Subgroups of fibromyalgia patients using the 1990 American College of Rheumatology criteria and the modified 2010 preliminary diagnostic criteria: the al-Ándalus project

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ABSTRACT

Objective. *We aimed to investigate the symptom profiles in subsets of fibromyalgia patients according to the subgroups created from the satisfaction of the 1990 American College of Rheumatology (ACR) diagnostic criteria (1990c) and/or the modified 2010 ACR preliminary diagnostic criteria (m-2010c).*

Methods. *A total of 913 (84 men) participants took part in this cross-sectional study. Participants were grouped as follows: i) 285 who did not fulfil any ACR diagnostic criteria (non-fibromyalgia); ii) 73 who fulfilled the 1990c only; iii) 96 who fulfilled the m-2010c only; iv) 459 who fulfilled both ACR diagnostic criteria. Experimental and clinical pain, chronic pain self-efficacy, pain catastrophising, fibromyalgia severity, fatigue, health-related quality of life, depression, state anxiety and physical fitness were assessed by means of several questionnaires and tests.*

Results. *Overall, the differences were consistent across all study outcomes (all, overall $p<0.001$), showing that the subgroup fulfilling both diagnostic criteria had the worst profile of all the subgroups, whereas those fulfilling any diagnostic criteria (non-fibromyalgia participants) had the most favourable results. Furthermore, the subgroup fulfilling the m-2010c only had a worse profile than the subgroup fulfilling the 1990c only, and presented similar but slightly better results than those fulfilling both diagnostic criteria.*

Conclusion. *Our results reinforce the understanding of fibromyalgia as a heterogeneous condition. Subgrouping of fibromyalgia patients is highly recommendable, since these subgroups show diverse clinical pictures and therefore treatment options should be individually tailored to their specific profile. The combination of 1990c and the m-2010c is potentially useful to identify subgroups of fibromyalgia patients.*

Introduction

Fibromyalgia is a complex dimensional disorder characterised by the presence of musculoskeletal pain (1) and other important symptoms such as fatigue, stiffness, sleep disorders, cognitive problems, depression and/or anxiety among others (1-3). The vast symptomatology limits most of daily fibromyalgia patients' activities, such as walking or carrying objects, which entails an enormous impact on patients' quality of life (4). Considered as a disorder of pain regulation of unknown aetiology, this disease remains not fully understood (3, 5, 6). As a result, no gold standard method for the fibromyalgia diagnosis exists, which makes the diagnosis of this disease difficult and controversial.

In 1990, the first American College of Rheumatology (ACR) criteria for the diagnosis of fibromyalgia were released (7). These criteria (hereinafter 1990c) required that individuals had widespread pain for at least 3 months and the presence of 11 out of 18 specific tender points to be diagnosed as having fibromyalgia (7). However, the criticism to the 1990c emerged soon (8). One of the concerns referred to the fact that these criteria did not take into consideration the presence of other multiple symptoms associated to fibromyalgia syndrome (8, 9). As a consequence, new partially (9) and completely (10) self-administered preliminary diagnostic criteria were released. Thereby, these preliminary diagnostic criteria incorporate a renewed understanding of the fibromyalgia syndrome as a multi-symptom condition rather than the previous criteria, which was mainly focused on pain/tenderness.

Over the years, the homogeneity of fibromyalgia patients has been questioned (11–13), even prior to the development of the 1990c (14). With the new understanding of fibromyalgia as a polysymptomatic distress condition (9, 15), it is even more convincing the existence of fibromyalgia subgroups according to their complex clinical profile. However, subgrouping of fibromyalgia patients is not a simple task. Different clusters according to measurements of tender points (11, 16), fibromyalgia patients' psychological distress and/or psychosocial characteristics (17–19) have been proposed. Wilson *et al*. (13) tried to create fibromyalgia subgroups according to psychological and physical symptoms (13). Also, the fibromyalgia impact questionnaire has also been used to classify different subgroups of fibromyalgia patients (20, 21).

Recently, the polysymptomatic distress (PSD), a scale obtained from the modified 2010 ACR preliminary diagnostic criteria (hereinafter m-2010c), has been proposed as a possible measure to differentiate subgroups of fibromyalgia patients (1). However, there are fibromyalgia patients diagnosed with the m-2010c that do not necessarily need to fulfil the 1990c (15). The coexistence of the 1990c and the m-2010c might help to elucidate the occurrence of different subgroups of fibromyalgia patients according to standardised ACR diagnostic criteria which can be used within different countries. In fact, we have recently shown that the use of both criteria to diagnose fibromyalgia shows the best sensitivity and specificity characteristics when compared to rheumatologist criteria (15). Now, another question arise: do fibromyalgia patients who satisfy a single or both ACR diagnostic criteria differ in their clinical symptoms?

