificatorios del grado de obesidad: bajo peso si IMC < 18,5; normopeso si el rango de IMC = 18,50-24,99 kg/m^2; sobrepeso si IMC = 25,00-29,99 kg/m^2 y obesidad si IMC > 30 kg/m^2[2,17].

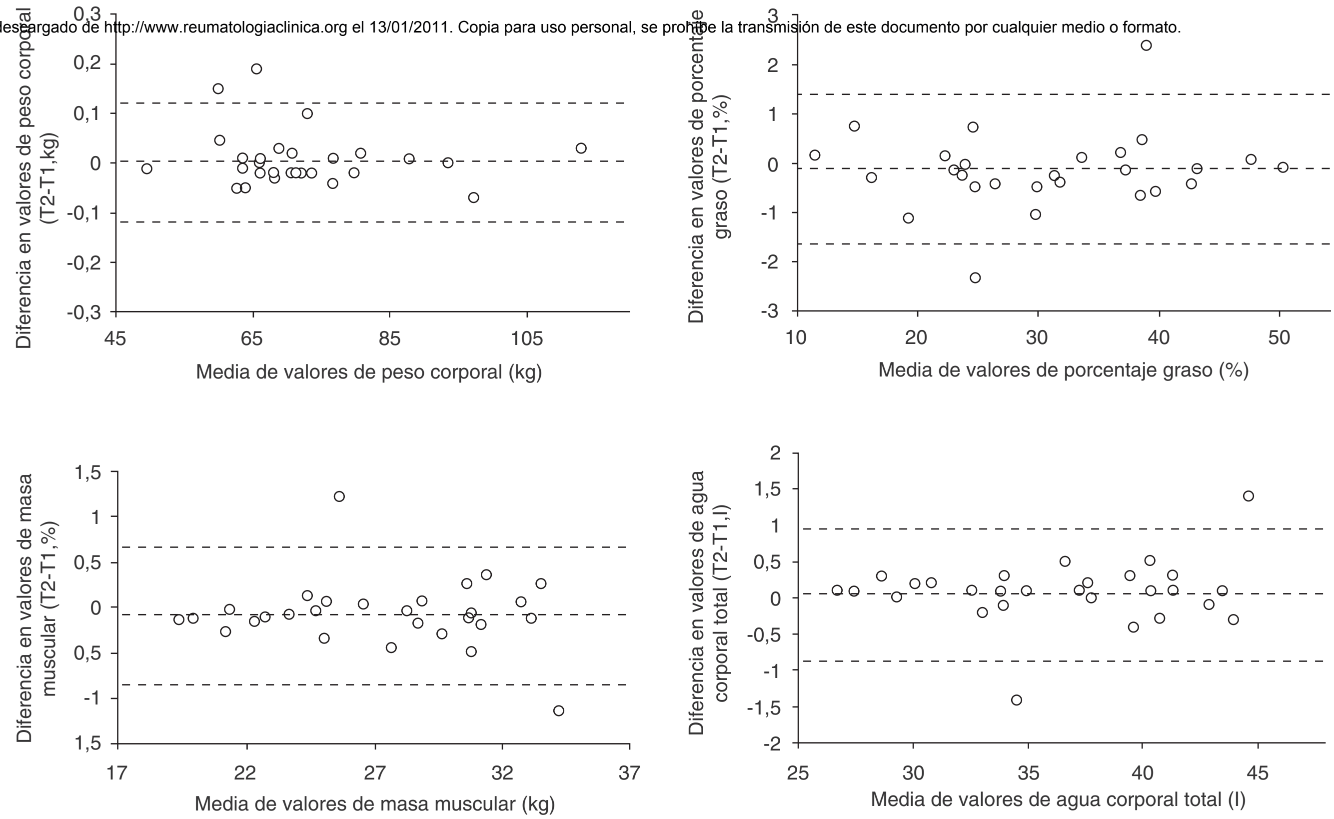

Figura 1. Gráfico Bland-Altman para peso, porcentaje graso, masa muscular y agua corporal total en pacientes de FM (N = 28). La línea central representa la media de las diferencias entre el segundo test (T2) y el primer test (T1). Las líneas discontinuas representan los límites superiores e inferiores del 95% de acuerdo (media ± 1,96 de la desviación estándar de las diferencias).

Fiabilidad del análisis de composición corporal

En una submuestra seleccionada de forma aleatorizada (N = 28) se llevaron a cabo dos mediciones sucesivas con 5 minutos de intervalo entre ellas, con el objeto de estudiar la fiabilidad o consistencia de la medida en esta población de estudio específica.

La fiabilidad del impedanciómetro utilizado ha sido examinada de acuerdo con el método Bland-Altman[18], y se muestra gráficamente mediante figuras de dispersión que enfrentan la diferencia de cada par de medidas (test 2-test 1, en adelante llamado T2-T1) contra la media de cada par de medidas [(T1 + T2)/2]. El 95% del límite de acuerdo para todas las variables de composición corporal se calculó como la media de las diferencias ± 1,96 de desviación estándar (de las diferencias).

Los diagramas Bland-Altman (fig. 1) muestran gráficamente la fiabilidad del impedanciómetro utilizado a partir del error sistemático (media de las diferencias entre medidas) y el error aleatorio (límite de acuerdo al 95%). Tanto el error sistemático, cercano a 0, como los límites de acuerdo observados, sugieren que la fiabilidad de las medidas realizadas en esta muestra de estudio es aceptable.

Análisis estadístico

Las características antropométricas y de composición corporal de la muestra estudiada se presentan como frecuencia y porcentajes para la variable de sobrepeso u obesidad y como media, desviación típica e intervalo de confianza para el resto de variables de carácter continuo. Todos los cálculos fueron llevados a cabo empleando el software estadístico SPSS v.15.0 para Windows.

Resultados

La tabla 1 presenta el grado de afectación de la enfermedad, el tiempo desde el diagnóstico de la enfermedad, padecimiento de la sintomatología y características demográficas de la muestra estudiada. La media de puntuación obtenida por la muestra en el Cuestionario de Impacto de la Fibromialgia (FIQ)[19] fue de 65,9 ± 13,5 puntos y un 34% mostró FM severa de acuerdo con el valor observado de FIQ (≥ 70).[19] El 74% de las pacientes estaba casada y un 60% era ama de casa. Por otra parte, más del 40% de las mujeres presentó un salario inferior a 1.200 €.

La tabla 2 muestra la distribución de la muestra atendiendo al valor de IMC siguiendo los criterios de clasificación de la OMS[17]. La prevalencia de «bajo peso» fue casi inexistente, mientras que un tercio de las mujeres estudiadas tuvo sobrepeso y otro tercio obesidad.

En la tabla 3 se muestran las distintas variables de composición corporal expresadas como media (desviación típica) e intervalo de confianza al 95% para la media. La edad media de las mujeres con FM estudiadas fue 50,4 ± 7,7 años, con un peso promedio de 71,3 ± 13,4 kg, 158,1 ± 6 cm de altura, 28,6 ± 5,1 kg/m^2 de IMC, 38,6 ± 7,6% de porcentaje graso, 31,6 ± 3,8 l de agua corporal total y 23,4 ± 3,0 kg de masa muscular.

Discusión

El presente estudio describe en profundidad la composición corporal de mujeres con FM, aspecto poco estudiado hasta la fecha, tanto a nivel nacional como internacional. La media de edad de la muestra analizada se sitúa en 50,4 ± 7,7 años, en torno a la edad media de prevalencia de la enfermedad[2,4]. La mayoría de estu-

Tabla 1
Variables demográficas y clínicas de las pacientes

Variable	%[a]
Raza blanca	100
Estado civil	
Casada	74
Soltera	9
Separada/divorciada/viuda	17
Nivel de estudios	
Sin estudios	8
Finalizado Primaria	44
Finalizado Secundaria	21
Carrera universitaria/posgrado	27
Situación laboral	
Ama de casa	60
Estudiante	2
Trabajadora	24
Desempleada	7
Jubilada/retirada	7
Nivel de ingresos	
< 1.200 €	43
1.201-1.800 €	18
> 1.800 €	39
Años padeciendo la sintomatología (media ± desv. típica)	16,5 ± 10,4
Valor medio de FIQ (media ± desv. típica)	65,9 ± 13,5
Años desde el diagnóstico (media ± desv. típica)	6,5 ± 3,9
Fibromialgia severa (FIQ ≥ 70)	34

FIQ: *Fibromyalgia Impact Questionnaire*, Cuestionario de Impacto de la Fibromialgia).
[a] Los valores representan porcentajes a menos que se indique lo contrario.

Tabla 2
Distribución de la muestra a partir de los criterios de clasificación del grado de obesidad de la Organización Mundial de la Salud

	IMC	n	%
Bajo peso	< 18,5	1	0,96
Normopeso	18,50-24,99	31	29,81
Sobrepeso (pre-obesidad)	25,00-29,99	37	35,58
Obesidad	> 30,00	35	33,65

IMC: índice de masa corporal.

dios en los que ha sido analizado el peso corporal de pacientes de FM ha obtenido prevalencias de obesidad superiores a los grupos control, con un rango comprendido entre el 32[9] y el 50%[11]. Nuestros resultados muestran una prevalencia de obesidad (IMC > 30) en mujeres con FM del sur de España del 33,7%, porcentaje que yace dentro del rango mencionado. Sin embargo, nuestra muestra de pacientes de FM presenta un porcentaje de obesidad superior a los valores de referencia sugeridos por los estudios nacionales SEEDO y DORICA para mujeres del sur de España de igual edad, i.e. 28,7 y 27,6%, respectivamente[20,21]. Diversos autores han indicado que este mayor grado de obesidad observado en pacientes de FM podría ser consecuencia del menor gasto metabólico basal[22], característica de esta enfermedad en parte debida a una menor musculatura, a su vez consecuencia del sedentarismo y la imposibilidad de realizar muchas de las actividades cotidianas o actividad física, entre otras causas[22,23]. Otros factores que podrían contribuir a explicar los resultados observados son: condiciones comórbidas a la FM que disminuyan la capacidad física de las enfermas, tales como artritis reumatoide; la tendencia al hipotiroidismo de este grupo de pacientes o un perfil neuroendocrino alterado[11]; y el efecto secundario de la farmacología empleada como inhibidora de la recaptación de serotonina sobre el peso corporal.

El IMC medio de nuestro grupo de mujeres con FM es de 28,5 ± 5,1 kg/m^2 y el peso de 71,3 ± 13,4 kg, valores muy similares a los de otros grupos de pacientes procedentes de otros estudios europeos[9,22,24] y españoles[12,13]. En los estudios españoles con pacientes de FM del mismo rango de edad, los valores para el IMC estuvieron entre 26,6 ± 3,5[13] y 29,0 ± 5,0 kg/m^2[2,12].

Aunque el tamaño muestral de los estudios mencionados fue relativamente pequeño (N = 32 y N = 33, respectivamente), los valores observados son muy similares a los nuestros. La media nacional de valores de referencia de IMC de mujeres españolas de edad comprendida entre los 45 y 54 años proveniente de estudios epidemiológicos de amplio tamaño muestral (estudios SEEDO y DORICA)[20,21,25] se sitúa en torno a 27,5 kg/m^2[2,21]. Las prevalencias de obesidad más elevadas en España se encuentran en la región noroeste peninsular, sur-sureste peninsular y Canarias[21]. Por lo tanto, para comparar de forma más precisa el grupo de mujeres con

Tabla 3
Composición corporal en mujeres con fibromialgia (N = 104)

Variable	Media	IC para la media al 95%	
		Límite inferior	Límite superior
Edad (años)	50,4 (7,7)	48,9	51,9
Peso (kg)	71,3 (13,4)	68,7	73,9
Altura (cm)	158,1 (6,0)	156,9	159,2
Índice de masa corporal (kg/m^2)	28,5 (5,1)	27,5	29,5
Masa grasa (kg)	28,3 (10,2)	26,3	30,2
Porcentaje graso (%)	38,6 (7,6)	37,1	40,1
Agua corporal total (l)	31,6 (3,8)	30,9	32,3
Agua intracelular (l)	19,5 (2,3)	19,0	19,9
Agua extracelular (l)	12,1 (1,5)	11,9	12,4
Contenido proteico (kg)	8,4 (1,0)	8,2	8,6
Masa muscular esquelética (kg)	23,4 (3,0)	22,8	24,0
Contenido mineral (kg)	3,0 (0,4)	2,9	3,1
Peso libre de grasa (kg)	43,0 (5,1)	42,0	44,0
Masa grasa del brazo derecho (kg)	2,35 (1,23)	2,11	2,59
Masa grasa del brazo izquierdo (kg)	2,37 (1,23)	2,13	2,61
Masa grasa de tronco (kg)	14,29 (5,02)	13,31	15,26
Masa grasa de la pierna derecha (kg)	4,03 (1,31)	3,77	4,28
Masa grasa de la pierna izquierda (kg)	4,01 (1,30)	3,76	4,26
Edema (l)	0,337 (0,004)	0,336	0,338
Edema brazo derecho (l)	0,332 (0,003)	0,331	0,332
Edema brazo izquierdo (l)	0,3327 (0,003)	0,332	0,333
Edema de tronco (l)	0,337 (0,004)	0,336	0,338
Edema pierna derecha (l)	0,338 (0,005)	0,337	0,339
Edema pierna izquierda (l)	0,339 (0,006)	0,338	0,340
Tasa metabólica basal (kcal)	1.298,7 (110,7)	1.277,1	1.320,2

Los datos están expresados como media (desviación típica). IC: intervalo de confianza.

FM estudiado (procedentes del sur de España) con valores normativos, es conveniente utilizar el límite superior del rango de valores normativos nacionales. El límite superior para el IMC de los datos nacionales es de 28,4 kg/m[2,21], cifra casi idéntica a la observada en las mujeres de FM estudiadas, indicando que su IMC es similar a los datos normativos de su región. En el reciente estudio de Sotillo et al[25] se analizó la composición corporal y los hábitos de vida de los andaluces, observando un IMC medio en mujeres de entre 40-49 años y 50-60 años de 27,6 ± 4,3 y de 30,2 ± 4,8 kg/m^2, respectivamente[25]. Si categorizamos nuestra muestra a partir de los mismos rangos de edad, no se presentan grandes diferencias con respecto a los valores de referencia de dicho estudio. El citado estudio empleó bioimpedancia eléctrica para evaluar la composición corporal en mujeres del sur de España[25]. El uso de la misma metodología de valoración de la composición corporal (impedianciometría), así como el estudio de mujeres de similar ubicación geográfica, permite la comparación de los datos procedentes de este estudio con los observados en nuestro trabajo. El porcentaje graso medio obtenido por Sotillo et al fue de 35,5 ± 6,2% para el rango de entre 40 a 49 años de edad y de 38,6 ± 5,1% para el rango de entre 50 y 60 años. Tras recategorizar nuestra muestra por los mismos rangos de edad utilizados en el estudio de Sotillo et al, se observó que el porcentaje graso de las mujeres con FM fue ligeramente inferior para el grupo de edad de entre 40 a 49 años (34,5 ± 8,4%) y ligeramente superior para el grupo de edad de 50 a 60 años (40,9 ± 6,5%). El peso libre de grasa y los niveles de agua corporal total en las pacientes de FM fueron casi idénticos a los de dicho estudio[25]. Con ello podemos afirmar que nuestro grupo de pacientes de FM no presenta grandes diferencias con respecto a los valores de referencia de la población andaluza analizada[25] una vez que la edad es tenida en cuenta en dichas comparaciones.

El hecho de que se presenten valores de IMC similares con respecto a grupos de mujeres de referencia y de que por el contrario se observen diferencias en la prevalencia de obesidad puede resultar contradictorio. Una posible explicación a este fenómeno sería la existencia de un grupo de pacientes de FM con una alta concienciación acerca de la necesidad de controlar el peso para mejorar la sintomatología de su enfermedad y de ahí que existiera un subgrupo de mujeres más delgadas y con menor IMC, que promediado con las pacientes con elevado IMC resultaría en un IMC medio similar a la población sana. Se podría afirmar también que en el grupo de sanas hay mucho mayor sobrepeso a costa de una menor obesidad y en el de enfermas ocurre lo contrario, existiendo una mayor obesidad a costa de un menor porcentaje de sobrepeso.

