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Physical and psychological paths toward less severe fibromyalgia: a structural equation model

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HIGHLIGHTS

- Resilience and catastrophizing, through distress, are related to fibromyalgia severity.
- Active lifestyle, directly and through fitness and fatigue, is related to fibromyalgia severity.
- Declarative memory (objectively measured) is not related to fibromyalgia severity.
- Subjective and objective assessments of fitness provide complementary information in fibromyalgia.

Abstract

Objectives. Previous research suggested isolated associations of physical and psychological factors with fibromyalgia severity. Integration of physical and psychological, experienced and observed, modifiable factors associated with fibromyalgia severity in a single model will reveal therapeutic paths toward less severity of disease. We aimed to examine an encompassing model of determinants of fibromyalgia severity.

Methods. This observational, population-based cross-sectional study included 569 people with fibromyalgia. An integrative model of fibromyalgia severity was tested by using structural equation modelling. This model included 8 factors: resilience, catastrophizing, active lifestyle, declarative memory, subjective fitness, objective fitness, psychological distress, and physical fatigue.

Results. Two core paths were associated with reduced fibromyalgia severity: 1) a psychological path connecting resilience and low catastrophizing with low distress and 2) a physical path, connecting a more active lifestyle (directly and via high objective and subjective physical fitness) with low fatigue. Additional interconnecting paths especially suggested a connection from the psychological to physical path. Our model explained 83% of the fibromyalgia severity.

Conclusions. The present model integrated the complexity of mutually influencing factors of fibromyalgia severity, which may help in better understanding the disease. It emphasised the importance of the following: 1) physical factors and psychological factors and their interconnections, 2) patients' experiences and clinical measurements, and 3) positive and negative signs such as physical fitness and distress. Future longitudinal and experimental

research should aim at testing clinical implications implied by the model. For instance, to reduce fatigue, exercise should enhance not only objective fitness but also fitness-related perceptions. Reducing distress and fatigue seems crucial for lowering fibromyalgia severity.

Keywords. adaptation; fibromyalgia impact; physical activity; quality of life; rheumatic and musculoskeletal diseases

Introduction

Fibromyalgia is a common disease consisting of chronic widespread pain and other symptoms including fatigue, unrefreshing sleep, cognitive difficulties and somatic symptoms. It represents a serious burden that can impose significant disability. The Fibromyalgia Impact Questionnaire (FIQ), or its revised version (FIQR), is considered the gold standard for assessing fibromyalgia severity [1]. This self-reporting instrument evaluates the previous 7-day average level of pain, energy, mental health and memory problems among other symptoms.

Fibromyalgia is poorly understood by society and healthcare professionals [2]. Because the disease has no cure, the main aim of therapy is to reduce its severity [3]. Therefore, identifying factors that are associated with reduced symptom burden has social, clinical and public health interest. These factors might be possible therapeutic targets if they are modifiable.

Several psychological and physical factors have been identified as potential determinants of fibromyalgia severity [4]. Among psychological factors, particularly meaningful are those related to maintaining patients' functioning, despite ongoing stress; namely, psychological resilience [5,6]. For example, high positive affect and low pain catastrophizing are associated

with low psychological distress, which in turn is related to low symptom severity [7,8]. Among physical factors, engaging in physical activity is associated with reduced fatigue in fibromyalgia [9].

The European League Against Rheumatism has postulated that any type of pain encompasses multiple and mutually interacting factors [10]. However, previous models of fibromyalgia severity mostly focused on isolated factors, which, from a clinical perspective, is somehow artificial. Other common caveats in the literature are the inclusion of mixed chronic pain samples (e.g., fibromyalgia and osteoarthritis analysed as a group [11]) or testing models that omitted physical factors (e.g., the association of psychological resilience with fibromyalgia severity [12]) or relied on self-reported measurements only (e.g., physical, social, and psychological factors assessed by questionnaires [4]). Thus, testing of more integrative models is needed, including variables assessed with a divergent method, that account for the covariance and influences between physical and psychological factors of relevance in fibromyalgia severity [8,13].

The al-Ándalus project was conducted in a large sample of individuals with fibromyalgia and included an extensive set of objective and subjective measures of physical and psychological variables that may be grouped into 8 factors [14]; namely, resilience, catastrophizing, active lifestyle, declarative memory, subjective fitness, objective fitness, psychological distress, and physical fatigue. Therefore, by considering the complex associations of these 8 (physical and psychological) factors within a single model, this project may provide a comprehensive picture of the determinants of (and their pathways to) fibromyalgia severity.