Subgrouping of fibromyalgia patients might help to know with greater certainty the potential benefits of different intervention programs (*e.g*. a psychological intervention would seem unsuccessful or less effective than it really is if we ignore that some fibromyalgia patients may not be psychologically impaired and therefore, the lack of improvement due to the 'floor effect' in these patients, might mask the actual potential of this intervention in those patients who really need it). Thus, attend to fibromyalgia subgroup differences might help to match treatments to patients' characteristics in order to improve their specific clinical outcomes. In fact, different subgroups of fibromyalgia patients have shown to respond differently to a standard interdisciplinary treatment programme (22). Therefore, we aimed at investigating the symptom profiles in subsets of fibromyalgia patients according to the subgroups created from the satisfaction of the 1990c and/or the m-2010c

Material and methods

Participants

We contacted fibromyalgia patients from the 8 provinces of Andalusia (southern Spain) via associations, e-mail, letter or telephone. We also contacted non-fibromyalgia participants via fibromyalgia participants' acquaintances, e-mail and Internet advertisements (23). All participants (n=960) interested in participating signed a written informed consent. The study assessments were carried out between November 2011 and January 2013. Participants were included in the study when they had no acute or terminal illness neither severe cognitive dysfunction [Mini Mental State Examination (MMSE)<10] (24). One participant had severe cognitive dysfunction. Four participants did not assist to the tender points' assessment whereas 42 did not fill out the m-2010c. A total of 913 (84 men) participants were enrolled in the study, which was reviewed and approved by the Ethics Committee of the Hospital Virgen de las Nieves, Granada, Spain.

For the present study, 4 different groups were created according to the satisfaction or not of the 1990c and/or m-2010c. Those who did not fulfil any ACR diagnostic criteria were classified as non-fibromyalgia patients. Then, 3 fibromyalgia subgroups were established: those fulfilling the 1990c only (the 1990c subgroup), those fulfilling the m-2010c only (the m-2010c subgroup), and those fulfilling both the 1990c and m-2010c (both criteria subgroup).

Procedure

At the first appointment, the MMSE was interviewed and the socio-demographic data and the Beck Depression Inventory-II (BDI-II) were filled out by participants. Furthermore, bioelectrical impedance and the tender points' examination were performed. Subsequently, participants received diverse questionnaires to be filled out at home. At the second appointment, participants returned the questionnaires to the researchers and the physical fitness tests were performed.

Outcome measures

Algometry. We assessed the minimum pain-pressure of the 18 tender points following the 1990c for classification of fibromyalgia (7) using a standard pressure algometer (FPK 20; Wagner Instruments, Greenwich, CT, USA). One trained researcher performed all the measurements. Two alternative measurements at each tender site were performed and the mean score was recorded. A pressure threshold ≤4 kg/cm^2 was considered a positive tender point. The number of positive tender points (tender points count) was recorded for each participant. An algometer score was calculated as the sum of the minimum pain-pressure values obtained for each tender point.

The modified 2010 ACR preliminary criteria. These criteria for fibromyalgia diagnosis have been described elsewhere (10, 15). Briefly, the self-administered questionnaire for the m-2010c (10) is composed of two scales. The widespread pain questionnaire asked participants to grade whether (or not) they had pain or tenderness over the previous week in 19 body areas. Each item was scored as 0 or 1, so the total score of the widespread pain index (WPI) ranges from 0 up to 19. The symptom scale questionnaire asked participants to indicate the severity of fatigue, trouble thinking or remembering and waking up tired (unrefreshed) over the previous week. The possible values were 0 (no problem), 1 (slight or mild problems; generally mild or intermittent), 2 (moderate; considerable problems, often present and/or at a moderate level) and 3 (severe; continuous, life-disturbing

problems). Patients were also asked to answer whether (or not) they had had pain or cramps in the lower abdomen, depression or headache during the previous 6 months. Each item was scored as 0 (*i.e.* no) or 1 (*i.e.* yes). The total score of symptom severity (SS) goes from 0 up to 12. The WPI and SS were subsequently summed into a 0-31 index called the polysymptomatic distress (PSD) scale (1). The diagnostic criteria for fibromyalgia are satisfied if the WPI ≥7 and the SS ≥5, or the WPI is 3–6 and the SS ≥9.

The Mini Mental State Examination was used to evaluate whether patients had severe cognitive dysfunction as part of the exclusion criteria (25). The MMSE is a brief cognitive screening test which assesses cognitive functioning.