No hemos encontrado estudios, tanto en mujeres con FM como en mujeres sin dicha enfermedad, que realicen un análisis pormenorizado de la composición corporal, incluyendo grasa y edema por segmentos corporales, agua intracelular y extracelular. Por lo que las comparaciones de estas variables con estudios previos no ha sido posible.

En las mujeres con FM, el IMC está negativamente correlacionado con la función física, evaluada mediante el cuestionario general de salud SF-36[26] y el dolor[9,10]. Además, las mujeres con FM obesas presentan una mayor sensibilidad al dolor y una menor calidad de vida[27]. Además, en un reciente estudio, las pacientes de FM obesas han presentado menor cantidad y calidad del sueño, mayor fatiga y un perfil neuroendocrino alterado (niveles de catecolaminas, cortisol, proteína C reactiva e interleuquina-6)[11]. Otros estudios han observado una asociación entre IMC elevado y otras enfermedades dolorosas crónicas como dolor de espalda o cabeza[28] y un incremento general del dolor para todas las patologías[27]. Por todo ello, la reducción de peso, concretamente la prevención de la obesidad a través del ejercicio físico orientado y adaptado a esta población[29], así como cambios en la dieta de dichas pacientes[24], podría tener importantes consecuencias en la mejora de la calidad de vida de las mujeres que padecen esta enfermedad. Por este motivo, bajo nuestro punto de vista, son necesarios más estudios de intervención física y nutricional para establecer los posibles efectos beneficiosos del ejercicio físico y/o la dieta sobre la pérdida de peso en pacientes con FM y sus consecuencias directas sobre la sintomatología asociada a la enfermedad.

El presente estudio presenta una serie de limitaciones que cabría destacar: 1) la muestra no ha sido seleccionada de forma aleatorizada, el tamaño muestral se ha establecido de manera arbitraria y pertenecía en su totalidad a una asociación de enfermos de FM, por lo que pudiera presentarse sesgo de membresía; 2) no se ha contado con un grupo control de mujeres de idénticas características y zona geográfica, evaluadas exactamente con la misma metodología, y por último 3) la muestra ha estado limitada a la comunidad autónoma de Andalucía y a mujeres, siendo necesarios estudios donde la composición corporal de estos pacientes sea explorada en profundidad, tanto en otras áreas geográficas como en enfermos de FM.

Conclusiones

El presente trabajo aporta una detallada descripción de la composición corporal, basada en una medida fiable de la composición corporal, en un centenar de mujeres con FM. Los resultados sugieren que la obesidad es una condición frecuente entre mujeres con FM, siendo su prevalencia sustancialmente superior a los valores normativos nacionales.

El presente estudio viene a completar el conocimiento que se tiene sobre la enfermedad en un aspecto tan reseñable como es la composición corporal, que, además, viene influenciada por el contexto sociocultural, en este caso, el español. El estudio pone de manifiesto la necesidad de programas enfocados a la pérdida de peso en esta población.

Financiación

Este estudio fue financiado en parte gracias a becas del Ministerio de Educación y Ciencia (EX-2008-0641, AP-2006-03676) y Ciencia e Innovación (BES-2009-013442).

Agradecimientos

El desarrollo de este estudio no hubiera sido posible sin la generosa participación y colaboración de la Asociación de Enfermas de Fibromialgia de la Provincia de Granada (AGRAFIM).

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Fibromyalgia´s key symptoms in normal weight, overweight and obese female patients

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VI

Pain Management Nursing

In press

Original Article

Fibromyalgia's Key Symptoms in Normal-Weight, Overweight, and Obese Female Patients

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Received March 28, 2011; Revised June 1, 2011; Accepted June 2, 2011.

Supported in part by the Andalusia Institute of Sport, AGRAFIM, the Center of Initiatives for Cooperation and Development of the University of Granada (CICODE), and grants from the Spanish Ministry of Education (AP-2006-03676 and EX-2008-0641), Ministry of Science and Innovation (BES-2009-013442 and RYC-2010-05957), and the Swedish Heart-Lung Foundation (20090635).

1524-9042/$36.00

doi:10.1016/j.pmn.2011.06.002

■ Abstract:

Factors affecting the symptomatology of fibromyalgia (FM) are not fully understood. The aim of the present study was to analyze the relationship of weight status with pain, fatigue, and stiffness in Spanish female FM patients, with special focus on the differences between overweight and obese patients. The sample comprised 177 Spanish women with FM (51.3 ± 7.3 years old). We assessed tenderness (using pressure algometry), pain and vitality using the General Health Short-Form Survey (SF36), and pain, fatigue, morning tiredness, and stiffness using the Fibromyalgia Impact Questionnaire (FIQ). The international criteria for body mass index was used to classify the patients as normal weight, overweight, or obese. Thirty-two percent were normal-weight, 35% overweight, and 32% obese. Both overweight and obese patients had higher levels of pain than normal-weight patients, as assessed by FIQ and SF36 questionnaires and tender point count ($p < .01$). The same pattern was observed for algometer score, yet the differences were not significant. Both overweight and obese patients had higher levels of fatigue, and morning tiredness, and stiffness ($p < .05$) and less vitality than normal-weight patients. No significant differences were observed in any of the variables studied between overweight and obese patients. In conclusion, FM symptomatology in obese patients did not differ from overweight patients, whereas normal-weight patients significantly differed from overweight and obese patients in the studied symptoms. These findings suggest that keeping a healthy (normal) weight is not only associated with decreased risk for developing FM but might also be a relevant and useful way of improving FM symptomatology in women.

Fibromyalgia (FM) is a disorder characterized by the concurrent existence of chronic widespread musculoskeletal pain and multiple sites of tenderness (Wolfe, Smythe, Yunus, et al., 1990). The pathophysiology of FM includes

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a dysfunction of pain modulatory systems within the central nervous system and neuroendocrine dysfunction (Abeles, Pillinger, Solitar, & Abeles, 2007; Nielsen & Henriksson, 2007; Tanriverdi, Karaca, Unluhizarci, & Kelestimur, 2007). Among the FM symptoms, muscle pain, fatigue, stiffness, and nonrestorative sleep have been reported as the most relevant (Bennett, Jones, Turk, Russell, & Matallana, 2007; Silverman, Harnett, Zlateva, & Mardekian, 2010; Wilson, Robinson, & Turk, 2009; Wolfe et al., 1990).

In the general population, a high body mass index (BMI) is associated with back pain (Shiri, Solovieva, Husgafvel-Pursiainen, Taimela, Saarikoski, Huupponen, Viikari, Raitakari, & Viikari-Juntura, 2008; Lake, Power, & Cole, 2000), head pain as migraine (Bond, Roth, Nash, & Wing, 2010), and increased general pain (Janke, Collins, & Kozak, 2007). In a recent study, overweight and obese twins were more likely to report low back pain, tension-type or migraine headache, fibromyalgia, abdominal pain, and chronic widespread pain than normal-weight twins (Wright, Schur, Noonan, Ahumada, Buchwald, Buchwald, & Afari, 2010). Moreover, in the longitudinal Norwegian HUNT study (Mork, Vasseljen, & Nilsen, 2010), conducted on 15,990 women, overweight and obesity was associated with a 60%-70% higher risk of incident FM.

Overweight and obese FM patients have higher pain sensitivity (Janke, Collins, & Kozak, 2007; Neumann, Lerner, Glazer, Bolotin, Shefer, & Buskila, 2008; Yunus, Arslan, & Aldag, 2002), increased sensitivity to tender points palpation, reduced physical functioning and lower-body flexibility, shorter sleep duration, and greater restlessness during sleep than normal-weight FM patients (Mork et al., 2010; Okifuji, Bradshaw, & Olson, 2009; Okifuji, Donaldson, Barck, & Fine, 2010). Although a few studies have examined the differences in key symptoms across weight status categories (Neumann et al., 2008; Okifuji et al., 2009; Okifuji et al., 2010), it is unknown if there is a dose-response association between weight status and FM major symptoms, particularly whether obese FM patients have a worse symptomatology than overweight patients.

The aim of the present study was to compare pain, fatigue, and stiffness levels across weight status categories in Spanish female FM patients, with special focus on the differences between overweight and obese patients.

METHODS

Study Sample

We contacted an FM Association in Granada, Spain, with 440 members. One hundred ninety-free potentially eligible patients diagnosed as having FM by a rheumatologist following the American College of Rheumatology criteria (Wolfe et al., 1990) responded, and gave their written informed consents after receiving detailed information by the association about the aims and procedures of the study. Exclusion criteria for the data analysis were having other rheumatic diseases and/or severe somatic or psychiatric disorders, such as cancer, severe coronary disease, or schizophrenia, and not having a valid BMI measurement. The final study sample comprised 177 women aged 51.3 ± 7.3 years. The study was reviewed and approved by the Ethics Committee of the "Hospital Virgen de las Nieves" (Granada, Spain).

Procedures

Anthropometric Assessment. Height (cm) was measured using a stadiometer (Seca 22, Hamburg, Germany) and weight (kg) with an 8-polar tactile-electrode impedanciometer (InBody 720; Biospace, Seoul, Korea). The validity of this impedanciometer has been reported elsewhere (Malavolti, Mussi, Poli, et al., 2003; Sartorio, Malavolti, Agosti, et al., 2005). BMI was calculated as weight (kg) divided by height (m) squared. Patients were categorized according to the international criteria: underweight (<18.5 kg/m^2), normal weight (18.5-24.99 kg/m^2), overweight (25.0-29.99 kg/m^2), and obese (≥ 30.0 kg/m^2).

Pain Assessed by Four Different Indicators.

1. We used the Spanish version (Rivera & Gonzalez, 2004) of the Fibromyalgia Impact Questionnaire (FIQ) (Burckhardt, Clark, & Bennett, 1991) to assess FM-related symptoms. The FIQ assesses the components of health status that are believed to be most affected by FM. It is composed of ten subscales: physical impairment, overall well being, work missed, and seven subscales using a 10-cm-long visual analog scale (VAS) Q1 marked in 1-cm increments, on which the patient rates work difficulty, pain, fatigue, morning tiredness, stiffness, anxiety, and depression. The FIQ score ranges from 0 to 100, and a higher value indicates a higher impact of the disorder (Bennett, 2005). We used the FIQ-pain subscale to assess pain.

In the analysis of reliability and stability of the FIQ, correlation coefficients between test and retest were between 0.58 for VAS-anxiety and 0.83 for days of work missed. Internal consistency showed an alpha coefficient of 0.82 for the total items of the FIQ, 0.79 for the eight items not concerning work, and 0.86 for the nine items concerning physical impairment (Rivera et al., 2004).

2. The Short-Form Health Survey 36 (SF36) is a generic instrument for assessing health-related quality of life which has been validated for Spanish populations (Alonso, Prieto, & Anto, 1995). This questionnaire

is composed of 36 items, which include questions about both physical and mental health. It assesses eight subscales: physical functioning, physical role, bodily pain, general health, vitality, social functioning, emotional role, mental health, and general health. Each subscale score is standardized (range 0-100), where 0 indicates the worst possible health status and 100 the best possible. In the present study, we assessed pain by means of the SF36–bodily pain subscale.

In the analysis of reliability and stability of the SF36, correlation coefficients between test and retest were between 0.58 for SF36–emotional role to 0.99 for SF36–physical role. Internal consistency showed an alpha coefficient between 0.78 for SF36-vitality and 0.96 for SF36–physical role (Alonso et al., 1995).

3. A trained physiotherapist assessed the 18 tender points count according to the American College of Rheumatology (Wolfe et al., 1990) with a standard pressure algometer (FPK 20, Effegi, Italy). The pain threshold at each tender point was determined by applying increasing pressure, with the algometer perpendicular to the tissue, at a rate of ~1 kg/s. Patients were asked to say "stop" at the moment that pressure became painful. The mean of two successive measurements at each tender point was used for the analysis. A tender point scored as positive when the patient noted pain at pressure of ≤4 kg/cm^2. The total of such positive tender points was recorded as the individual's tender points count.
4. An algometer score was calculated as the sum of the pain-pressure values obtained for each tender point.

Fatigue and Stiffness. Fatigue levels were assessed by means of the FIQ-fatigue subscale, FIQ–morning tiredness subscale, and the SF36-vitality subscale. Higher scores in FIQ-fatigue or FIQ–morning tiredness indicate worse status and therefore more fatigue, whereas higher scores on SF36-vitality subscale indicate better status and therefore lower fatigue. Stiffness was assessed by means of the FIQ-stiffness subscale. Higher scores indicate more stiffness.

Statistical Analysis

All analyses were performed using the Statistical Package for Social Sciences (SPSS version 16.0 for Windows; SPSS, Chicago, IL), and the level of significance was set at .05. Partial correlation coefficients adjusted by age were used to examine the relationships of BMI with key FM symptoms. One-way analysis of covariance with adjustment by age was used to compare pain, fatigue, and stiffness across weight status categories. Pairwise comparisons were performed with Bonferroni adjustment.

RESULTS

Demographics and Sample Characteristics

Demographic and clinical characteristics of the study sample are presented in Table 1.

Physical characteristics of the study sample are presented in Table 2. Thirty-two percent of the FM patients were normal-weight, 35% were overweight, and 32% were obese. Only one patient was underweight, and was excluded from the analyses.

Body Mass Index and Symptomatology

Partial correlations between BMI and pain, fatigue, and stiffness are presented in Table 3. BMI showed a correlation with SF36-pain ($r = 0.243$; $p = .001$) and with FIQ-pain ($r = 0.169$; $p < .05$). BMI was not correlated with tenderness as measured by algometer score and tender points count. BMI was correlated with FIQ-fatigue ($r = 0.189$), FIQ–morning tiredness ($r = 0.176$), and FIQ-stiffness ($r = 0.170$; all $p < .05$), but not with SF36-vitality. In all the correlations, higher BMI was related to worse symptomatology (Table 3).

Table 1.
Demographic and Clinical Characteristics of the Study Sample

Variable	n	%
Years since clinical diagnosis		
≤5 years	65	52
>5 years	61	48
Marital status		
Married	94	73
Unmarried	13	10
Separated/divorced/widowed	21	16
Educational status		
Unfinished studies	10	8
Primary school	53	42
Secondary school	26	21
University degree	37	29
Occupational status		
Housewife	71	60
Student	2	2
Working	30	25
Unemployed	8	7
Retired	8	7
Income*		
≤1,200.00 €	51	42
1,201.00-1,800.00 €	20	17
>1,800.00 €	50	41
Fibromyalgia Impact Questionnaire, mean ± SD	67.4 ± 13.2	

*1,676.70 € was the average salary in Spain in 2007 (INE, 2009).

Table 2.
Physical Characteristics of the Study Sample

	Range	Mean (SD)
Age (y)	31-70	51.3 (7.3)
Height (cm)	139-178	157.3 (5.5)
Weight (kg)	43-118	69.8 (13.2)
Body mass index (kg/m^2)	18-46	28.2 (5.5)
Weight status*	**n**	**%**
Underweight	1	0.6
Normal weight	57	31.5
Overweight	62	34.3
Obese	57	31.3

*Underweight: BMI <18.5 kg/m^2; normal weight: BMI 18.5-24.99 kg/m^2; overweight: BMI 25.0-29.99 kg/m^2; obese; BMI ≥30.0 kg/m^2.

Weight Status and Pain

Figure 1 shows the differences in pain, as measured by four different indicators, across weight status categories. Both overweight and obese groups had higher levels of pain than their normal-weight peers, as assessed by FIQ, SF36, and tender points count ($p < .01$; $p < .001$; and $p < .05$; respectively). The same pattern was observed for algometer score, yet those differences were not significant. The analysis of single tender points showed that the main differences across weight status categories were observed in the occiput, second rib, and knee tender points (p values .03, .005, and 0.02, respectively; data not shown).

Weight Status, Fatigue, and Stiffness

The differences in fatigue (measured by FIQ-fatigue, FIQ–morning tiredness, and SF36-vitality subscales) and stiffness (measured by FIQ-stiffness) across weight status are shown in Figure 2. Both overweight and obese patients had higher levels of FIQ-fatigue and FIQ–morning tiredness and lower SF36-vitality ($p < .05$; $p < .01$; and $p < .05$; respectively). Overweight as well as obese patients also had higher levels of FIQ-stiffness ($p < .01$). No significant differences were observed between overweight and obese patients in any of the variables studied.