Figure 1 displays 3 factors that can be targeted in treatment on the left, the overall severity of fibromyalgia on the right, and several factors that can be both maintaining factors and outcome variables in the middle. We hypothesised that, in relation to fibromyalgia severity, two pathways coexist (physical and psychological) and interplay [4,10]. The physical pathway goes from active lifestyle to physical fatigue, directly [15] and through objective (observed) and subjective (self-reported) physical fitness [16]. In the psychological pathway, resilience and catastrophizing are related to psychological distress [7]. Moreover, physical fatigue is associated with psychological distress [17]. Finally, physical fatigue and psychological distress are related to fibromyalgia severity [17,18].

Several studies emphasised the importance of differentiating between objective and subjective instruments when examining determinants and health outcomes in fibromyalgia [19,20]. For instance, cognitive problems are core to fibromyalgia [21], but a study with a small sample found no association between objectively evaluated declarative memory and fibromyalgia severity [20]. In the present study, we expected to corroborate this lack of association between objective memory performance and fibromyalgia severity in a large sample.

This study aimed at testing a comprehensive and integrative model of fibromyalgia severity accounting for modifiable psychological and physical factors *per se* and their mutual influences. This model might help healthcare providers by providing a road map for reducing fibromyalgia severity. If our hypotheses are confirmed, the model may indicate that to augment the potential positive effects of pursuing an active lifestyle on reducing fatigue, both the physical performance and related appraisals (i.e., objective and subjective fitness, respectively) should be enhanced. Additionally, we would identify 3 potential pathways to

lower psychological distress and consequently fibromyalgia severity, namely, to increase resilience, reduce catastrophizing or reduce physical fatigue.

Methods

The reporting of the paper follows STROBE guidelines (http://www.equator-network.org/reporting-guidelines/strobe/).

Participants

We focused on including a representative sample of people with fibromyalgia from southern Spain (Andalusia). Participants were mostly recruited from different local fibromyalgia associations throughout the 8 provinces of Andalusia. Additional participants were recruited via e-mail, letter, telephone, and announcements in local mass media and university websites. In this observational, population-based cross-sectional study, the data collection was performed in 2 waves: the first wave was assessed between November 2011 and January 2013 and the second wave was assessed between September 2015 and September 2016. The inclusion criteria for participating in the present study were as follows: 1) a certified diagnosis of fibromyalgia by a rheumatologist and 2) current verification of fibromyalgia according to 1990 American College of Rheumatology (ACR) criteria or the modified 2011 preliminary criteria questionnaire [21].

All interested participants (n = 750) gave their written informed consent after receiving detailed information about the study aims and procedures. The al-Ándalus project was reviewed and approved by the Ethics Committee of the Hospital Virgen de las Nieves (Granada, Spain) (registration number: 15/11/2013-N72). The ethical guidelines of the Declaration of Helsinki (modified in 2000) were followed.

Measures

Detailed description of the instruments are provided elsewhere [14]. Briefly, the present study included 31 variables that according to exploratory factor analyses available elsewhere [14] were summarised in the 8 following factors:

Resilience, which included subjective levels of emotional repair, positive affect, and optimism reported on the Trait Meta-Mood Scale (TMMS-24 [22]), Positive and Negative Affect Schedule (PANAS [23]), and Life Orientation Test Revised [24], respectively. Thus, resilience was operationalised as an umbrella term involving positive mood, emotions, and cognitions.

Catastrophizing, which included subjective levels of rumination, magnification, and helplessness reported on the Pain Catastrophizing Scale ([25]).

Active lifestyle, which included objective levels (min/day) of sedentary time, light physical activity, and moderate physical activity measured by triaxial accelerometers GT3X+ (Actigraph, Pensacola, FL, USA). We have provided detailed description of this assessment previously [9].

Declarative memory, which included objective levels of verbal learning, delayed recall, and recognition memory measured by performance on the Rey Auditory Verbal Learning Test (RAVLT [26]).

Subjective fitness, which included levels of speed-agility, muscular strength, flexibility, and cardiorespiratory fitness reported on the International Fitness Scale ([27]).

Objective fitness, which included participants' performance in the following tests: the 30-sec arm curl, 30-sec chair stand, 6-min walk, and chair sit-and-reach tests from the Senior Fitness Test (SFT) battery [16].

Psychological distress, which included subjective levels of anxiety state, negative affect, sleep quality, and depression from the State-Trait Anxiety Inventory ([28]), PANAS [23], Pittsburgh Sleep Quality Index ([29]), and Beck Depression Inventory-II (BDI-II [30]), respectively, as well as mental health and emotional role both from the Medical Outcomes Study 36-item Short Form (SF-36 [31]).