A *portable eight-polar tactile-electrode impedanciometre* (InBody R20, Biospace, Seoul, Korea) was used to measure body fat (%). The measurements were made at least two hours after the last lunch, released from clothing and metal objects and having remained standing at least 5 minutes before the assessment. The validity and reliability of this instrument have been reported elsewhere (26, 27).

A *Pain Visual Analogue Scale (PVAS)* was used to assess the current pain intensity (28). It is composed of a continuous 10-cm line (0=no pain; 10=maximum imaginable pain) along which participants report their pain. Higher scores indicate greater pain intensity.

The Chronic Pain Self-efficacy Scale assess efficacy expectations for coping with pain (29). The total score is the sum of copying, function and pain subscales (ranging 0-300), where higher scores indicate higher self-efficacy.

The Pain Catastrophising Scale (30) was used to assess painful experiences and thoughts or feelings about pain. It contains 13 items on a 5-point scale. For this study, the total score (ranging from 0 to 52) was used, where higher scores represent a more negative appraisal of pain.

The Revised Fibromyalgia Impact Questionnaire (FIQR) comprises 21 individual questions with a rating scale of 0 to 10 (31). The FIQR total score range from 0 to 100, with a higher score indicating a greater fibromyalgia severity. The Symptom Impact Questionnaire (SIQR) (32) is a slightly modified version of the FIQR which was used with non-fibromyalgia patients. Number of questions and scoring is the same as the FIQR.

The Spanish version of the Multidimensional Fatigue Inventory (MFI-S) was used to measure fatigue severity (33). Four items with 5-point Likert scales composes the general fatigue subscale, which was used in the present study. Scores range from 4 to 20, with higher scores indicating greater fatigue.

The *Short-Form Health Survey 36 (SF-36)* is a generic instrument for assessing health-related quality of life (34). It contains 36 items grouped into 8 dimensions: physical functioning, physical role, body pain, general health, vitality, social functioning, emotional role, and mental health. The scores range from 0 to 100 in every dimension, where higher scores indicate better health. A standardised physical component (range 0-100) and a standardised mental component (range 0-100) were calculated (following the SF-36 version 2 scoring manual) and used in the present study.

The Beck Depression Inventory-II was used to assess depression severity (35). It contains 21 items and the range of score is 0–63 with higher score indicating greater depression.

The State Trait Anxiety Inventory (STAI) was used to assess the level of current anxiety (*i.e.* state anxiety) (36). This subscale contains 20 items; the range of score is 20–80, with higher scores indicating a greater state of anxiety.

The Functional Senior Fitness Test Battery was used to assess physical fitness (37). Additionally the hand grip strength test (38) was included. The reliability and feasibility of these tests has been reported elsewhere (39). The tests are described below:

The *chair sit-and-reach* test was performed as measure of lower-body flexibility. The patients started in a sitting position with one leg extended, and slowly bended 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 (minus score) or reaching beyond it (plus score) was recorded. The test was performed twice for each leg, and the average of the best value from each of them was employed.

The *back scratch* test was used as measure of upper-body flexibility. It provides a measure of the overall shoulder range of motion, as the distance between (or overlap of) the middle fingers behind the back with a ruler. The participants performed the test twice, and the average of the best value from both hands was used.

The *8-foot up-and-go* test is a measure of motor agility. It consists in standing up from a chair, walking 8 feet (2.44 m) to and around a cone, and returning to the chair in the shortest period of time. The best time from two trials was recorded.

The *30-s chair stand* test is a measure of lower-body muscle strength. It measures the number of times an individual can rise to a full stand, starting from a seated position, with the back straight and feet flat on the floor within 30 seconds.

The *handgrip strength* test was performed with a digital dynamometer (TKK 5101 Grip-D; Takey, Tokyo, Japan) as described elsewhere (38). The test was performed twice with each arm. The average score of the best value from both hands was used.

The *arm curl* test was performed as measure of upper-body muscle strength. It measures the number of times a hand weight (2.3 kg for women) can be curled through a full range of motion within 30 s. The test was performed once with each arm. The average number of repetitions was recorded.

The *6-min walk* test assesses aerobic fitness by measuring the maximum distance (in meters) that the patient is able to walk in 6 min along a 45.7 m rectangular course.

Drugs consumption. The regular consumption of analgesics and antidepressants were registered as binary variables (yes/no).