Table 3.
Partial Correlations Between Body Mass Index and Pain, Fatigue, and Physical Functioning

		Body Mass Index		
	Variable	**n**	**r***	**p**
Pain	Pain (SF36)	174	−0.243	.001
	Pain (FIQ)	165	0.169	.031
	Algometer score	127	−0.174	.108
	Tender points count	127	0.148	.181
Fatigue	Vitality (SF36)	174	−0.083	.278
	Morning tiredness (FIQ)	167	0.176	.023
	Fatigue (FIQ)	167	0.189	.015
Stiffness	Stiffness (FIQ)	167	0.170	.029

SF36, General Health Short-Form Survey; FIQ, Fibromyalgia Impact Questionnaire.

*Adjusted by age.

DISCUSSION

The results of the present study suggest that both overweight and obese FM patients have higher levels of pain (as measured by FIQ, SF36, and tender points count), fatigue (FIQ-fatigue, FIQ–morning tiredness, and SF36-vitality), and stiffness (FIQ-stiffness) than normal-weight patients. Interestingly, no significant differences were observed between overweight and obese patients in any of the FM symptoms studied, suggesting that only by keeping a normal weight are the benefits on FM symptomatology achieved. Of note is that the correlations between BMI and symptoms observed in the present study were weak, which is probably due to the fact that no significant differences were observed between overweight and obese subjects.

As mentioned above, ~70% of the sample studied was overweight or obese (~35 and ~32%, respectively). Despite this alarming figure, similar (Okifuji et al., 2009; Yunus et al., 2002) or even higher (Neumann et al., 2008; Okifuji et al., 2010) percentages have been observed in earlier studies conducted in female FM patients. Furthermore, among the general Spanish population, overweight and obesity prevalence in women of the same age and geographic area is extremely high (~43 and ~28%, respectively) (Aranceta-Bartrina, Serra-Majem, Foz-Sala, & Moreno-Esteban, 2005; Sotillo, Lopez-Jurado, Aranda, et al., 2007).

Weight Status and FM Key Symptoms

In the present study, both overweight and obese FM patients showed higher levels of pain, as assessed by different indicators, than normal-weight patients, which concurs with other studies (Okifuji et al., 2009; Okifuji et al., 2010; Yunus et al., 2002). Yunus et al. (2002) observed a higher tender points count in overweight/obese female FM patients. They also studied pain with the use of the FIQ and self-rated pain with a 4-point Likert-type question (from none = 1 to severe = 4) and observed no significant difference between normal-weight and overweight/obese patients. Okifuji et al. (2010) studied whether the tender points count differed across weight status categories in female FM patients. Those authors observed significant differences across the three groups (higher weight status was related to more pain), but no

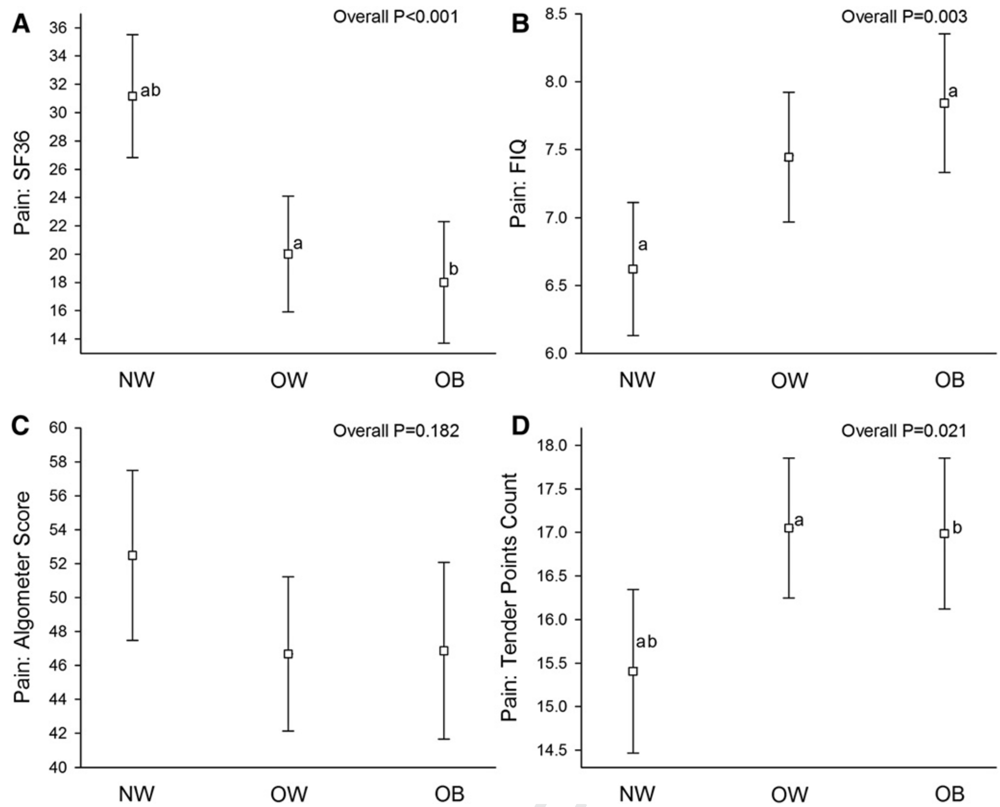

Figure 1. ■ Relationship between pain, as measured by four different indicators, and weight status. Values are shown as mean with 95% confidence interval. NW, normal weight (body mass index [BMI] 18.5-23.99 kg/m^2); OW, overweight (BMI 25.0-29.99 kg/m^2); OB, obese (BMI ≥30.0 kg/m^2); SF36, General Health Short-Form Survey; FIQ, Fibromyalgia Impact Questionnaire. ^{a,b}Common superscripts indicate a significant difference (p < .05). Pairwise comparisons were performed with Bonferroni adjustment. For SF36 and algometer score, lower scores indicate more pain.

pairwise comparisons were conducted. The authors additionally reported that the group differences were more pronounced in the lower body sites (i.e., gluteal, greater trochanter, and knee sites). We found both lower body (knee) and upper body (occiput, second rib) tender points to be different across weight status categories. Okifuji et al. (2010) also assessed pain by the FIQ and observed no significant difference across weight status groups, in agreement with Yunus et al. (2002) and in contrast with the present results. Neumann et al. (2008) observed a borderline relationship between weight status and tender points count in female FM patients, such that the higher the weight status, the higher the pain. However, those authors did not test between which groups (i.e., normal-weight, overweight, or obese) the differences were significant.

Two of the studies mentioned above additionally studied some indicators of fatigue and/or stiffness (Okifuji et al., 2010; Yunus et al., 2002). Yunus et al. (2002) did not observe differences across weight status groups in fatigue measured by the FIQ, but they observed higher levels of self-rated morning tiredness/fatigue in patients with higher weight status with the use of a 4-point Likert-type question. Okifuji et al. (2010) studied fatigue, morning tiredness, and stiffness by means of the FIQ and did not observe any difference across weight status groups, which does not concur with the present findings.

The mechanisms underlying the link between an excessive weight/fat mass and pain sensitivity are not fully understood. One of the possible mechanisms suggested might be related to the endogenous opioid system, that is involved in the regulation of mood and pain (McKendall & Haier, 1983) and has shown to be altered in obese Zucker rats (Roane & Porter, 1986). Obesity seems also to be linearly related to greater levels of inflammatory markers in FM patients, specifically interleukin-6 and C-reactive protein (Okifuji et al., 2009), which could play a role in hypothalamic-pituitary-adrenal axis regulation, increasing pain sensitivity (Kawasaki, Zhang, Cheng, & Ji, 2008; Okifuji et al., 2009). However, Hernandez et al. (2010) analyzed the BMI as a covariate of proinflammatory cytokines levels in FM patients and showed that serum

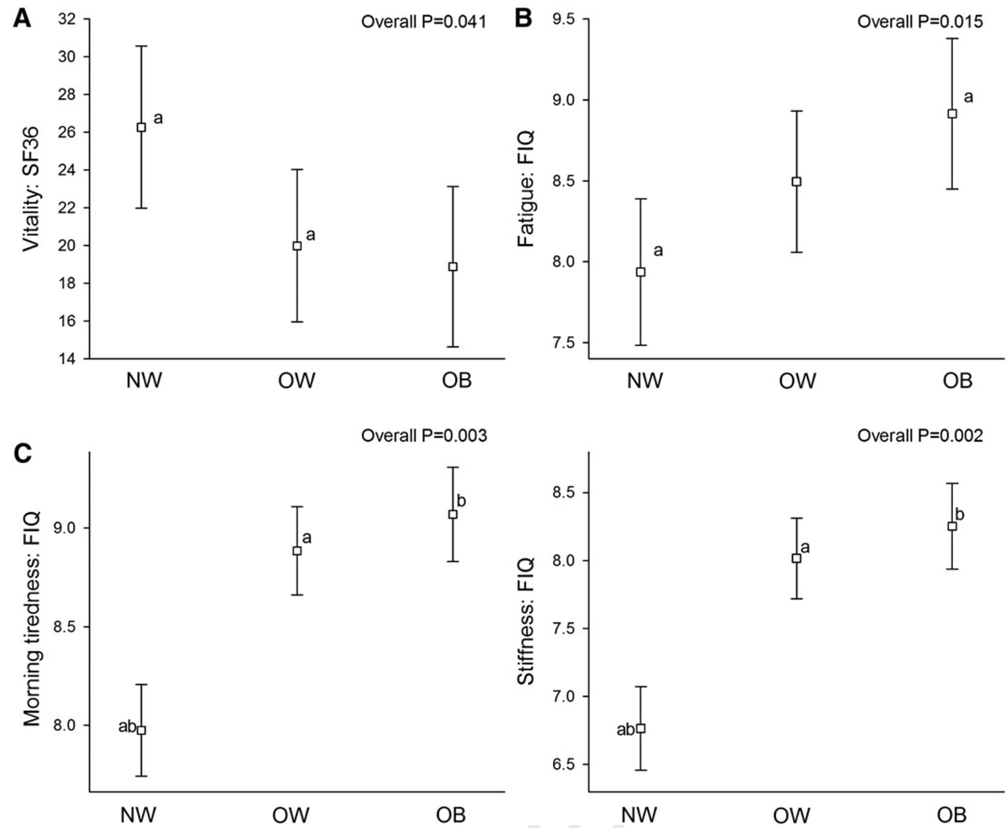

FIGURE 2. ■ Relationship between fatigue/stiffness and weight status. Values are shown as mean with 95% confidence interval. Abbreviations are as in Figure 1. [a,b]Common superscripts indicate a significant difference ($p < .05$). Pairwise comparisons were performed with Bonferroni adjustment.

tumor necrosis factor alpha and interleukin-6 levels were independent of BMI.

The levels of certain endocrine hormones, such as leptin and ghrelin, are related to changes in weight and overweight/obesity (Broberger, 2005). Circulating ghrelin levels negatively correlate with BMI, and ghrelin secretion is reduced in obese people (Tschop, Weyer, Tataranni, et al., 2001). Guneli et al. (2010) indicated that ghrelin could play a role in the obesity-pain relationship and could regulate other systems that are related to pain pathway. They suggested that a decrease in endogenous ghrelin activity might induce an increased pain sensitivity in obese subjects.

Poor physical conditioning, which is related to higher adiposity levels, has been considered as one of the potential contributors of pain sensitivity (Neumann et al., 2008; Okifuji et al., 2010), yet this association is probably bidirectional, whereas some physical and/or psychologic therapies, such as aquatic aerobic exercise (Gusi & Tomas-Carus, 2008), biodanza (Carbonell-Baeza, Aparicio, Martins-Pereira, et al., 2010), yoga (Carson, Carson, Jones, et al., 2010), and multidisciplinary interventions (Carbonell-Baeza, Aparicio, Ortega, et al., 2010), seem to reduce pain threshold in FM patients.

Weight loss has been shown to reduce musculoskeletal pain (Kotowski & Davis, 2010). One potential mechanism may be that a reduction of weight decreases the biomechanical stress on the load-bearing joints, reducing pain responses (Kotowski et al., 2010). Similarly, weight loss reduced headache frequency and severity in obese migraineurs (Bond et al., 2010). In the intervention reported by Shapiro et al. (2005), weight loss significantly predicted a reduction in FM-related symptoms, body satisfaction, and quality of life.

Clinical Implications

The present findings have important clinical implications. Particularly, pain management nurses should advise their patients to lose weight to reduce their FM's key symptoms.

Behavioral weight-loss programs, with diet changes (Arranz, Canela, & Rafecas, 2010; Shapiro et al., 2005) and involving exercise designed for and adapted to this specific population (Busch, Schachter, Overend, Peloso, & Barber, 2008), may positively influence FM symptoms and overall quality of life. Finally, women with chronic pain are at an increased risk for metabolic syndrome (Loevinger, Muller, Alonso, & Coe, 2007).

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The combination of a healthy diet together with increases in the physical activity level could improve FM symptoms at the same time that they could reduce metabolic syndrome by decreasing central obesity, dyslipidemia, hypertension, and glucose intolerance (Dragusha, Elezi, Dragusha, Gorani, & Begolli, 2010).

Strengths and Limitations

Some limitations of the prresent study need to be mentioned. First, information about sleep disturbances, a relevant symptom in FM, was not registered. Second, the study design was cross-sectional, so it is not possible to know the direction of the associations observed. It could be that the presence of more symptoms negatively influence lifestyle, e.g., reduced activity levels, increasing the risk of developing overweight/obesity; or it could be the other way around. Third, the participants were volunteers, which could have affected the representativeness of the study sample. Fourth, individually tailored medication used for FM symptomatology might have potentially affected the study findings. Fifth, physical activity levels of the patients was not registered. On the other hand, the equally distributed sample across weight status categories participating in this study and the pairwise comparison analyses between weight status groups provide new and relevant information and contribute to understand how adiposity relates to FM symptomatology.

CONCLUSIONS

The FM symptomatology in obese patients did not differ from overweight patients, whereas normal-weight patients had significantly fewer key symptoms than either overweight and obese patients, suggesting that keeping a healthy (normal) weight might be a relevant and useful way of improving FM symptomatology in women. Intervention studies focused on weight loss in overweight and obese FM patients will confirm or contrast the present findings. Further research is needed to clarify the mechanisms that link overweight/obesity and FM symptomatology. The measure of BMI and weight status might provide useful information to clinicians when assessing and interpreting the severity of the disease.

UNCITED REFERENCE

Instituto Nacional de Estadística, (2009).

Acknowledgements

The authors gratefully acknowledge all of the participants for their collaboration. The authors also acknowledge all of the AGRAFIM (the FM association from Granada, Spain) members involved in the field work for their efforts and great enthusiasm.

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Relationship of weight status with mental and physical health in female fibromyalgia patients.

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Obesity Facts

Second revision

VII

Relationship of weight status with mental and physical health in female fibromyalgia patients

Running head: Weight status and health in fibromyalgia

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ABSTRACT

Objetive: To analyze the association of weight status with anxiety, depression, quality of life and physical fitness in fibromyalgia (FM) patients.

Methods: The sample comprised 175 Spanish female FM patients (51.2±7 years). We assessed quality of life by means of the Short-Form-36 Health Survey (SF36) and anxiety and depression by means of the Hospital Anxiety and Depression Scale (HADS). We used standardized field-based fitness tests to assess cardiorespiratory fitness, muscular strength, flexibility, agility, and static and dynamic balance. BMI was calculated and categorized using the international criteria.

Results: A 33% of the sample was normal-weight, 35% overweight and 33% obese. HADS-anxiety and HADS-depression levels increased across weight status categories. Obese patients had higher anxiety and depression levels compared to normal-weight patients ($P<0.05$) whereas no differences were observed between overweight and obese.

Physical functioning, bodily pain, general health (all $P<0.01$) and mental health ($P<0.05$) subscales from the SF36 were worse across weight status categories. Likewise, levels of cardiorespiratory fitness, dynamic balance/motor agility (both $P<0.05$) and upper flexibility ($P<0.001$) decreased as weight status increased. Pairwise comparisons showed significant differences mainly between the normal-weight vs. obese groups.

Conclusions: Obese female FM patients displayed higher levels of anxiety and depression and worse quality of life, cardiorespiratory fitness, dynamic balance/motor agility and upper flexibility than their normal-weight peers.

Key words: weight status, anxiety, depression, physical fitness, quality of life, fibromyalgia, women.