Physical fatigue, which included subjective levels of physical fatigue, general fatigue, and reduced activity from the Multidimensional Fatigue Inventory [32] and vitality and physical role from the SF-36 [31].

For the purpose of the present study, in addition to the above-mentioned factors, we included *fibromyalgia severity* as the outcome factor. This factor reflects the perceived levels of function, overall impact, and symptoms of fibromyalgia [1].

Procedure

Assessments were conducted over 3 consecutive days. On day 1, sociodemographic characteristics, clinical data, the BDI-II and tender point count were collected. Participants then completed several questionnaires at home, and on day 3, they returned the questionnaires and performed the RAVLT and SFT. Participants were then given an accelerometer to be worn for 9 consecutive days.

Statistical analyses

IBM SPSS for Windows v22.0 (Armonk, NY, USA) and Mplus v6.12 (Los Angeles, CA, USA) were used for descriptive and structural equation modelling, respectively. Before conducting the main analyses, assumptions of structural equation modelling were corroborated (see, online supplementary material). Internal consistency and convergent validity of the variables included in the model were computed with the composite reliability (CR) and average variance extracted (AVE). CR >0.70 and AVE >0.50 were considered acceptable; as an alternative and with CR >0.60, AVE <0.50 was also acceptable [33].

In the present study, we followed a model development strategy by using the robust maximum likelihood estimation method. The model goodness-of-fit was measured by 1) the Yuan-Bentler scaled χ^2 statistic (Y-B χ^2) and its degree of freedom (df) and p values, 2) the root mean square error of approximation (RMSEA) with the 90% confidence interval (CI), and the 3) Comparative Fix Index (CFI), as an incremental fit index. An acceptable model fit was defined as RMSEA <0.07 and CFI ≥0.90 [34]. Given our large sample size, we also considered the Y-B χ^2/df ratio; Y-B χ^2/df between 1 and 3 is deemed adequate [34].

Results

Among 750 interested participants, 89 were excluded because they did not have a previous fibromyalgia diagnosis (n = 39) or they did not fulfill the fibromyalgia diagnosis as examined by the research team (n = 50). Among the remaining 661 participants, 569 who completed all the assessments were included in the present study; their characteristics are in Table 1.

With regard to the measurement model, Table 2 shows the factor loadings (β coefficients) of the 34 variables grouped into 9 factors and their CR and AVE values; all

values were acceptable. The model goodness-of-fit was also adequate (Y-B χ^2 = 1332.97, df = 491, p<0.001; RMSEA = 0.06; CFI = 0.90; Y-B χ^2/df = 2.71).

With regard to the structural model, the hypothesised model was not fully proven (Y-B χ^2 = 1537.74, df = 510, p < 0.001; RMSEA = 0.06; CFI = 0.88; Y-B χ^2/df = 3.02), so we made some adjustments based on modification indices. Only factors supported by previous empirical studies were followed, namely, direct paths from resilience to 1) subjective fitness and 2) fibromyalgia severity as well as from catastrophizing to 3) objective and 4) subjective fitness. Figure 2 and Table 2 show the adjustment of this final model, which was adequate (Y-B χ^2 = 1368.10, df = 505, p<0.001; RMSEA = 0.06; CFI = 0.90; Y-B χ^2/df = 2.71). When the hypothesised and final models were compared, the final model showed better goodness-of-fit indices and parsimony (Y-B χ^2 scaled difference = 168.36, df = 5, p<0.001). Details on the indirect effects, total and specific, established among the structural model variables are in Supplementary Table 5.

Discussion

The present study confirmed the existence of two core (psychological and physical) pathways of fibromyalgia severity: 1) a psychological path of high resilience and low catastrophizing (2 inversely correlated predictors) both associated with low psychological distress and, consequently, reduced fibromyalgia severity and also a direct non-hypothesised path from high resilience to reduced fibromyalgia severity; and 2) a physical path of a more active lifestyle (directly and via increased physical fitness) leading to low physical fatigue, in turn related to reduced fibromyalgia severity. The psychological path was connected to the physical path: catastrophizing was connected to physical fitness (objectively and subjectively assessed) and increased resilience was associated with increased subjective physical fitness.

Our final model also showed other interconnections between the 2 core (physical and psychological) pathways. We confirmed that catastrophizing and resilience was correlated with active lifestyle, the hypothesised pathway from physical fatigue to psychological distress, and non-hypothesised pathways emerged, for instance, from resilience to subjective fitness.