Statistical analysis

Between-group differences in continuous socio-demographic variables were tested by using independent samples t-test, whereas chi-square test was used for socio-demographic categorical variables. Given that all the physical fitness

measurements presented similar distribution across groups, a global physical fitness variable was computed. The standardised age- and sex-specific normalised index (z-score=[value-mean]/standard deviation) was created for each fitness outcome. The 8-foot up-and-go test z-score was inverted (since higher score represent lower motor agility). To obtain an overall measure of fitness, the average of all z-scores was computed. Between-group differences in all the study outcomes (PSD, tender points count, algometer score, PVAS, chronic pain self-efficacy, pain catastrophising, impact of fibromyalgia, health-related quality of life, depression, anxiety and global physical fitness) were tested with analysis of covariance (ANCOVA). Statistically significant clinical and socio-demographic variables (age, body fat (%), educational status and current occupational status), sex, analgesics and antidepressants consumption were used as covariates in all the analyses. Post-hoc analysis with the Bonferroni's correction for multiple comparisons assessed the differences across groups on all the study outcomes.

The Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, v. 20.0, Armonk, New York) was used. The level of significance was set at $p<0.05$.

Results

The clinical and socio-demographic characteristics of the study participants divided by fibromyalgia subgroup of patients are shown in Table I. Overall, the non-fibromyalgia group showed the best profile in all variables compared to the other subgroups (all, $p<0.01$), unless otherwise indicated below.

There were differences in the PSD, tender points count and algometer score across all the different subgroups (all, overall $p<0.001$) (Table II). The subgroup fulfilling both criteria presented the worst results in all variables compared to the other subgroups (all, $p<0.05$). The 1990c subgroup showed lower PSD and algometer score and higher tender points count than the m-2010c subgroup (all, $p<0.001$).

We observed significant differences in PVAS, chronic pain self-efficacy, pain catastrophising and fatigue across the different subgroups (all, overall $p<0.001$) (Table II). The subgroup fulfilling both criteria presented higher PVAS values than the 1990c subgroup and the m-2010c group (all, $p<0.001$). Chronic pain self-efficacy was lower in the m-2010c subgroup and those who fulfilled both criteria, compared to the 1990c subgroup (all, $p<0.001$). Pain catastrophising was higher in the subgroup who fulfilled both criteria and the m-2010c subgroup compared to the 1990c subgroup (all, $p<0.01$). No differences in pain catastrophising between the non-fibromyalgia group and the 1990c subgroup were observed. General fatigue was higher in the subgroup who fulfilled both criteria and the m-2010c subgroup compared to the 1990c subgroup (all, $p<0.001$).

Differences were also observed in the FIQR total score and SF-36 across the different subgroups (all, overall $p<0.001$) (Fig. 1). FIQR total score and physical health-related quality of life differed across all subgroups (all, $p<0.01$). The subgroup fulfilling both criteria presented the worst results compared to the other subgroups (all, $p<0.01$). Mental health-related quality of life was higher in the subgroup who fulfilled both criteria and the m-2010c subgroup compared to the 1990c subgroup (all, $p<0.001$). No differences in mental health-related quality of life between the non-fibromyalgia group and the 1990c subgroup were observed.

There were differences in BDI-II and STAI across the different diagnostic subgroups (all, overall $p<0.001$) (Fig. 2). Depression and anxiety were higher in the subgroup who fulfilled both criteria and the m-2010c subgroup compared to the 1990c subgroup (all, $p<0.001$). No differences in anxiety between the non-fibromyalgia group and the 1990c subgroup were observed.

Differences in global physical fitness across the different diagnostic subgroups were observed (overall $p<0.001$) (Fig. 3). Global physical fitness was higher in the subgroup who fulfilled both criteria compared to the m-2010c subgroup and the 1990c subgroup (all, $p<0.01$).

Table I. Clinical and socio-demographic characteristics of the study subgroups created from the satisfaction of the 1990 American College of Rheumatology (ACR) diagnostic criteria and/or the modified 2010 preliminary diagnostic criteria.

	Non-fibromyalgia (n=285)	1990c (n=73)	m-2010c (n=96)	Both criteria (n=459)	*p*
Variable	n (%)	n (%)	n (%)	n (%)	
Age (years), mean (SD)	49.1 (10.1)	52.4 (9.0)	52.0 (8.9)	51.7 (8.1)	<0.001
Fat (%), mean (SD)	35.1 (7.7)	40.0 (7.3)	38.9 (8.4)	28.2 (8.2)	<0.001
Marital status					
Married	202 (70.9)	53 (72.6)	67 (69.8)	349 (76.0)	0.358
Not married	83 (29.1)	20 (27.4)	29 (30.2)	110 (24.0)	
Educational status					
No studies or Primary school	117 (41.1)	56 (76.7)	64 (66.7)	259 (56.4)	<0.001
Secondary school	101 (35.4)	9 (12.3)	22 (22.9)	134 (29.2)	
University degree	67 (23.5)	8 (11.0)	10 (10.4)	66 (14.4)	
Current occupational status					
Working	123 (43.2)	26 (35.6)	33 (34.4)	109 (23.7)	<0.001
Housewife	79 (27.7)	30 (41.1)	26 (27.1)	133 (29.0)	
Not working	83 (29.1)	17 (23.3)	37 (38.5)	217 (47.3)	