INTRODUCTION

Fibromyalgia (FM), a disorder characterized by the concurrent existence of chronic, widespread musculoskeletal pain and multiple sites of tenderness [1], has an enormous impact on the patients' health-related quality of life, since it limits activities of daily life such as walking, lifting and transporting objects [2]. Fibromyalgia has been found to be strongly associated with depressive and anxiety symptoms, a personal or family history of depression, and accompanying antidepressant treatment [3]. Physical fitness is decreased in FM patients compared to age-matched healthy peers [4], and is similar to healthy older adults [4].

Overweight and obese FM patients appear to present a higher pain sensibility [5], increased sensitivity to tender points palpation, reduced physical function, lower-body flexibility, shorter sleep duration, and greater restlessness during sleep [6]. Findings from the longitudinal HUNT study [7], showed an increased risk of incidence of FM in overweight/obese women compared to normal-weight women, especially among women who also reported low levels of physical activity. Furthermore, a twin study reported that overweight and obese twins were more likely to have FM than normal-weight twins [8].

In the general population, raised BMI has been associated with increased risk for depression as well as psychiatric disorders [9]. However, this association needs further research in people with FM; in fact the mechanisms underlying the link between an excessive weight/fat mass and FM are not fully understood. For instance, the endogenous opioid system, that is involved in the regulation of mood and pain [10] has shown to be altered in obese Zucker rats [11] as well as in FM patients [12]. Obesity also seems to be associated with greater levels of inflammatory markers in FM patients, specifically Interleukin-6 and C-reactive protein [13], which could play a role in hypothalamic–pituitary–adrenal axis regulation, altering pain sensitivity and mood [13]. The levels of certain endocrine hormones, such as leptin and ghrelin, are related to changes in weight and overweight/obesity [14]. Circulating ghrelin levels negatively correlate with BMI, and ghrelin secretion is reduced in obese people and also in women with FM. It has been suggested that ghrelin could play a role in obesity-pain relationship [15-16]. The differences in fitness, as a health indicator [17], between weight status groups in FM patients also requires further research. Okifuji et al. [6] studied the association of weight status with several physical fitness tests, however, they did not conduct pair-wise comparisons (i.e. between normal-weight vs. overweight, and overweight vs. obese).

The aim of the present study was to examine the association of weight status with anxiety, depression, quality of life and physical fitness levels in Spanish female FM patients.

MATERIAL AND METHODS

Patients

The study sample comprised 175 women from a Local Association of FM (Granada, Spain), diagnosed as having FM by a rheumatologist following the American College of Rheumatology criteria [1]. The mean age of the sample was 51.2±7.1 years and thus, close to the mean age of the global and Spanish prevalence of the FM [1,18]. All patients were informed about the study and signed a written informed consent to participate. Inclusion criteria were not to have other rheumatic diseases. All patients were assessed by the same researcher´s group to reduce interexaminer error and the study was reviewed and approved by the Ethics Committee of the "Hospital Virgen de las Nieves" (Granada, Spain).

Material and procedures

Height (cm) was measured using a stadiometer (Seca 22, Hamburg, Germany) and weight (kg) with a scale (InBody 720, Biospace, Seoul, Korea). Body mass index (BMI) was calculated as weight (in kilograms) divided by height (in meters) squared and categorized using the international criteria: underweight (<18.5 kg/m^2), normal-weight (18.5-24.99 kg/m^2), overweight (25.0-29.99 kg/m^2) and obese (≥30.0 kg/m^2).

Most of the study field-based fitness tests were part of the *Functional Senior Fitness Test* battery [19]. This test battery is relatively easy to administer and score, it is safe, and requires minimal equipment and space [19]. Additionally, we also measured the handgrip strength, back saver sit-and-reach and blind flamingo tests. The physical fitness tests studied were:

Cardiorespiratory fitness. It was assessed by the "6-minutes walking" test. This test involves determining the maximum distance (meters) that can be walked in 6 min along a 45.7 meters rectangular course [19]. Heart rate was measured during the test with a heart rate monitor (4 SW. Kempele, Finland), and the heart rate at the end of the test was selected for the analysis.

Upper-body muscular strength: It was assessed measuring the handgrip strength using a hand dynamometer with adjustable grip (TKK 5101 Grip D; Takey, Tokio Japan). Optimal grip span was calculated using the formula suggested by Ruiz et al [20]: $y = x/5 + 1.5$ in women; "x" being the hand size, and "y" the grip length. Each person performed two attempts with each hand, with the arm fully extended, forming an angle of 30° with respect to the trunk. The maximum score in kilograms for each hand was recorded and the mean score of left and right hand was used in the analyses.

Lower-body muscular strength. It was assessed by the "30-s chair stand" test, which involves counting the times within 30 seconds that an individual can rise to a full stand from a seated position with back straight and feet flat on the floor, without assistance from the arms. The subjects performed 1 trial after familiarization [19].

Upper-body flexibility. It was assessed by the "back scratch" test, a measure of overall shoulder range of motion that involves measuring the distance between (or overlap of) the middle fingers behind the back with a ruler [19]. This test was assessed twice, alternately with both hands, and the best value was registered. The average of both hands was used in the analysis.

Lower-body flexibility. It was assessed by the "chair sit-and-reach" test. The person, seated with one leg extended, slowly bends forward sliding the hands down the extended leg in an attempt to touch (or pass) the toes. The number of centimetres short of reaching the toe (negative score) or reaching beyond it (positive score) was recorded [19]. Two trials with each leg were measured and the best value of each leg was registered, the average of both legs was used in the analysis.

Static balance. It was assessed with the "blind flamingo" test [21]. The number of trials needed to complete 30 seconds blindfolded in static position on one leg is recorded, and the chronometer is stopped whenever the person does not comply with the protocol conditions. One trial was performed for each leg and the average of both values was selected for the analysis.

Motor agility/dynamic balance. It was assessed with the "8-feet up & go" test. This test involves standing up from a chair, walking 8 feet (2.44 meters) to and around a cone, and returning to the chair in the shortest possible time [19]. The best time of two trials in seconds was recorded and used in the analysis.

The Spanish version of the *Short-Form-36 Health Survey* (SF36) [22] was used to assess quality of life. This questionnaire is composed of 36 items, grouped into eight scales assessing eight dimensions: physical functioning, physical role, bodily pain, general health, vitality, social functioning, emotional role, mental health and general health. Each subscale score is standardized and ranges from 0±100, where 0 indicates the worst possible health status and 100 the best possible. The test-retest reliability and internal consistency of this questionnaire has been studied [23]. Correlation coefficients between the test and retest were between 0.58 for SF36-emotional role subscale to 0.99 for SF36-physical role. Internal consistency showed Cronbach's alpha coefficients between 0.78 for SF36-vitality subscale to 0.96 for SF36-physical role subscale.

The Spanish version [24] of the *Fibromyalgia Impact Questionnaire* (FIQ) was used to assess FM severity. The FIQ assesses the components of health status that are believed to be most affected by FM. The FIQ total score ranges from 0 to 100 and a higher value indicates a greater impact of the disorder [25]. According to Bennet et al. [25] patients can be considered as having moderate FM if their score in the FIQ is below 70 and as having severe FM if the FIQ is higher or equal to 70. Correlation coefficients between the test and retest were between 0.58 for VAS-anxiety to 0.83 for work days missed. Internal consistency showed Cronbach's alpha coefficients of 0.82 for the total items of the FIQ; alpha=0.79 for the 8 items, excluding the 2 work-related items, and alpha=0.86 for the 9 sub-items of the physical impairment [24].

Anxiety and depression was assessed by means of the Spanish version of the *Hospital Anxiety and Depression Scale* (HADS) [26]. The HADS is divided into an Anxiety subscale (HADS-Anxiety) and a Depression subscale (HADS-Depression) both containing seven intermingled items. HADS has been found to perform well in assessing the symptom severity and presence of anxiety disorders and depression in both somatic, psychiatric and primary care patients and in the general population [27]. The HADS contains 14 statements, ranging from 0 to 3 in which a higher score indicates a higher degree of distress. The scores comprise 2 subscales: anxiety (0–21) and depression (0–21) [28]. The Spanish version of the HADS test-retest reliability presented correlation coefficients above 0.85. The internal consistency was high, with Cronbach's alphas coefficients of 0.86 for both anxiety and depression [26].

Statistical analysis

All analyses were performed using the Statistical Package for Social Sciences (SPSS, version 16.0 for Windows; SPSS Inc., Chicago, IL), and the level of significance was set at $P<0.05$. The association between weight status and the study outcomes was examined by one-way analysis of covariance (ANCOVA) after adjusting for age. The overall P value is that reported for the main effects of the fixed factor (i.e. weight status) as provided by the one-way analysis of covariance (ANCOVA) after adjusting for age. A significant P value indicates there are differences at least between two of the weight status groups. When significant, pairwise comparisons with Bonferroni's adjustment were performed to keep the experiment wise error rate to $\alpha=0.05$ and to identify between which groups the differences were significant (e.g. normal-weight vs. obesity).

RESULTS

Seventy percent of the patients were postmenopausal. The majority of the participants were married (73%). Sixty percent were housewives, 25% working, 7% retired, 7% unemployed and 2% students. The mean age of the sample was 51.2±7.1 years, with a height of 157.3±5.5 cm, a weight of 69.8±13.2 kg and a BMI of 28.2±5.5 kg/m^2. Thirty-three percent of the patients were normal-weight (n=57), 35% were overweight (n=61), and 33% were obese (n=57). The mean FIQ total score was 67.4±13.2.

Figure 1 shows the association of weight status and anxiety and depression. Levels of HADS-anxiety and HADS-depression increased across weight status categories, being significantly worse in obese compared to normal-weight FM patients (both $P<0.05$). No differences were observed between overweight and obese groups or between normal-weight and overweight.

Table 1 shows quality of life, as measured by SF36, across weight status categories. Physical functioning, bodily pain, general health (all $P<0.01$) and mental health ($P<0.05$) were worse among the higher weight status categories. Pairwise comparisons showed worse physical functioning in overweight compared to normal-weight group and in obese compared to overweight group. Mental health was worse in obese compared to normal-weight patients. Bodily pain and general health were worse in overweight and obese groups compared to normal-weight group.

Table 2 shows physical fitness indicators by weight status categories. Cardiorespiratory fitness, was worse in obese compared to normal-weight patients (both $P<0.05$). Dynamic balance/motor agility was worse as weight status increased ($P<0.05$) but no pairwise differences between groups were observed after

Bonferroni's adjustment. Upper flexibility was worse in overweight and obese groups compared to the normal-weight group (P<0.001). Finally, static balance showed a borderline significant difference (P=0.056), being worse in obese compared with normal-weight patients.

DISCUSSION

The present study suggests that obese female FM patients have higher levels of anxiety and depression and worse quality of life, cardiorespiratory fitness, dynamic balance/motor agility and flexibility than their normal-weight peers. The study sample was equally distributed among weight status categories, i.e. one third of the female patients was normal-weight, another third was overweight and the remaining third was obese. These data therefore provide a good opportunity to make proper comparisons between different weight status.

Our results do not concur with those reported by Yunus et al. [29]. They examined the differences in anxiety and depression between normal-weight vs. overweight/obese female FM patients and observed no differences between groups. This may be due to the different method used to assess anxiety and depression (they used the State and Trait Anxiety Inventory (STAI-1, STAI-2), the Zung Self Rating Depression Scale (ZSDS) and a 4-point Likert-type questions (from none=1 to severe=4 anxiety and depression).

Neumann et al. [5] examined the association between weight status and quality of life in FM patients. They found a relationship between BMI and a single value of quality of life computed from all the SF36 subscales (r= -0.205; P=0.044) but they observed no differences across weight status groups. Furthermore, they did not analyze the pairwise differences between groups (i.e. normal-weight, overweight or obese) and thus, we cannot compare quality of life differences between weight status categories.

To the best of our knowledge, the study of Okifuji et al. [6] is the only one examining the association between weight status and physical fitness in FM patients. In contrast with our results, the authors observed reduced flexibility in the lower body areas, as well as reduced strengths in general, whereas we observed reduced upper-body flexibility but not lower-body flexibility or strength [6]. It is important to note that we have observed differences in cardiorespiratory fitness (as assessed by the distance in the 6-min walking test) between normal-weight and obese patients whereas the Okifuji et al. [6] study failed to find such difference.

In the general population, relative increases in maximal cardiorespiratory fitness and habitual physical activity have been associated with lower depressive symptomatology and greater emotional well-being [30]. In FM patients, poor physical conditioning has been considered as one of the potential contributors to pain sensitivity [5-6]. In addition, multidisciplinary interventions may improve physical fitness and quality of life in FM patients [31]. Weight loss appears correlate to a reduction in FM-related symptoms, body satisfaction, and quality of life [32]. Behavioral weight-loss programs, with changes in the diet [32] and involving exercise designed and adapted to this specific population [31] may positively influence FM patients cardiorespiratory fitness, anxiety and depression levels and overall quality of life.

Some limitations need to be mentioned. First, we have not analyzed differences regarding to obesity grades (1, 2 or 3) due to the small number of participants falling into these sub-groups. Second, due to the study design (cross-sectional) we cannot know the direction of the associations observed. Third, the present study was carried out only in women, future studies should replicated this study in men with FM. Fourth, the study was only based on a group of FM patients and future studies should also include comparison groups without FM.

CONCLUSION

Obesity seems to be related with higher anxiety and depression levels, worse quality of life, cardiorespiratory fitness, dynamic balance/motor agility and flexibility in female FM patients. Intervention studies will confirm or contrast these findings. Intervention studies are needed to show whether a weight reduction intervention in female FM patients induces a better anxiety and depression profile, as well as an improved quality of life and fitness.

Acknowledgments

The authors gratefully acknowledge all the AGRAFIM (FM association from Granada, Spain) members involved in the field work for their effort and great enthusiasm. We also acknowledge Barry Wolahan for language revision.

This study was in part financially supported by grants from the Spanish Ministry of Education (AP-2006-03676 and EX-2008-0641), Ministry of Science and Innovation (BES-2009-013442 and RYC-2010-05957), and the Swedish Council for Working Life and Social Research (FAS).

Competing interests

The authors declare that they have no competing interests.

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Table 1. Quality of life in fibromyalgia patients by weight status groups after adjustment for age.

Quality of life	**Normal-weight (N=57)** Mean (SD)	**Overweight (N=61)** Mean (SD)	**Obese (N=57)** Mean (SD)	**P**
SF36				
Physical functioning	45.27 (3.04)[a]	39.24 (2.65)[b]	28.14 (2.88)[ab]	<0.001
Emotional Role	44.25 (7.10)	26.09 (6.20)	32.36 (6.72)	0.170
Physical role	8.78 (3.00)	5.99 (2.63)	0.58 (2.85)	0.136
Vitality	26.19 (2.61)	20.83 (2.27)	18.83 (2.47)	0.121
Mental Health	54.31 (3.33)[a]	47.05 (2.90)	41.79 (3.14)[a]	0.029
Social functioning	48.29 (3.94)	43.85 (3.43)	42.83 (3.72)	0.580
Bodily pain	31.64 (2.66)[ab]	21.22 (2.32)[a]	18.18 (2.52)[b]	0.001
General Health	36.69 (2.49)[ab]	28.45 (2.17)[a]	25.86 (2.36)[b]	0.007

SD, standard error. SF36, Short-Form-36 Health Survey. # Lower scores indicate better performance. [a,b] Common superscripts in a same raw indicate a significant difference ($P<0.05$) between the groups with the same letter. Pairwise comparisons were performed with Bonferroni's adjustment.

Table 2. Physical fitness in fibromyalgia patients by weight status groups after adjustment for age.

Fitness Component		**Test**	**Normal-weight (N=57)** Mean (SD)	**Overweight (N=61)** Mean (SD)	**Obese (N=57)** Mean (SD)	**P**
Cardiorespiratory fitness		6-min walking (m)	483.3 (13.2)[a]	450.6 (11.2)	428.1 (12.0)[a]	0.011
Muscular fitness	Upper body	Handgrip strength (kg)	19.63 (0.87)	17.22 (0.82)	17.50 (0.85)	0.107
	Lower body	30-s chair stand (no. stands)	8.06 (0.50)	7.26 (0.42)	6.66 (0.44)	0.121
Flexibility	Upper body	Back scratch (cm)	0.27 (1.96)[ab]	-11.66 (1.67)[a]	-15.83 (1.83)[b]	<0.001
	Lower body	Chair sit-and-reach (cm)	-6.79 (2.43)	-10.43 (2.05)	-11.72 (2.21)	0.321
Balance	Static	30-s blind flamingo # (failures)	8.57 (0.92)	10.57 (0.87)	11.73 (0.90)	0.056
	Dynamic /agility	8-feet up&go # (s)	7.41 (0.38)	8.56 (0.33)	8.64 (0.35)	0.040

SD, standard error. # Lower scores indicate better performance. [a,b] Common superscripts in a same raw indicate a significant difference (P<0.05) between the groups with the same letter. Pairwise comparisons were performed with Bonferroni's adjustment.