Values are n (%) unless otherwise indicated. 1990c, 1990 ACR diagnostic criteria; m-2010c, modified 2010 ACR preliminary diagnostic criteria; SD, standard deviation.

Discussion

The findings of the current study suggest that fibromyalgia is a heterogeneous entity with some subgroups of patients suffering greater symptomatology and lower health-related quality of life than others do. The combination of the 1990c and the m-2010c seems useful to identify different subgroups of fibromyalgia patients. Overall, those who fulfilled both criteria presented the worst profile with severe levels of symptoms and poor health-related quality of life.

Table II. Differences in Polysymptomatic Distress Scale (PSD), tender points count, algometer score, self-reported pain (PVAS), chronic pain self-efficacy, pain catastrophising and general fatigue between diagnostic subgroups.

Variables	Non-fibromyalgia		Fibromyalgia subgroups					
			1990c only		m-2010c only		Both criteria	
PSD	6.6[a]	(6.1 - 7.2)	12.0[a]	(11.0 - 13.0)	20.7[a]	(19.9 - 21.5)	22.0[a]	(21.6 -2 2.4)
Tender points count	3.0[a]	(2.7 - 3.4)	15.7[a]	(15.1 - 16.2)	4.7[a]	(4.3 - 5.2)	16.6[a]	(16.4 - 16.8)
Algometer score (kg/cm^2)	107.1[a]	(104.8 - 109.4)	51.2[a]	(47.3 - 55.1)	93.1[a]	(89.7 - 96.5)	44.5[a]	(42.8 - 46.2)
PVAS	1.5[a,b]	(1.2 - 1.8)	3.9[a]	(3.4 - 4.4)	4.5[b,c]	(4.1 - 4.9)	5.9[a,c]	(5.7 - 6.1)
Chronic pain self-efficacy	212.2[a,b]	(205.3 - 219.0)	188.3[a,c]	(176.5 - 200.0)	148.2[a]	(138.0 - 158.4)	143.0[b,c]	(138.0 - 148.0)
Pain catastrophising	13.8[a,b]	(12.3 - 15.4)	16.8[c,d]	(14.1 - 19.4)	22.7[a,c]	(20.4 - 25.0)	23.9[b,d]	(22.7 - 25.0)
General fatigue	11.0[a,b]	(10.6 - 11.5)	14.5[a,c]	(13.8 - 15.3)	17.0[a]	(16.4 - 17.7)	17.7[b,c]	(17.4 - 18.0)

The analysis of covariance (ANCOVA) with the Bonferroni's correction for multiple comparison was used. Age, sex, educational status, current occupational status and drugs consumption were introduced as covariates. Higher algometer scores represent better levels of pain threshold. Higher chronic pain self-efficacy scores represent better levels of self-efficacy. The values represent adjusted means (95% confidence intervals). Common superscripts indicate significant (p<0.05) differences in the variable studied between the subgroups with the same letter. 1990c, 1990 American College of Rheumatology diagnostic criteria; m-2010c, modified 2010 American College of Rheumatology preliminary diagnostic criteria.

The m-2010c subgroup generally presented greater impaired symptoms and poorer health-related quality of life than the 1990c subgroup, except for experimental pain. As far as we know, this is the first study evaluating the heterogeneity of fibromyalgia patients by using both the 1990c and m-2010c.

As expected, fibromyalgia patients who fulfilled the 1990c presented higher number of positive tender points and lower pain thresholds than those who did not fulfil these criteria. A previous research suggested that neurophysiological changes might underlie the development of fibromyalgia since all patients showed the presence of hyperalgesia and allodynia (20). However, we understand that the aforementioned study has an important methodological constraint: all participants were evaluated according to the 1990c, which implies the satisfaction of 11 from the 18 tender points, and therefore, it is rational that all the patients presented hyperalgesia and allodynia. With the new ACR preliminary diagnostic criteria, patients would not necessarily have to fulfil the tender points criteria (9, 10, 15). In fact, a research prior to the development of the m-2010c already suggested this idea (12). The results of the present study are in agreement with the new concept of fibromyalgia (40–42), suggesting that patients do not need to fulfil the tender points evaluation, since many other symptoms constitute the disease (1, 10, 40, 41).