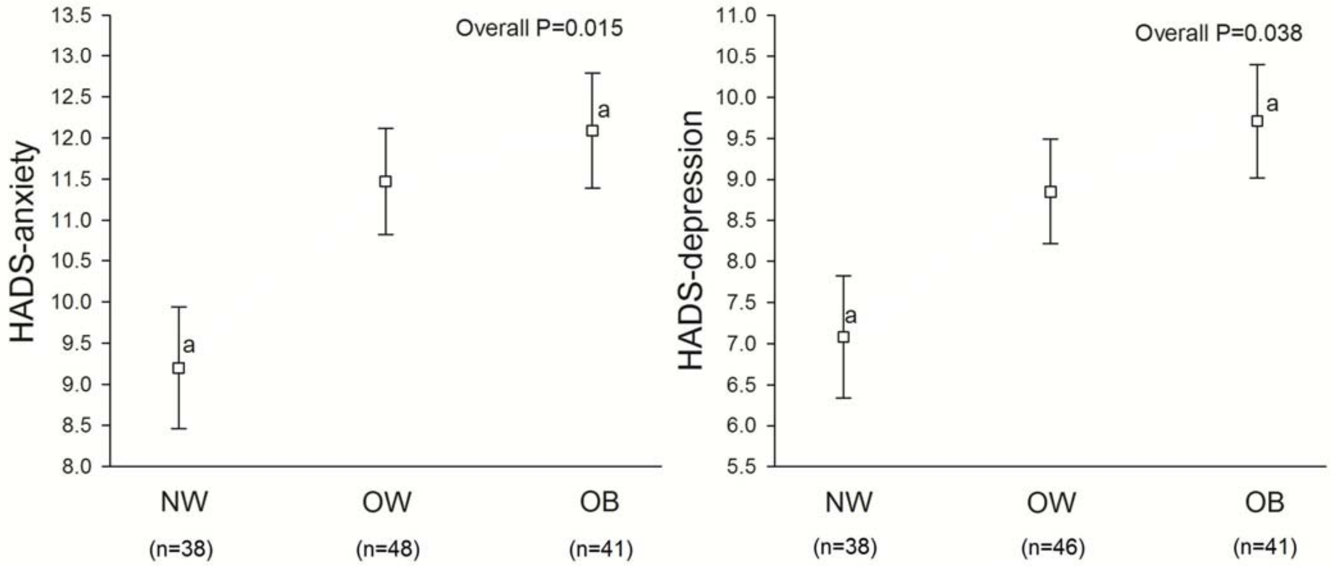

Figure 1. Anxiety and depression levels in fibromyalgia patients by weight status groups after adjustment for age.

Values expressed as mean (standard error). HADS, Hospital Anxiety and Depression Scale. NW, normal-weight; OW, overweight; OB, obese. [a] Common superscript indicates a significant (P<0.05) difference between the groups with the same letter. Pairwise comparisons were performed with Bonferroni's adjustment.

3. PAIN AND FIBROMYALGIA

(Papers VIII and IX)

Anxiety, depression and fibromyalgia pain and severity in women

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Submitted

VIII

Anxiety, depression and fibromyalgia pain and severity in women

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Number of tables: 3

Number of figures: 0

Word count: 3557

Running tittle: Anxiety, depression and fibromyalgia pain and severity.

ABSTRACT

Context: Data regarding the impact of anxiety and depression on fibromyalgia are still scarce. **Objetives:** To analyze the relationship of anxiety and depression with FM pain and severity. **Methods:** The study sample comprised 127 women aged 51.9±7 years. Anxiety and depression was assessed by means of the Hospital Anxiety and Depression Scale (HADS). Quality of life was measured with the Short-Form-36 Health Survey (SF36) and FM severity with the Fibromyalgia Impact Questionnaire (FIQ). Pain was assessed by four indicators: tenderness (tender points count (TPC) and algometer score) and SF36-pain and FIQ-pain subscales. **Results:** Perceived pain, as measured by SF36-pain, differed across anxiety and depression categories ($P<0.01$ and $P<0.05$, respectively). SF36-pain scores were worse in the severe anxiety-group compared with the low and mild anxiety-groups (12.1±3.4 vs 27.0±2.9 and 27.9±3.1, respectively, both $P<0.05$). Likewise, SF36-pain scores were lower in the severe compared with the low depression-group (7.5±5.4 vs 25.9±2.2, respectively, $P<0.05$). Perceived pain, as measured by FIQ, was higher for the severe compared to the low anxiety-group (8.1±0.4 vs 6.6±0.3, respectively, $P<0.05$) whereas no differences were found in FIQ-pain, algometer score and TPC. HADS-anxiety scores ≥8 were associated with an increased odds ratio (OR) of severe FM (OR=4.98; 95% CI:2.03–12.21 and OR=1.87; 95% CI:0.80-4.43 for FIQ≥59 and FIQ≥70, respectively). Likewise, HADS-depression scores ≥8 were associated with severe FM (OR=4.95; 95% CI:2.02–12.10, and OR=3.11; 95% CI:1.45-6.66 for FIQ≥59 and FIQ≥70, respectively). **Conclusion:** Women with higher levels of anxiety and depression present increased risk of severe FM.

Key words: fibromyalgia, anxiety, depression, perceived pain, tenderness, women.

INTRODUCTION

Chronic pain is often associated with comorbidities such as anxiety and depression, resulting in a low health-related quality of life.[1-4] Fibromyalgia (FM) has been found to be strongly associated with depressive and anxiety symptoms, a personal or family history of depression, and accompanying antidepressant treatment.[5] Many individuals with FM also have comorbid psychiatric disorders, which can present diagnostic dilemmas and require additional treatment considerations to optimize patient outcomes.[2] Furthermore, Gormsen et al.[6] observed that patients with FM have more psychological symptoms such as depression and anxiety than patients with neuropatic pain. Moreover, associations between pain intensity and mood phenomena were only found in FM patients. On the other hand, Jensen et al.[7] observed that negative mood in FM patients can lead to a poor perception of one's physical health (and vice-versa) but do not influence the performance in clinical and experimental pain assessments.

Despite relevant evidence of physical illness promoting FM syndrome, some authors claim that it is a psychological disorder, or due to "psychological amplification". More evidence for such views is lacking. The physical distress of FM syndrome can increase both anxiety and depression. Current imaging studies support the view that central effects connected with FM syndrome relate to the processing of noxious stimulation more than affective disorder.[8]

Although there are several studies investigating the relationship between depressive disorders and symptoms of FM, data regarding the impact of anxiety and depression on perceived pain and tenderness in FM patients are still scarce. The aim of the present study was to analyze the relationship of anxiety and depression with FM perceived pain (as measured by questionnaires) and tenderness (measured by tender points count and algometer score) and FM severity in women.

MATERIAL AND METHODS

Patients

The study sample comprised 127 women aged 51.3±7.3 years diagnosed as having FM by a rheumatologist following the American College of Rheumatology criteria.[1] All patients were informed about the study and signed a written informed consent to participate. Inclusion criteria for the data analysis were not to have other rheumatic diseases and/or severe disorders such as cancer, severe coronary disease, or schizophrenia, and to have valid data in the *Hospital Anxiety and Depression Scale* (HADS).[9] The study was reviewed and approved by the Ethics Committee of the "Hospital Virgen de las Nieves" (Granada, Spain).

Material and procedures

Anthropometric assessment

Height (cm) was measured using a stadiometer (Seca 22, Hamburg, Germany) and weight (kg) with a scale (InBody 720, Biospace, Seoul, Korea). Body mass index (BMI) was calculated as weight (in kilograms) divided by height squared (in meters) and categorized using the international criteria: underweight (<18.5 kg/m^2), normal weight (18.5-24.99 kg/m^2), overweight (25.0-29.99 kg/m^2) and obese (≥30.0 kg/m^2).

Anxiety and depression

We assessed anxiety and depression by means of the HADS.[9] The HADS was developed by Zigmond and Snaith[10] in 1983 to identify caseness (possible and probable) of anxiety disorders and depression among patients in non-psychiatric hospital clinics. It was divided into an Anxiety subscale (HADS-Anxiety) and a

Depression subscale (HADS-Depression) both containing seven intermingled items. HADS has been found to perform well in assessing the symptom severity and caseness of anxiety disorders and depression in both somatic, psychiatric and primary care patients and in the general population.[11]

The HADS contains 14 statements, ranging from 0 to 3 in which a higher score indicates a higher degree of distress. The scores build 2 subscales: anxiety (0–21) and depression (0–21).[10] Interpretation of the HADS is based primarily on the use of cut-off scores, although there is no generally accepted cut-off to define anxiety or depression.[11] Some authors recommend that scores of between 8 and 10 identify mild cases, 11–15 moderate cases, and 16 or above, severe cases.[12] In most studies, an optimal balance between sensitivity and specificity was achieved with a score of 8 or higher on both HADS-Anxiety and HADS-Depression.[10-11, 13] In the present study we have used both types of cut-off scores as appropriated.

Quality of life

The Spanish version of the *Short-Form-36 Health Survey* (SF36)[14] was used to assess health-related quality of life. The SF36 is composed of 36 items, grouped into eight scales, which include both physical and mental health, assessing eight dimensions: physical functioning, physical role, bodily pain, general health, vitality, social functioning, emotional role, mental health and general health. Each subscale score is standardized and ranges from 0 to 100, where 0 indicates the worst possible health status and 100 the best possible. The scores represent the percentage of the total possible score achieved.[15]

Fibromyalgia severity

We used the Spanish version[16] of the *Fibromyalgia Impact Questionnaire* (FIQ)[17] to assess FM severity. FIQ assesses the components of health status that are believed to be most affected by FM. It is composed of ten subscales: physical impairment, overall well being, work missed and a seven items of a visual analogy scale (VAS) marked in 1-cm increments on which the patient rates the job difficulty, pain, fatigue, morning tiredness, stiffness, anxiety and depression. The FIQ total score ranges from 0 to 100 and a higher value indicates a greater impact of the disorder.[18] Patients were categorized as having moderate or severe FM according to the FIQ cut-offs proposed by Bennet [18] and Bennet et al. [19]: FIQ <70 vs. ≥70, for moderate and severe FM, respectively; and FIQ <59 vs. ≥59 for moderate and severe FM, respectively. Patients were further categorized following the FIQ-based classification of FM-type I and FM-type II described by Souza et al..[20] Souza et al. suggested that both pain and stiffness were universal FM symptoms, but that psychological distress was a feature present only in some patients. Accordingly, they established a new FIQ-based classification of FM type I, characterized by lower levels of anxiety, depressive and morning tiredness symptoms, and FM type II, characterized by elevated levels of pain, fatigue, morning tiredness, stiffness, anxiety and depressive symptoms.

Pain: assessed by two different indicators

1) Questionnaires: We used the *FIQ-pain* dimension (from de VAS ranged 0 to 10) and the *SF36-bodily pain* subscale to assess perceived pain.

2) Tenderness: We assessed 18 tender points according to the American College of Rheumatology criteria for classification of FM.[1] A standard pressure algometer (EFFEGI, FPK 20, Alfonsine, Italy) was used to measure tender point count. The pain threshold at each tender point was determined by applying increasing pressure with the algometer perpendicular to the tissue, at a rate of ~1 kg/s. Patients were asked to say 'stop' at the moment pressure became painful. 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 of 4 kg/cm^2 or less. The total of such positive tender points was recorded as the individual's *tender point count*. An *algometer score* was calculated as the sum of the pain-pressure values obtained for each tender point. This examination was conducted by a trained physiotherapist.

Statistical analysis

One-way analysis of covariance (ANCOVA) with adjustment by age and BMI was used to compare pain across HADS-anxiety and HADS-depression status categories. Pairwise comparisons were performed with Bonferroni's adjustment. Binary logistic regression after adjustment for age and BMI was used to further study the relationship of high HADS-anxiety and high HADS-depression with FM severity (FIQ≥59 or FIQ≥70) and Type II FM. All analyses were conducted using SPSS version 16.0 for Windows (SPSS, Chicago, IL). The level of significance was set at $P<0.05$.

RESULTS

The demographic and clinical characteristics of the study sample were the following (data not shown): 48% patients had been diagnosed five or less years ago and 52% had been diagnosed of FM more than 5 years ago. Seventy percent were postmenopausal. The majority of the participants were married (73%). Eight percent of the sample had unfinished studies, 42% finished primary school, 21% secondary school and 29% had a University degree. Sixty percent were employed at home (housewife), 25% working, 7% retired, 7% unemployed and 2% were students.

Physical and psychological characteristics of the study sample are shown in **Table 1**. We analyzed the differences in perceived pain, as measured by FIQ and SF36 questionnaires and tenderness (algometer score and tender points count) across the three categories of HADS-anxiety and HADS-depression status proposed by Snaith and Zigmond [12]. We additionally included the cut-off of HADS-anxiety and HADS-depression ≤8 proposed by several authors [10-11, 13] (**Table 2**). Perceived pain, as measured by SF36-pain, differed across anxiety and depression categories (P<0.01 and P<0.05, respectively). SF36-pain scores were significantly worse in the severe anxiety-group compared with the low and mild anxiety-groups (12.1±3.4 vs 27.0±2.9 and 27.9±3.1, respectively, both P<0.05). Likewise, SF36-pain scores were lower in the depression-severe group compared with the low group (7.5±5.4 vs 25.9±2.2, respectively, P<0.05). There were also differences in perceived pain, as measured by FIQ, between severe and low anxiety-group (8.1±0.4 vs 6.6±0.3, respectively, P<0.05). There were no significant differences on FIQ-pain, algometer score and tender points count across HADS-depression and HADS-anxiety categories.

Logistic binary regression analysis adjusted by age and BMI was used to analyze the relationship between higher levels of anxiety and depression (HADS ≥8) and severe FM (FIQ≥59 or FIQ≥70) and type II FM (**Table 3**). HADS-anxiety scores ≥8 were associated with an increased odds ratio (OR) of severe FM (OR=4.98; 95% CI:2.03–12.21 and OR=1.87; 95% CI:0.80-4.43 for FIQ≥59 and FIQ≥70, respectively), and an increase OR of type II FM (OR=8.62; 95% CI:3.23-23.03). Likewise, HADS-depression scores ≥8 were associated with severe FM (OR=4.95; 95% CI:2.02–12.10, and OR=3.11; 95% CI:1.45-6.66 for FIQ≥59 and FIQ≥70, respectively) and Type II FM (OR=12.69; 95% CI:4.14-38.90).

DISCUSSION

The present study shows that high levels of anxiety and depression are associated with higher perceived pain (as measured by questionnaires) but not with higher tenderness (measured by tender points count and algometer score) in women with FM. HADS-anxiety and HADS-depression scores ≥8 are associated with increased ORs of severe FM and Type II FM, which refers to elevated levels of pain, fatigue, morning tiredness, stiffness, anxiety and depressive symptoms.

Fibromyalgia patients have more psychological distress including depression and anxiety than healthy controls.[6] In our study, mean values of depression and anxiety were not pathological (HADS-anxiety and HADS-depression scores higher to 16), as well as has been reported in other similar studies.[6-7] However, to note is that in the study of Aguglia et al.[21] the 83% of the FM patients had clinically significant depressive symptoms.

We have observed a relationship between anxiety and perceived pain, as measured by VAS and SF36-pain scores whereas in the study of Jensen et al.[7] anxiety symptoms did not correlate with clinical pain or experimental pain ratings. FM patients tend to report more stressful life events than controls.[22] Stisi et al.[22] observed that this phenomena was due to the tendency of FM patients to rate more severely mild stressful events. Therefore, they concluded that the particularly high number of events in their patients might be due to increased perception of stress.