According to the results, although some fibromyalgia patients did not fulfil the tender points' criteria, their overall clinical pain did not differ from that of patients who did fulfil these criteria. One of the critiques to the 1990c is that the tender points do not objectively assess whole body pain (8). The results of the present study support this statement, since while not having the 11 tender points, the m-2010c group presented high levels of perceived pain. This is an argument in favour of the m-2010c (10),

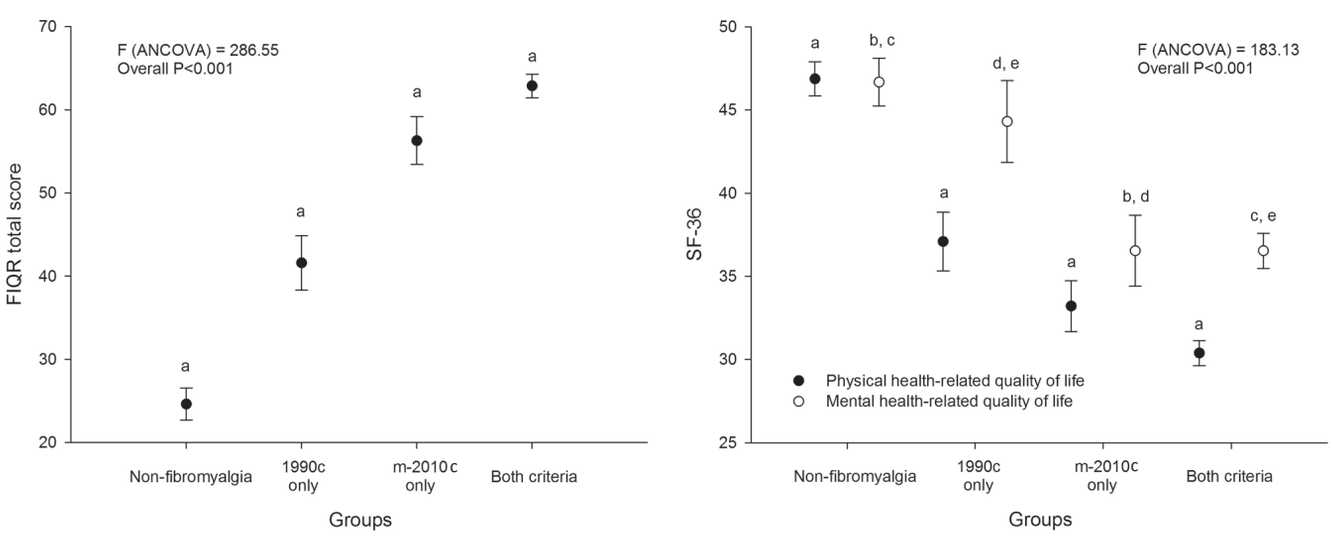

Fig. 1. Differences in impact of fibromyalgia and physical and mental health-related quality of life between diagnostic subgroups. The analysis of covariance (ANCOVA) with the Bonferroni's correction for multiple comparison was used. Age, sex, educational status, current occupational status and drugs consumption were introduced as covariates. Higher SF-36 scores represent better levels of health-related quality of life. The circles represent adjusted means and error bars the 95% confidence intervals. Common superscripts indicate significant (p≤0.01) differences between the subgroups with the same letter. 1990c, 1990 American College of Rheumatology diagnostic criteria; m-2010c, modified 2010 American College of Rheumatology preliminary diagnostic criteria.

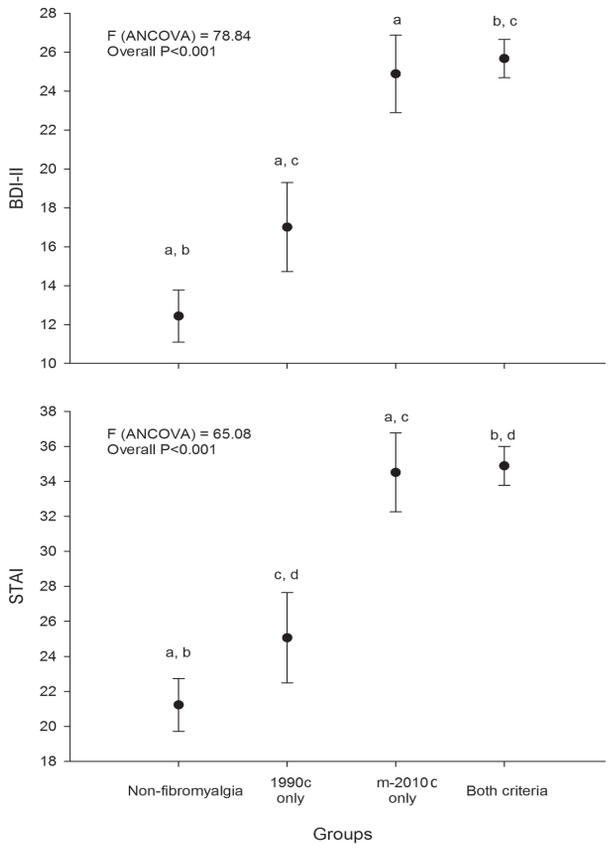

Fig. 2. Differences in mental health (depression and anxiety) between diagnostic subgroups. The analysis of covariance (ANCOVA) with the Bonferroni's correction for multiple comparison was used. Age, sex, educational status, current occupational status and drugs consumption were introduced as covariates. The circles represent adjusted means and error bars the 95% confidence intervals. Common superscripts indicate significant (p<0.05) differences between the subgroups with the same letter. 1990c, 1990 American College of Rheumatology diagnostic criteria; m-2010c, modified 2010 American College of Rheumatology preliminary diagnostic criteria.

suggesting that pain is a common symptom of the disorder but that psychological distress is a characteristic present only in some patients (20).

Strikingly, general fatigue, which is the second most reported symptom in fibromyalgia (2, 10), did not differ between the non-fibromyalgia and the 1990c subgroups. Those fulfilling the 1990c also showed lower levels of anxiety and depression than any other subgroups. Furthermore, the overall impact of fibromyalgia in the 1990c subgroup was lower than that of the other fibromyalgia subgroups. It might be suggested that there is a subgroup of fibromyalgia patients who mainly suffer from tenderness and present a better clinical picture. Yunnus *et al*. (11) previously proposed the term of '*incomplete fibromyalgia*' referring to those patients who fulfil one component of the 1990c but not the other (11 or more positive tender points or widespread pain for at least 3 months). These patients with '*incomplete fibromyalgia*' presented less frequent and severe symptoms than those with '*complete fibromyalgia*' (11). Although the fibromyalgia subgrouping methodology between this study (11) and ours is different, the final conclusions are in agreement, supporting the heterogeneity of these patients.

As expected, fibromyalgia patients who fulfilled the m-2010c presented higher PSD score than those who did not fulfil these criteria. We also observed that patients who fulfilled the m-2010c presented poorer pain self-efficacy and higher levels of chronic pain catastrophising, fatigue, depression and anxiety than those who did not. Curiously, a previous research suggested that morning tiredness, anxiety and depressive symptoms are particularly important in distinguish fibromyalgia subtypes (20), which is consistent with the results of the present study. Furthermore, anxiety and depression have been related to poor perception of health (43), which concurs with the results of the present study, since the subgroups displaying poorer mental health also manifested worse perceived health-related quality of life.

Interestingly, fulfilling both criteria resulted in the worst profile regarding PSD, both experimental and clinical pain, chronic pain self-efficacy, fibromyalgia severity, physical health-related quality of life and global physical fitness. It has been suggested that cognitive, emotional factors and pain are interconnected (44). This supports the results of the present study suggesting that, when both tenderness and symptoms are present in fibromyalgia, the relationship between them is partially cyclical, affecting each other negatively and consequently worsening the clinical picture of this subgroup of patients. The large quantity and poorer profile of symptoms of these patients might lead to poorer mental health and consequently low capacity to cope with pain. High levels of catastrophising may alter the pain perception contributing to even further spread of pain (45, 46). Thus, future research should investigate if cognitive and copying therapies might be beneficial for fibromyalgia patients with high levels of catastrophising and poor pain self-efficacy (46).

All fibromyalgia subgroups displayed lower levels of global physical fitness than the non-fibromyalgia group, and again the subgroup fulfilling both criteria showed the worst profile. Physical fitness might be an important predictor of fibromyalgia severity such that it has shown a remarkable potential utility in the fibromyalgia diagnosis (47). Fear of pain (48) limits voluntary physical activities in this population (49). Therefore, fibromyalgia patients usually reduce their activity levels (50) and tend to refrain from physical activity (51). In contrast to the patients' beliefs, physical activity avoidance entails a worsening of physical fitness levels and, consequently, a more severe symptomatology (52, 53). Thus, it has been strongly recommended that all fibromyalgia patients are physically active and take part in physical activity programs which might help them to improve their physical fitness levels (53, 54).