The relationship between depressive symptoms and pain in FM patients has been further explored in similar studies that have focused on depressive symptoms on pain processing in FM [7, 21, 23-24]. We have found an association between depression and higher levels of perceived pain as measured by SF36-pain but not with VAS scores (FIQ-pain). In the study of Aguglia et al.[21] patients with depressive symptoms displayed significantly higher VAS scores, lower quality of life scores, and a higher Paykel Scale score, than those without depressive symptoms. The patients with depressive symptoms of Jackson et al.[24] also displayed significantly higher VAS scores. In contrast in the study of Jensen et al.,[7] the scores of depressive symptoms, anxiety and catastrophizing did not correlate with any measure of pain sensitivity and thus the authors do not support pronounced affective pain modulation in FM. Instead, the significant correlation between depression, anxiety and the subjective rating on one's health (general health score in SF36 and FIQ) that they obtained suggests that negative mood affects the perception of one's health status. Negative mood in FM patients could thus lead to a poor perception of one's physical health but not to poor performance in clinical and experimental pain assessments as tenderness. Gieseke et al.[23] also observed that depressive symptoms had no influence on the intensity of clinical pain or the sensory discriminative processing of induced pressure pain. However, with increasing depressive symptoms, activity in two brain regions pertaining to emotional processing, i.e. insula and amygdala, increased during sustained pain provocation.[23] A similar study performed in rheumatoid arthritis patients[25] showed no relationship between depressive symptoms and cerebral pain processing in rheumatoid arthritis patients during experimental pain (heat). However, there was a positive correlation between ratings of depressive symptoms and activation of the medial prefrontal cortex during provoked joint pain.

Recent research strongly suggests that alterations in central processing of sensory input also contribute to the cardinal symptoms of FM, persistent widespread pain and enhanced pain sensitivity. Exposure to psychosocial and environmental stressors, as well as altered autonomic nervous system and neuroendocrine responses, also may contribute to alterations in pain perception or pain inhibition. Understanding the pathophysiology of FM and co-occurring disorders may help clinicians provide the most appropriate treatment to their patients.[26]

There have been speculations about a generally exaggerated emotional response in FM patients, suggesting that FM was a virtual disease, caused by psychological vulnerability.[27] However, the effects of antidepressants on pain seem to be independent of mood, since the antidepressant and analgesic effects are independent of each other in clinical trials.[28-29] On the other hand, the role of psychological factors in the pathogenesis of FM is controversial. Depressive symptoms are often present, but it has been difficult to determine if depressive disorders are a primary cause of FM, or a reaction to the debilitating symptoms of this disease.[24]

Another explanation for the higher perception of pain in FM patients with depressive symptoms is the tendency of depressed patients to adopt a cognitive style defined “catastrophizing”.[21, 30] Catastrophizing increases the perception of pain through the modification of attention and the anticipation of the pain itself, emphasizing emotional responses. Depression and catastrophizing are critically important variables in understanding the experience of pain in patients with rheumatologic disorders.[31] Pain, depression, and catastrophizing might all be uniquely important therapeutic targets in the multimodal management of FM.[31]

Psychological interventions, and particularly cognitive behavioral therapy, can reduce catastrophizing and depression even in groups of patients with severe fibromyalgia.[32] Intervention studies will confirm or contrast the potential long-term benefits of reducing catastrophizing and depression in patients with rheumatic conditions, focusing particularly on studies of tailored early intervention[33] that may help to move patients from a 'high-risk' to a relatively lower-risk profile in order to improve long-term pain outcomes.

Some limitations of the present study need to be mentioned. First, the study was only developed in women and thus research on depression and anxiety presence and it relationship with pain in male FM patients is needed. Second, individually tailored medication such analgesics, antidepressants and anxiolytics used for FM symptoms may have had some influence on pain, anxiety and depression levels. On the other hand, we have analyzed pain across low, mild, moderate and severe depression and anxiety subgroups, which allows us to compare between different anxiety and depression intensities.

In conclusion, high levels of anxiety and depression were associated with higher perceived pain but not with higher tenderness. Patients with higher levels of anxiety and depression presented increased risk of severe FM and Type II FM. Since these anxiety and depressive symptoms are associated with increased pain perception, anxiety and depression should be diagnosed and properly treated in order to improve pain symptomatology of these patients.

Acknowledgments

The authors gratefully acknowledge all the participants for their collaboration. We also acknowledge all the AGRAFIM (FM association from Granada, Spain) members involved in the field work for their efforts and great enthusiasm.

This study was in part financially supported by grants from the Spanish Ministry of Education (AP-2006-03676 and EX-2008-0641), Ministry of Science and Innovation (BES-2009-013442 and RYC-2010-05957) and the Swedish Heart-Lung Foundation (20090635).

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Table 1. Physical and psychological characteristics of the study sample (n=127).

Variable	Range	Mean (SD)
Age (years)	31-70	51.9 (7.2)
Height (cm)	139-178	157.3 (5.0)
Weight (kg)	43-118	70.3 (13.6)
Body mass index (kg/m^2)	18-46	28.4 (5.6)
Weight status (%) UW/NW/OW/OB	-	1/32/35/32
FIQ total score	14-92	66.8 (14.0)
Tender Points Count	4-18	16.6 (2.8)
Algometer Score	24-87	48.4 (13.5)
HADS-anxiety	0-20	10.6 (4.8)
HADS-depression	1-20	8.6 (4.4)
SF36		
Mental Health	4-96	47.1 (20.8)
Bodily pain	0-68	22.7 (16.9)
Social functioning	0-100	42.9 (24.5)
Physical functioning	0-90	36.6 (19.0)
Vitality	0-80	21.5 (16.1)
Emotional Role	0-100	34.9 (43.3)
Physical role	0-100	5.5 (19.5)
General Health	0-85	30.5 (15.9)

SD, standard deviation; UW, underweight; NW, normal weight; OW, overweight; OB, obese; FIQ, Fibromyalgia Impact Questionnaire; SF36, General Health Short-Form Survey; HADS, Hospital Anxiety and Depression Scale.

Table 2. Relationship between HADS-anxiety, HADS-depression and pain (measured by four indicators).

HADS-Anxiety		**Low <8 (n=30)**	**Mild 8-10 (n=26)**	**Moderate 11-15 (n=46)**	**Severe ≥16 (n=23)**	**P**
Pain	Pain (SF36)*	27.0 (2.9)[a]	27.9 (3.1)[b]	21.6 (2.4)	12.1 (3.4)[ab]	0.003
	Pain (VAS from FIQ)	6.6 (0.3)[a]	7.2 (0.4)	6.9 (0.3)	8.1 (0.4)[a]	0.024
	Algometer score	45.1 (2.7)	51.7 (3.2)	49.4 (2.4)	48.1 (3.5)	0.427
	Tender points count	16.9 (0.5)	16.1 (0.6)	16.4 (0.4)	16.9 (0.6)	0.614
HADS-depression		**Low <8 (n=55)**	**Mild 8-10 (n=30)**	**Moderate 11-15 (n=31)**	**Severe ≥16 (n=9)**	**P**
Pain	Pain (SF36)*	25.9 (2.2)[a]	23.6 (3.0)	19.5 (2.9)	7.5 (5.4)[a]	0.013
	Pain (FIQ)	6.9 (2.5)	6.9 (0.34)	7.2 (0.3)	8.4 (0.7)	0.209
	Algometer score	50.2 (2.1)	46.4 (2.8)	47.4 (3.1)	45.4 (5.6)	0.650
	Tender points count	15.9 (0.4)	17.3 (0.5)	17.2 (0.5)	16.7 (0.9)	0.117

Values are means (standard error); HADS, Hospital Anxiety and Depression Scale; SF36, General Health Short-Form Survey; FIQ, Fibromyalgia Impact Questionnaire; VAS, visual analogic scale; [a,b] Common superscripts in a same raw indicate a significant difference ($P<0.05$); Pairwise comparisons were performed with Bonferroni's adjustment; * Lower scores indicate higher pain.

Table 3. Logistic regression analysis adjusted by age and BMI analyzing the relationship between higher levels of anxiety and depression by severe fibromyalgia (FIQ≥59 or FIQ≥70 cut-offs) or Type II fibromyalgia.

		Logistic regression adjusted by age and BMI		
		n	**OR†**	**95% CI**
Severe fibromyalgia (FIQ≥59) (n=127)	**HADS-anxiety (≥8)**	76	4.98	2.03-12.21
	HADS-depression (≥8)	59	4.95	2.02-12.10
Severe fibromyalgia (FIQ≥70) (n=127)	**HADS-anxiety (≥8)**	50	1.87	0.80-4.43
	HADS-depression (≥8)	43	3.11	1.45-6.66
Type II fibromyalgia (n=116)	**HADS-anxiety (≥8)**	75	8.62	3.23-23.03
	HADS-depression (≥8)	60	12.69	4.14-38.90

FIQ, Fibromyalgia Impact Questionnaire; BMI, body mass index; HADS, Hospital Anxiety and Depression Scale; † Lowest HADS were used as reference.

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Clin Exp Rheumatol

In press

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Usefulness of tenderness to characterise fibromyalgia severity in women

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This study was in part financially supported by the Center of Initiatives for Cooperation and Development of the University of Granada (CICODE) and grants from the Spanish Ministry of Education (AP-2006-03676 and EX-2008-0641), Ministry of Science and Innovation (BES-2009-013442, and RYC-2010-05957).

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Received on November 30, 2010; accepted in revised form on March 8, 2011.

Key words: fibromyalgia, women, pain, quality of life

Competing interests: none declared.

ABSTRACT

Objective. *To investigate the usefulness of tenderness (tender points count (TPC) and algometer score) to characterise fibromyalgia (FM) severity and symptomatology in women.*

Methods. *The study sample comprised 174 women aged 51±7 years. We assessed tenderness using pressure algometry; quality of life by means of the Short-Form 36 Health Survey (SF-36) and the Hospital Anxiety and Depression Scale (HADS). We used the FM impact questionnaire (FIQ) to assess FM severity and symptomatology. Patients were categorised according to three FIQ-derived categories: FIQ <70 vs. ≥70; FIQ <59 vs. ≥59; and FM-type I and II.*

Results. *TPC was significantly higher in the group of patients with FIQ≥59 (16.9±2 vs. 15.6±4, p=0.02), whereas no differences between groups were observed according to FIQ≥70 (17.0±2 vs. 16.2±3, p=0.12) or FM type (16.8±3 for type II vs. 15.9±4 for type I, p=0.13). We observed a significant association between TPC and FIQ-job difficulty, pain, morning tiredness and stiffness dimensions (all p<0.05), yet it was not correlated with total score of FIQ, and FIQ-anxiety and depression dimensions (all p>0.05). Algometer score was lower in the FIQ≥70 (45.7±12 vs. 51.1±14, p=0.05) and FIQ≥59 (46.7±13 vs. 52.7±14, p=0.05) groups, and there were no difference between FM types (48.7±13 vs. 49.5±14 for type II and I respectively, p=0.81). Algometer score was not associated with total score of FIQ or FIQ dimensions (all p≥0.1).*

Conclusion. *Widespread pain and pain hypersensitivity, as measured by TPC and algometer score, do not seem to be useful to characterise FM severity and symptomatology (measured by FIQ) in women.*

Introduction

Fibromyalgia (FM) is considered a disorder of pain regulation (1), indicated by an increased sensitivity to painful stimuli (hyperalgesia) and lowered pain threshold (allodynia) (2). Additional to the pain, FM patient's symptoms typically include fatigue, stiffness, insomnia-related symptoms or memory and cognitive difficulties (3-6). The prevalence of comorbidities among patients diagnosed with FM is very high (7), which increases patients' needs for appropriate medical management and results in higher healthcare resource utilisation compared with people without FM (8). A recent review suggest that FM pharmacotherapy is more prevalent in clinical practice and that cellular, molecular and pathophysiologic mechanisms contributing to widespread musculoskeletal and neuropathic pain has emerged (9).

FM has an enormous impact on the health-related quality of life of patients (10-11). Furthermore, patients with FM see the disease as having a worse health than arthritis rheumatoid patients and the general population, especially in terms of mental health (10).

Several tools have been used for the diagnosis of FM. The tender points count (TPC) has traditionally been such a tool (5) and has been criticised for placing diagnosis at the far end of the severity spectrum, thereby neglecting the appreciation of the spectrum itself (12). In fact, nowadays FM is considered to be more than just a pain syndrome (4-7). Due to the complex nature of the disease, the diagnosis of FM appears to be a dynamic process. Indeed, due to the apparent difficulty and controversy around the assessment of TPC, the American College of Rheumatology (ACR) has recently presented an alternative preliminary diagnostic criteria mainly based on symptoms severity (13). To note is that this diagnosis criteria statement has newly opened the debate (14-15).

Several health-related questionnaires are often used as complementary information in the diagnosis and monitoring of FM. However, despite the burgeoning theoretical literature and the proliferation of instruments for measuring various health status domains, no unified approach has been developed and there is little agreement concerning the meaning of the results (16). One of the most used and specific questionnaires in FM is the *Fibromyalgia Impact Questionnaire* (FIQ) (17-18). The FIQ was designed in the early 90s, yet, it is still considered as one of the main tools to assess FM symptomatology (17, 19). From a clinical point of view, it is important to discriminate between patients with mild or severe impairment of the disorder. Several studies suggested FIQ cut-off points to establish different degrees of the FM severity (17, 20-21). Bennet *et al*. (17), in a review performed in 2005 about the FIQ development, operating characteristics and uses, reported that a FIQ score ≥70 was useful to establish severe impairment of the disease. More recently, Bennet *et al*. (20) proposed a FIQ cut-off ≥59 and affirmed that this new one was quite in agreement with that suggested originally. In 2008, de Souza *et al*. (21) suggested that both pain and stiffness were universal FM symptoms, but that psychological distress was a feature present only in some patients. Accordingly, they established a new FIQ-based classification of FM type I, characterised by lower levels of anxiety, depressive and morning tiredness symptoms, and FM type II, characterised by elevated levels of pain, fatigue, morning tiredness, stiffness, anxiety and depressive symptoms. The same study was replicated by Calandre *et al*. (22) with a larger sample of patients of both genders, and the authors concluded that the proposed FM classification was reliable and easy to perform.

To further understand whether TPC is a useful tool to characterise FM severity and symptomatology in women is of clinical interest. The present study investigated the usefulness of tender points count (TPC) to characterise FM severity and symptomatology in women. We compared TPC and algometer score, as well as quality of life and FM symptomatology across several published FIQ cut-offs of severity (FIQ <59 *vs*. ≥59 and FIQ <70 *vs*. ≥70) (17, 20), as well as between the FIQ-based classification of FM type I *vs*. type II (21).

Material and methods

Study sample and design

The study sample comprised 174 women aged 51.3±7.3 years old from a local association of FM patients from Granada (Spain). Patients were diagnosed as having FM by a rheumatologist following the ACR criteria (5). Patients were informed about the study aims and methodology and signed a written informed consent to participate. Inclusion criteria were not to have other rheumatic diseases and other chronic pain diseases (*i.e.* neoplasic diseases, etc.).

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

Material and procedures

Anthropometrics measurements

Height (cm) was measured using a stadiometer (Seca 22, Hamburg, Germany) and weight (kg) with a scale (InBody 720, Biospace, Seoul, Korea). Body mass index (BMI) was calculated as weight (in kilogrammes) divided by height squared (in metres).

Tenderness

We assessed 18 tender points with standard pressure algometer (EFFEGI, FPK 20, Italy) and following the ACR criteria for classification of FM (5). The pain threshold at each tender point was determined by applying increasing pressure with the algometer perpendicular to the tissue, at a rate of ~1 kg/s. Patients were asked to say 'stop' at the moment pressure became painful. 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 of 4 kg/cm^2 or less. For each patient, the number of positive tender points was summed and recorded as the individual's TPC. We also computed the algometer score by summing up the pain-pressure values obtained at each tender point. The examinations were conducted by a trained physiotherapist.

Fibromyalgia Impact Questionnaire

We used the Spanish version (23) of the FIQ (18) to assess FM-related symptoms. FIQ assesses the components of health status that are believed to be most affected by FM. The FIQ total score ranges from 0 to 100 and a higher value indicates a greater impact of the disorder (17).

As mentioned above, patients were categorised as having moderate or severe FM according to the FIQ cut-offs proposed by Bennet (17) and Bennet *et al*. (20): FIQ <70 *vs*. ≥70, for moderate and severe FM, respectively; or FIQ <59 *vs*. ≥59 for moderate and severe FM, respectively. Patients were further categorised following the FIQ-based classification of FM-type I and FM-type II described by Souza *et al*. (21).