The FIQR total score is intended to differentiate the severity of fibromyalgia in diverse patients (31). The overall impact of fibromyalgia differed across all subgroups in the current study. The estimated means of the 1990c subgroup, the m-2010c subgroup and those fulfilling both criteria were 42, 56 and 63, which corresponds to mild, moderate

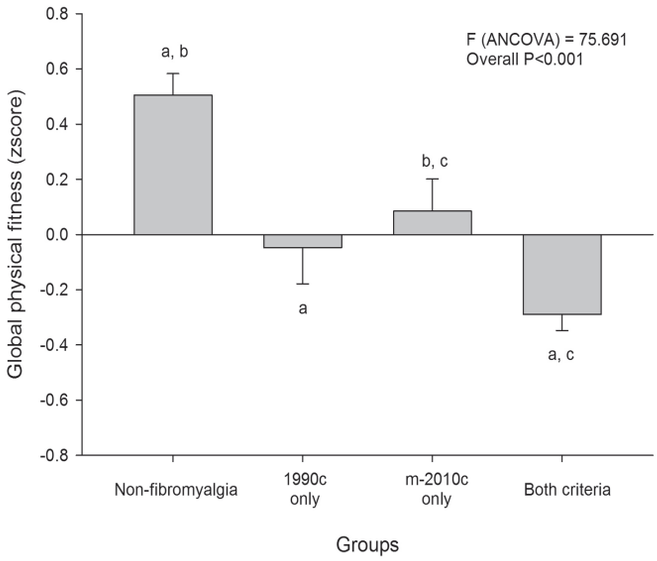

Fig. 3. Differences in general physical fitness (z-score) between diagnostic subgroups. The analysis of covariance (ANCOVA) with the Bonferroni's correction for multiple comparison was used. Age, sex, educational status, current occupational status and drugs consumption were introduced as covariates. Higher z-scores represent better levels of physical fitness. The bars represent adjusted means and error bars the standard error of the mean. Common superscripts indicate significant (p<0.001) differences between the subgroups with the same letter. 1990c, 1990 American College of Rheumatology diagnostic criteria; m-2010c, modified 2010 American College of Rheumatology preliminary diagnostic criteria.

and severe fibromyalgia, respectively. This fact speaks favourably about the consistency of this way of subgrouping by using both the 1990c and m-2010c in fibromyalgia. Due to the different overall impact and severity of symptoms across fibromyalgia subgroups, tailoring treatment to the patients' characteristics seems warranted (22).

Overall, the results of the present study were highly consistent across all the physical and psychological outcomes studied, showing that fibromyalgia is a heterogeneous condition and some patients do not necessarily need to suffer from allodynia. We previously showed that the combination of both the 1990c and the m-2010c might improve the fibromyalgia diagnosis compared to these criteria separately (15). The results of the present study further support the validation of these diagnostic criteria combination (15) and expose its utility for fibromyalgia subgrouping purpose. Furthermore, these are standardised criteria that can be used in different countries, allowing researchers to make geographical comparisons.

Limitations and strengths

The cross-sectional design of the present study does not allow establishing causal relationships. The sample might not be representative of the global fibromyalgia population. Also, the male sample size was low compared with the women's sample size; nevertheless, it is consistent with the general sex prevalence of fibromyalgia. Given that sex-separated groups showed similar results and due to the low male sample size, women and men were analysed together. Several variables were assessed using self-report instruments. Although inadvertent (*e.g.* inaccurate recall) or intentional (*e.g.* influenced by social desirability) misreported answers are feasible, all the questionnaires used in this study have shown to be valid and reliable in this population. By contrast, fitness components were objectively measured with standardised fitness tests (37, 39). Otherwise, the large sample size was the main strength of the present study, being representative of the fibromyalgia population from southern Spain. We also used both the 1990c and the m-2010c in the study sample, which allowed us to create standardised subgroups of fibromyalgia patients, which can be extensive to other populations.

In summary, the findings of the present study support the understanding of fibromyalgia as a polysymptomatic entity with highly heterogeneous patients. Due to the large variety of symptoms across fibromyalgia, subgrouping fibromyalgia patients might be interesting, since treatment options could be adapted to their specific symptomatology. The use of 1990c and the m-2010c is potentially helpful to identify subgroups of fibromyalgia patients. Furthermore, these criteria are internationally spread and might be potentially used in different countries and populations worldwide. Nonetheless, until there are clear differences in treatment or the approach to these patients, these results must be taken carefully. In this context, future intervention studies are warranted in order to elucidate the potential of this subgrouping in fibromyalgia.

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