Quality of life

The Spanish version of the *Short-Form 36 Health Survey* (SF-36) (24) was used to assess health-related quality of life. The SF-36 is composed of 36 items, grouped into eight subscales. Each subscale score is standardised and ranges from 0–100, where 0 indicates the worst possible health status and 100 the best possible.

We also assessed depression and anxiety by means of the Spanish version of the *Hospital Anxiety and Depression Scale* (HADS) (26). The HADS contains 14 statements, ranging from 0 to 3, in which a higher score indicates a higher degree of distress. The scores build 2 subscales: anxiety (0–21) and depression (0–21) (27).

Statistical analysis

The distribution of the residuals was examined and parametric and non-parametric statistical tests were used as appropriated. We conducted analysis of variance to examine age and BMI differences across FIQ groups, whereas Mann-Whitney test was used to examine total score of FIQ as well as FIQ dimensions, and HADS and SF-36 variables across FIQ groups. Spearman correlation coefficients were used to examine the association of TPC and algometer score with FIQ total score and FIQ-dimensions.

All analyses were conducted using SPSS version 16.0 for Windows (SPSS, Chicago, IL) and the level of significance was set at $p<0.05$.

Results

A total 127 patients had valid data on HADS and tenderness. The characteristics of the study sample by FM severity (FIQ <70 *vs.* ≥70 and FIQ <59 *vs.* ≥59 cut-offs) and by FM typology (type I vs. type II) are shown in Table I. BMI was lower in the moderate FM group regardless of the FIQ cut-off point used (both $p\leq0.05$). BMI was similar in type I and type II groups ($p=0.862$). Quality of life and FM symptomatology, as measured by HADS and SF-36 questionnaires, were significantly worse (all $p<0.01$) in the group with FIQ≥70 (severe FM) compared to the group with FIQ<70 (moderate FM), except the SF-36 physical role subscale ($p=0.088$). Likewise, quality of life was worse (all $p<0.05$) in the group with FIQ≥59 (severe FM) compared to the group FIQ<59 (moderate FM) group. Patients categorised in the FM type II group had significantly (all $p<0.001$) worse values of quality of life, except the SF-36 physical role subscale ($p=0.089$).

Figure 1 shows the TPC and algometer score mean values across FIQ categories. TPC was significantly higher in the group of patients with FIQ≥59 (16.9±2 *vs.* 15.6±4, $p=0.02$), whereas no differences between groups were observed according to FIQ≥70 (17.0±2 *vs.* 16.2±3, $p=0.12$) or FM type (16.8±3 for type II *vs.* 15.9±4 for type I, $p=0.13$). Algometer score was lower in the group of patients with FIQ≥70 (45.7±12 *vs.* 51.1±14, $p=0.05$) and FIQ≥59 (46.7±13 *vs.* 52.7±14, $p=0.05$), and there were no difference between FM types (48.7±13 *vs.* 49.5±14 for type II and I respectively, $p=0.81$).

There was a significant association between TPC and FIQ-job difficulty, pain, morning tiredness and stiffness dimensions (all $p<0.05$), yet TPC was not associated with total score of FIQ, and FIQ-anxiety and depression dimensions (all $p>0.05$)
(Table II). Algometer score was not associated with total score of FIQ or FIQ dimensions (all $p\geq0.1$).

Discussion

The findings of the present study suggest that the usefulness of widespread pain and pain hypersensitivity, as measured by tenderness, to characterise FM severity and symptomatology (measured by FIQ) in women is of concern. These results provide further support on that FM is not just a pain syndrome and confirm the need of diagnosing and monitoring the FM severity and symptomatology with subjective tools.

Our results concur with those reported by de Souza *et al.* (21). They observed no differences in pressure pain threshold (algometer score) between type I and type II FM. Both Souza *et al.* (21) and Calandre *et al.* (22) observed differences between FM groups (I vs. II) in the mental component but not in the physical components of the quality of life. These results are logical due to the fact that this type of FM classifica-

Table I. Characteristics of the female fibromyalgia (FM) sample by severity (FIQ≥70 or FIQ≥59 cut-offs) and by FM typology (type 1 or type 2).

	FM severity by different cut-offs (n=174)						FM typology (n=167)		
	Moderate (FIQ<70) (n=90)	Severe (FIQ≥70) (n=84)	P^a	Moderate (FIQ<59) (n=48)	Severe (FIQ≥59) (n=126)	P^a	Type I (n=43)	Type II (n=124)	P^a
Age (years)*	51.6 (7.8)	50.9 (6.9)	0.512	51.3 (8.4)	51.4 (6.9)	0.962	50.4 (7.3)	51.3 (7.3)	0.481
Body mass index (kg/m²)*	27.3 (5.5)	29.0 (5.46)	0.050	26.8 (5.0)	28.7 (5.6)	0.048	28.0 (6.1)	27.9 (5.3)	0.862
SF-36	P^b		P^b		P^b				
Physical functioning	44.4 (30.0-60.0)	30.0 (15.0-40.0)	<0.001	45.0 (35.0-60.0)	30.0 (20.0-45.0)	<0.001	45.0 (33.3-60.0)	30.0 (20.0-45.0)	<0.001
Emotional role	33.3 (0-100)	0 (0-33.3)	0.003	66.8 (0-100)	0 (0-66.7)	<0.001	100 (33.3-100)	0 (0-58.3)	<0.001
Physical role	0 (0-0)	0 (0-0)	0.088	0 (0-0)	0 (0-0)	0.034	0 (0-0)	0 (0-0)	0.089
Vitality	25.0 (18.8-40.0)	10.0 (0-23.8)	<0.001	30.0 (21.3-40.0)	15.0 (5.0-25.0)	<0.001	30.0 (20.0-40.0)	20.0 (5.0-25.0)	<0.001
Mental health	56.0 (44.0-68.0)	36.0 (24.0-48.0)	<0.001	60.0 (52.0-72.0)	40.0 (28.0-56.0)	<0.001	64.0 (60.0-80.0)	40.0 (28.0-52.0)	<0.001
Social functioning	56.0 (44.0-68.0)	32.5 (20.0-47.5)	<0.001	58.8 (43.1-67.5)	32.5 (22.5-55.0)	<0.001	65.0 (45.0-67.5)	32.5 (22.5-51.9)	<0.001
Bodily pain	22.5 (22.5-45.0)	12.5 (0-22.5)	<0.001	35.0 (22.5-47.5)	22.5 (0-22.5)	<0.001	32.5 (22.5-47.5)	22.5 (10.0-22.5)	<0.001
General health	35.0 (25.0-45.0)	25.0 (15.0-35.0)	<0.001	35.1 (30.0-50.0)	25.0 (15.0-35.0)	<0.001	40.0 (30.0-50.0)	25.0 (15.0-35.0)	<0.001
FIQ total score	58.2 (51.5-66.8)	76.8 (73.2-83.3)	<0.001	52.0 (45.9-56.2)	73.2 (68.1-79.7)	<0.001	55.5 (46.4-66.9)	71.9 (66.3-79.4)	<0.001
FIQ-pain subscale	6.6 (5.0-8.0)	8.0 (7.2-9.5)	<0.001	5.5 (4.4-7.0)	8.0 (7.0-9.0)	<0.001	7.0 (4.6-7.5)	8.0 (6.3-9.0)	<0.001
HADS anxiety	10.0 (6.5-12.0)	12.0 (9.0-16.0)	<0.001	8.0 (4.0-10.5)	12.0 (9.0-15.3)	<0.001	7.0 (4.5-9.5)	12.0 (10.0-14.0)	<0.001
HADS depression	7.0 (4.0-9.5)	10.0 (6.5-13.0)	<0.001	5.0 (3.0-8.0)	9.0 (6.0-12.0)	<0.001	4.0 (3.0-6.0)	10.0 (12.0)	<0.001

*Values are means (standard deviation), otherwise median (25th, 75th percentiles); FIQ: Fibromyalgia Impact Questionnaire; SF-36: Short-Form 36 Health Survey; HADS: Hospital Anxiety and Depression Scale; P^a from analysis of variance, P^b from Mann-Whitney test.
Patients were categorised into moderate or severe FM group according to the FIQ cut-offs proposed by Bennet (17) and Bennet *et al.* (20): FIQ <70 *vs.* ≥70, for moderate and severe, respectively; and FIQ <59 *vs.* ≥59 for moderate and severe, respectively; as well as the FIQ-based classification of FM-type I and II described by Souza *et al.* (21).

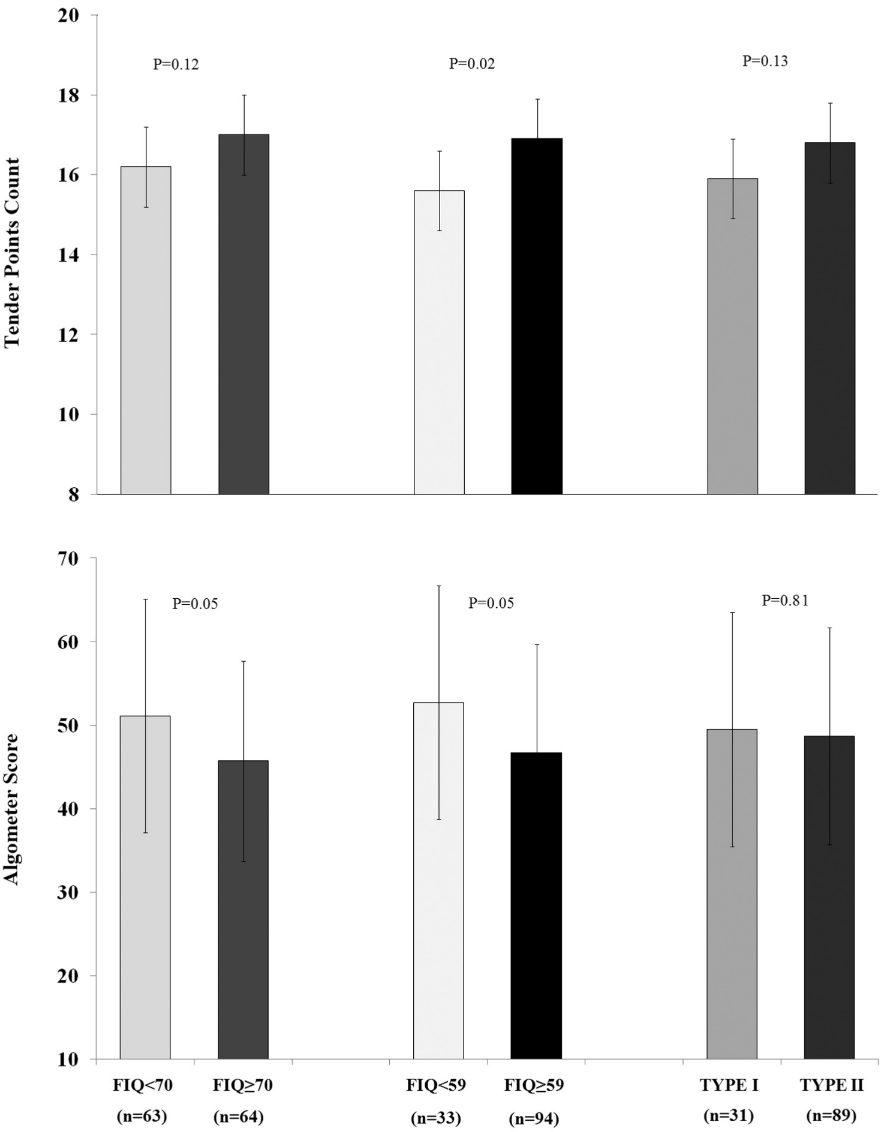

Fig. 1. Differences in tender points count and algometer score attending to the severity and type of fibromyalgia (FM). Values are means and 95% confidence interval.
Patients were categorised into moderate or severe FM group according to the FIQ cut-offs proposed by Bennet (17) and Bennet *et al*. (20): FIQ <70 *vs*. ≥70, for moderate and severe, respectively; and FIQ <59 *vs*. ≥59 for moderate and severe, respectively; as well as the FIQ-based classification of FM-type I and II described by Souza *et al*. (21).

tion is based on distinguishing patients attending to anxiety and depressive symptoms.

Salli *et al*. (28) investigated the relationship between TPC and the severity of the FM in 107 women and observed a positive association between TPC and FIQ total score (r=0.43), which is not in agreement with our results (rho=0.17). They also observed a significant associations of TPC with pain (r=0.51) and with depression (r=0.24), as measured by the Beck Depression Index. The authors concluded that TPC was a simple and noninvasive examination that could supply information about the disease severity and the depression in FM. We observed weaker associations of TPC with FIQ-pain (rho=0.20, p=0.04) and FIQ-depression (rho=0.18, p=0.05). Other studies did not observe significant associations between FIQ total score and TPC as measured by digital palpation of tender point sites (29-30) or algometer (31), which is in agreement with our results.

There are important associations between widespread pain and multiple TPC (19, 32) and it has been shown that significant tenderness can be achieved on specific points also in healthy individuals (33-34). There seem to be a considerable overlap between patients with FM and those with other unexplained syndromes (35). In this regard, patients may be artificially diagnosed as having FM if they have higher TPC with few symptoms and some patients with classical symptoms may be excluded because they exhibit fewer than 11 tender points or pain threshold of more than 4 kg/cm^2 at some specific points (33, 35-38). To note is that TPC as well as the perception of pain are influenced by other factors such as the menstrual cycle (39), cultural features (31, 40) or even ethnicity (41).

Tastekin *et al*. (38) analysed the discriminative value of all tender points, alone and in combination, by investigating the appropriate pressure magnitude that should be applied during tenderness examination. They observed that the pressure pain threshold was different across the tender points, which suggested that the magnitude pressure should be point-specific. In a previous study, Tasketin *et al*. (30) also observed no association between algometer score (the sum of the pain-pressure values obtained for each tender point) and FIQ, which may indicate that this is still not the best solution.

According to the ACR, FM is a chronic widespread pain with widespread allodynia to pressure pain (5). Coster *et al*. (19) observed, in a randomly selected sample from the general population, that only about 50% of individuals reporting chronic widespread pain related to the musculoskeletal system meet the ACR tender point criteria and there was no clear clinical diagnosis for the remaining 50%. Amris *et al*. (42) suggested that musculoskeletal pain in patients with FM and chronic widespread pain has neuropathic features. They suggest that the pain detect questionnaire might be an additional useful and easily applied screening tool assisting in the identification of central sensitisation in patients reporting chronic widespread musculoskeletal pain, and that the Pain Detect Questionnaire (PDQ) has a potential in the future diagnostic assessment of patients with FM. TPC is not replaceable tool for FM diagnosis,

Table II. Spearman correlations of tender points count and algometer score with fibromyalgia (FM) Impact Questionnaire (FIQ) dimensions and FIQ total score in female FM patients (n=127).

	Tender points count		Algometer score	
	rho	*p*	rho	*p*
Total score FIQ	0.168	0.06	-0.156	0.14
Job difficulty	0.266	0.03	-0.264	0.06
Pain	0.195	0.04	-0.103	0.35
Fatigue	0.164	0.07	0.005	0.96
Morning tiredness	0.241	0.01	-0.160	0.15
Stiffness	0.205	0.03	-0.093	0.40
Anxiety	0.033	0.72	0.181	0.10
Depression	0.179	0.05	0.048	0.66

but these results support the need of more than TPC and the importance of the inclusion of subjective scales when diagnosing FM.

We do not know whether these results could be applied to men, and future studies should investigate the usefulness of tenderness to characterise FM severity and symptomatology in men. It would be of clinical interest to replicate this study in other diseases related to pain such as arthritis rheumatoid, lupus, or chronic fatigue syndrome, as well as in the general population.

In conclusion, the findings of this study suggest that widespread pain and pain hypersensitivity, as measured by TPC and algometer score, do not seem to be useful to characterise FM severity and symptomatology (measured by FIQ) in women

Acknowledgments

The authors gratefully acknowledge all the participants for their collaboration. We also acknowledge all the AGRAFIM (FM association from Granada, Spain) members involved in the field work for their efforts and great enthusiasm.

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CONCLUSIONES

- No se han observado diferencias consistentes que confirmen diferencias de género en calidad de vida y sintomatología en pacientes con fibromialgia.
- La fuerza de prensión manual está reducida tanto en hombres como en mujeres con fibromialgia, así como en aquellos pacientes que padecen fibromialgia severa con respecto a los que la presentan moderada. La identificación de personas que no alcanzan los puntos de corte de fuerza de prensión manual sugeridos en la presente Tesis podría ser una herramienta complementaria y de utilidad para el médico/reumatólogo.
- La condición física en general y, particularmente, el test de los 30 segundos de levantadas en una silla, discrimina entre mujeres con fibromialgia y sanas, así como entre las que padecen fibromialgia severa de la moderada.
- La obesidad es una condición frecuente en mujeres con fibromialgia, siendo su prevalencia sustancialmente superior a los valores normativos nacionales.
- La sintomatología de las enfermas de fibromialgia con sobrepeso no difiere de las obesas. Sin embargo, las pacientes con normopeso muestran menor severidad en los síntomas, lo que sugiere que mantener un peso saludable (normopeso) podría ser una forma útil de mejorar la sintomatología de la enfermedad.
- Las enfermas de fibromialgia obesas presentan mayores niveles de ansiedad, y depresión junto con una peor calidad de vida, capacidad aeróbica, equilibrio dinámico y flexibilidad que aquellas con normopeso.
- Altos niveles de ansiedad y depresión se asocian con un mayor dolor percibido. Además, las mujeres con mayores niveles de depresión y ansiedad presentan un mayor riesgo de padecer fibromialgia severa y/o Tipo II.
- La estimación de los puntos de dolor no discrimina entre enfermas con fibromialgia moderada y severa.

Conclusión general:

Los resultados de la presente memoria de Tesis ponen de manifiesto la utilidad de la valoración de la condición física y de la composición corporal como herramienta complementaria en el diagnóstico y seguimiento de la fibromialgia.

CONCLUSIONS

- Our data do not support meaningful gender differences in quality of life and fibromyalgia symptomatology.
- Handgrip strength is reduced in women and men with fibromyalgia as well as in those with severe fibromyalgia compared from their peers with moderate fibromyalgia. Identification of persons who fail to meet the suggested handgrip strength standards proposed in this Thesis can be a helpful and informative tool for the clinician.
- Physical fitness in general and, particularly, the 30-s chair stand test, discriminate women with fibromyalgia from those without fibromyalgia, as well as those with moderate fibromyalgia from their peers with severe fibromyalgia.
- Obesity is a common condition in women diagnosed with fibromyalgia and its prevalence in this population is higher than the national reference values.
- Fibromyalgia symptomatology in obese patients do not differ from overweight patients, whereas normal weight patients significantly differ from either overweight and obese patients, suggesting that keeping a healthy (normal) weight might be a relevant and useful way of improving fibromyalgia symptomatology in women.
- Obese female fibromyalgia patients display higher levels of anxiety and depression and worse quality of life, cardiorespiratory fitness, dynamic balance/motor agility and upper flexibility than their normal weight peers.
- High levels of anxiety and depression are associated with higher perceived pain but not tenderness. Women with higher levels of anxiety and depression present increased risk of severe or/and Type II fibromyalgia.
- Tender points count do not discriminate women with moderate fibromyalgia from those with severe fibromyalgia.

Overall conclusion:

The results of the present Thesis highlight the usefulness of physical fitness testing and body composition as a complementary tool in the diagnosis and monitoring of the fibromyalgia.

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AGRADECIMIENTOS

A mi **madre**, porque esta tesis es tan sólo un ejemplo de las muchas cosas que has sabido proyectar en mí. Gracias por despertarme la inquietud por la Cultura en el amplio sentido de la palabra. Por enseñarme que aprender no tiene precio y que no hay sueldo que reconforte, ni por asomo, dedicarte a lo que te gusta. Gracias por enseñarme que las cosas más importantes de la vida son las más pequeñas y que ser fiel a uno mismo, aún pagando un alto precio, nunca es cuestionable. Gracias por tu autenticidad, por tu nobleza, por enseñarme a ir de frente y a anteponer la ética personal a los logros económicos y/o académicos. ¡Ole mamá!, por sacarme adelante tan sola y a la vez conseguir que jamás haya sentido ningún tipo de carencia. *"Que ser valiente no salga tan caro, que ser cobarde no valga la pena".*

A **mi salud**, de la cual muchas veces nos olvidamos, y muy especialmente a mi cuello, por aguantar hasta el final los días y noches de ordenador, y los meses de cama y almohada de Jägargatan. *"Que el escenario me tiña las canas".*

Como he leído ya muchas dedicatorias de tesis de compañeros, sé que aquí vendría el espacio que se dedica a la pareja…☺ ¡Pero tú! ¿Dónde te metes? *"Que el corazón no se pase de moda".*

A toda mi **familia**, porque no seremos de muchos abrazos y besos (especialmente yo), pero sé que ahí están. Independientemente de sus ideas políticas y creencias, ellos me aceptan, respetan y apoyan tal y como soy, en todos los sentidos. No todo el mundo tiene la suerte de poder decir lo mismo de cada uno de los miembros de su familia. **Esperanza**, tú también eres parte de mi familia, ¡vamos a dejarlo en como una tita!. A mi "**Mamo**", el vecino que se convirtió en el mejor abuelo posible. A mis **prim@s**, sí, incluidos en la familia, pero también amigos con los que he compartido muy buenos momentos de niñez, aborrescencia :p y enredos ;) *"Que cada cena sea tu última cena".*

A mis directores de tesis: Manuel, Fran y Jonatan. A **Manuel**, gracias por decirme "sí quiero" el día que fui en tu busca desde Cáceres para iniciar un doctorado en la línea de actividad física y salud. Eres una de las personas más generosas que conozco en la Universidad y has sido como un padre en esto de la

ciencia. Creo que todo un ejemplo a seguir por tu forma de trabajar en equipo (uno de mis puntos débiles, sobretodo hasta llegar a ti) y de concebir la vida. Tu humildad, tu parecerte tantas cosas "espectaculares" ☺, tu dedicación a las personas que te rodean, tu renunciar a ofertas para que los demás avancemos si necesitamos un *empujoncito*, tu sapiencia a la hora de establecer prioridades y aplicar, no sólo sobre el papel, que lo primero es la salud y la felicidad personal y luego viene todo lo demás. Eres un verdadero catedrático, pero de la vida. *"Que las persianas corrijan la aurora".*

Fran y Jonatan. Muchas veces las acciones cotidianas de la vida se convierten en metáforas: Gracias por salir a correr e invitarme a seguiros con la bici.

Fran, tú eras justo lo que yo necesitaba y llegaste a mi vida en el momento exacto. He de decir que fuiste toda una sorpresa. Gracias por enseñarme a respirar y releer antes de darle al botón "enviar". Por tu serenidad y capacidad para guiarme con tanta humildad, aún cuando yo llegaba de "listilla" y estaba a años luz de ti (aún sigo estándolo). Gracias por tu paciencia, soy consciente de que mi emoción y prisas puede exasperar a cualquiera y tú has sabido pulir, en parte, eso de mí. Me has enseñado la importancia de cuidar los detalles para hacer las cosas bien. Te mereces todo lo mejor porque eres un auténtico "crack" en todos los sentidos, sobretodo en el personal. *"Que nunca sepas ni cómo, ni cuándo, ni ciento volando, ni ayer ni mañana".*

Desde niña me ha gustado hacer puzles, quizás esa sea una de las razones por las que me atrae tanto esto de la "Ciencia". **Jonatan**, recuerdo que hace unos meses te escuché asemejar un artículo científico a un puzle. ¿Cómo lo haces para seguir conservando el entusiasmo de un niño cada vez que encajas una nueva pieza? Gracias por tu amistad, por esa risa contagiosa que te alegra el alma, por hacerme creer en el amor verdadero y por ser mi modelo a seguir acerca de cómo ha de mimarse una relación y a una mujer cada día. Gracias **Amalia**, por el brillo de su mirada. *"Que el calendario no venga con prisas".*

¡Pero qué suerte la mía!, especialmente cuando escucho experiencias de otras personas que hacen el doctorado y tienen que lidiar con sus directores de tesis. Yo he contado con los tres mejores directores a los que se puede aspirar en lo

académico en este campo ¡Y encima me lo han hecho todo fácil y los considero amigos!

Ana, la mejor compañera de trabajo que se pueda esperar. Has sido mi compi de viajes, proyectos, evaluaciones, estancias, inquietudes, etc. pero también una buena amiga. Esta tesis es 60% tuya, 40% mía. Esta etapa ha sido sólo el inicio de muchos proyectos que espero que nos queden por compartir, aunque sea en la distancia. *"Que todas las noches sean noches de boda".*

A mis directores de la tesis "ratuna" y a mis compañeros del Departamento de Fisiología de la Facultad de Farmacia. Especialmente a **Pilar, Jesús, Elena, Cristina, María, María del Mar, Juan, Gloria, Gary, Sandra, Pilar, Chari y Lucía. Pilar**, de ti solo diré que si Manolo es como mi padre en esto de la Ciencia, tú eres mi madre en la UGR. **Jesús**, junto con Fran, eres otra de las personas que más me ha enseñado en estos años a ser metódica trabajando. Todo el trabajo de laboratorio que conozco, desde coger una pipeta, se lo debo al tiempo y la paciencia que me has regalado. Eres todo un caballero, de esos que lamentablemente no quedan en los tiempos que corren. Admiro tu capacidad para respetar al extremo a todo el mundo, tu ternura y tu tremenda humildad en tu profesión. ¡Aún cuando tienes conocimientos para comértelos a todos con patatas! ;). **Elenita**, ¿te das cuenta de que a lo largo de estos años nunca hemos tenido tensiones a pesar de haber estado muchas veces saturadas de trabajo?. Eso dice mucho de ti. *"Que los otoños os doren la piel".*

A mis compañeros del grupo CTS-545, especialmente a **Pablo, Palma, Isaac, Clelia, Claudia, Toté**, **Inma, Alejandro, Dani, Víctor, Mikel** y **Carmen** por vuestras ganas, buenas palabras y entusiasmo. Al "Dream Team" y resto de compañeros en el mundo de la ciencia y de mis estancias en el KI: **Pipi,** ¡ven ya!; **Miguel,** ¡qué bien que ya hayas vuelto!; **Idoia,** ¡qué clase tienes!; **mi Dani,** no hay nada mejor cuando uno está fuera, que contar con gente que te sabe hace reír de verdad. **Enrique**, eres un reflejo de salud para todos los que te rodean: física, pero también mental. **David,** ¡me tienes que recordar la receta de tu salmorejo porque sigue siendo el mejor!. **Rocío,** ¡muy ñoña, sí, pero mi ñoña favorita☺!. **Dong,** the nicest guy in Stockholm. You know I wait for you in Granada. **Mairena,** he echado

de menos esos cafetitos en el "rinconcito". **Magda,** gracias por tus verduritas sin gracia que me ayudaron a contrarrestar la "operación canellbulle" ;). **Signe,** a friend in Stockholm and my personal "nice, authentic blonde☺ and beauty English teacher". Y al resto de gente que me ha hecho sentir tan arropada lejos de casa: **Manolo, Mohammed, Mónica, Luis, Sofía, David…** ¡Cuántos cálidos momentos hemos vivido, aún pisando nieve! *"Que el equipaje no lastre tus alas".*

From left (up-down) to right: Idoia, Dirk, David, Virginia, Pedro, Fran, Diego, Pablo, David, Carmen, Jonatan, Dani, Pia, Vanes, Ana, Miguel, Manolo, Rocio, Signe, Pepe, German, Olle

To **Michael Sjostrom,** thanks a lot for providing me the opportunity to stay at your Unit in the Karolinska Institutet and for your always kind, warm and positive attitude, even when things became very hard. *"Skål".*

A mis amigos de Cádiz, porque hace un par de años no había pisado esa ciudad y sólo por vosotros ahora la considero "hogar". **Pepe**, gracias por hacerme sentir tan especial y con capacidad para comerme el mundo. **Carmen**, gracias por descubrirme que no se necesitan muchos años de vivencias para pasar a considerar a alguien una amiga. Tenemos un problema: ¡porque yo de mayor también quiero ser como tú! *"Que te aproveche mirar lo que miras".*

A mi **Anita,** porque has sido, eres y serás mi "ca". Ambas sabemos que podremos enfadarnos, dejar de dirigirnos la palabra si hace falta ☺, pero si a la media hora estamos mal o nos ocurre algo, si algo nos disgusta, todo queda atrás. Es entonces cuando nos llamamos como si nada hubiera sucedido, sin explicaciones. Es cuando dejamos todo lo que estemos haciendo a un lado y sólo pensamos en "socorrer". Ni tan siquiera entre hermanos se cuenta muchas veces con eso, y yo me siento muy afortunada de que así sea contigo y con tu familia (**Lourdes, Ana, Agustín** y mi **Manolitoooo**), la cual me ha acogido en Granada como a una hija, nieta y amiga. *"Que el fin del mundo te pille bailando".*

A **Carmen, ¡mi Caracol!** y gran amiga. De esas que saben decirte lo que no quieres escuchar cuando es necesario y de las que a la vez te pueden hacer sentir la mejor persona del mundo. Contigo tengo eso que sólo se comparte con los amigos de verdad: poder decir en alto todo lo que pienso. **Dámaris**, gracias porque desde que está contigo, y aunque no lo reconozca, sé que escogería la pastilla roja☺. Carmen, tú sabes que yo también quería estudiar periodismo. Siempre he pensado que un periodista no debe caracterizarse por ser imparcial, sino por ser justo y comprometido con la sociedad. Tú encarnas ese periodista que necesitamos tanto ahora y para la nueva sociedad que antes o después tiene que llegar, tal y como dice ese pensador que sabes que me encanta: José Luis Sampedro. *"Que las verdades no tengan complejos, que las mentiras parezcan mentiras".*

A mi abuela **Antonia**, mi tío **Agustín** y **Mari Carmen** y a mis hermanos, especialmente a **M.** Porque nunca es tarde si la dicha es buena y de adulta me ha llegado un regalo inesperado. Mi madre siempre me ha contado que mi padre era una persona muy tierna y sensible. Ahora me hago una mejor idea de hasta qué punto podía llegar a serlo. *"Que no te vendan amor sin espinas".*

A mi "pandi" de Granada: **Víctor, Laura, Ague, Elvira, Belén, Vanesa, Rocío, Patri, Ana, Marta, María José, Lucía, Mari…** por las risas compartidas. Siempre he considerado que en la vida es fundamental mantener un equilibrio entre trabajo y diversión, solo así se puede ser realmente productivo en lo primero. Gracias por estar siempre dispuestos a ayudarme a desconectar (independientemente del día de la semana que fuera☺). *"Que no nos cierren el bar de la esquina".*

A mis compañeros de carrera y de mis años en Cáceres: **Cecilia, Pilis, Carmen, Isabel, Inma, Luije, Fernando, David, Serván, Ana, Cristina, Conchi…** y muy especialmente a mi amiga **María**: ¡Haz el favor de venirte de Alemania YAA! Quiero que sepas que tú eres en parte culpable de que me lanzase a hacer el doctorado. *"Que los que esperan no cuenten las horas".*

A mis profesores del Colegio Claret de Don Benito. A todos ellos, a los que despertaron en mí la inquietud por aprender nuevas cosas y ejercieron de verdaderos maestros, pero también a los que me exigieron más de lo que me enseñaron, convirtiendo mi paso por la Universidad en un camino de rosas al lado de mis años de Bachillerato. Gracias mamá nuevamente, por no dejar que me hundieran ni que perdiera la confianza en mí. *"Que no se ocupe de ti el desamparo".*

A mis chicas de Don Benito: **Mónica, Elena, Queen, Puri, Isabel, Noelia, Maribel, Emi, Ana…** Porque tenéis "más moral que el Alcoyano" cuando seguís contando conmigo a pesar de mis ausencias. *"Que el maquillaje no apague tu risa".*

Al grupo **AFYCAV** de Cáceres, por su cálida acogida y hacernos sentir "de Cáceres, de toda la vida" desde el primer día. *"Que el diccionario detenga las balas".*

A los pacientes de fibromialgia que han participado en este estudio y a **AGRAFIM**. Sin vosotros esta Tesis no hubiera existido. Aún recuerdo y agradezco vuestro positivo recibimiento y predisposición cuando hace ya 5 años aparecimos por allí con la intención de usaros como conejillos de indias. Sólo espero que entre todos, poquito a poco, consigamos hacer esta enfermedad cada vez más pequeñita. *"Que gane el quiero la guerra del puedo".*

"A las aladas almas de las rosas…"