Fibromyalgia is considered a medically unexplained disease whose symptoms are mostly invisible [2]. As a consequence, people with fibromyalgia often are medically and socially invalidated probably because of a lack of understanding of the disease [2]. In line with recent research, the present model highlighted the importance of complementing clinical observations with patient-reported information [19]. For instance, high resilience predicted a better subjective but not objective score of physical fitness, and both measures of fitness affected physical fatigue. Therefore, the present structural equation model emphasises the need to pay attention to both patients' experiences and their clinical measurements.

Catastrophizing, psychological distress, active lifestyle and physical fatigue are well-known determinants of fibromyalgia severity [9,11,17,35]. The present model identified additional (protective) factors of fibromyalgia severity; namely, resilience and (subjective and objective) physical fitness. Of note, the model explained 83% of the fibromyalgia severity, which suggests that we included the key factors to be assessed and monitored in fibromyalgia. However, the assessment of all the factors included in the model is highly time-consuming and consequently unlikely to be applicable in clinical settings, where time availability is restricted. Thus, further research simplifying the assessments of the present study while accounting for all its factors is warranted. Specifically, the validity of visual analogue and numeric rating scales for assessing patients' appraisals must be tested. Furthermore,

smartphone apps may help to objectively quantify active lifestyle and physical fitness remotely [36]. Finally, the objective measurement of declarative memory was not shown to have much relevance for fibromyalgia severity and might be better replaced by a subjective assessment [20].

Previous literature has shown most of the relationships included in the present model but only in isolated models; for example, the individual associations of active lifestyle with subjective physical function has been reported previously [37]. By including all the factors in a single model, the present study yielded a more integrated view of fibromyalgia severity. For instance, from our data, a non-hypothesised path from high resilience to better subjective physical fitness emerged, which might provide preliminary evidence of interest for designing effective exercise programmes. Therefore, the present comprehensive model provides an overall picture of fibromyalgia severity instead of showing isolated associations, which might help in better understanding fibromyalgia and shed some light on its management.

If corroborated in future longitudinal and clinical-experimental studies, our model would tentatively suggest clinical implications by identifying the pathways by which several factors may influence each other and their final impact on fibromyalgia severity. According to the 2017 European League Against Rheumatism evidence-based recommendations for managing fibromyalgia, physical exercise is the first-line treatment for the disease [3]. According to our model, an active lifestyle is linked to not only (subjective and objective) physical fitness and fatigue but also resilience and catastrophizing. Thus, to reduce fatigue, both the physical and psychological function of a person with fibromyalgia seem to matter.

Exercise programmes in fibromyalgia usually focus on reducing symptoms or enhancing objective physical fitness. However, our findings show that over and above

objective physical fitness, the subjective assessment of fitness is also associated with physical fatigue. As compared with their levels of objective fitness, people with fibromyalgia experience remarkably lower levels of subjective fitness [19]. People who experience lower subjective fitness despite higher fitness levels observed in performance tasks may be also more likely to perceive exercise as stressful. Instead of enhancing physical fitness, in this group, other interventions might be tried to deal with subjective fitness that impedes recovery, for instance, engaging in meditative exercise (e.g., Tai Chi, Yoga, and Biodanza), with an exposure to confident and mindful movement. In this type of mind–body programme, people engage in gentle movements, which may lead enhanced physical performance and also experiencing the movement self-confidently and pleasantly. Consequently, meditative exercise could lower fatigue in fibromyalgia by soothing its well-known aberrations of the central nervous system such as alterations in the insula that may influence fatigue [38]. Meditative exercise may revert these aberrations by, for instance, preserving grey matter volume in the insula [39].

Because the experience of fibromyalgia differs among people [14] and within the same individual over time [15], adopting patient-centred approaches is recommended for this disease [10]. Thus, future research needs to test more sophisticated and dynamic models accounting for differences both between and within individuals. To accomplish such a goal, intensive longitudinal data in a large sample should be collected. In this context, online research implemented in electronic devices seems particularly feasible.

Our study has some limitations. First, our cross-sectional design did not allow us to test the directionality of our findings. Also, the explained variance of fibromyalgia severity will be lower in longitudinal models integrating also within-subject variance. Second, because

of the theory-driven a priori predictions, we did not test alternative models. Third, despite the comprehensiveness of our model, we cannot account for all the possible predisposing or perpetuating factors of fibromyalgia. We decided to focus on factors that are modifiable and useful therapeutic targets. To enhance the parsimony of our model, we did not include biographic, socioeconomic and clinical information (e.g., age and years since fibromyalgia diagnosis, respectively). Additionally, from the perspective of the biopsychosocial approach, a modifiable factor involving information about social functioning (e.g., social support) may increase the comprehensiveness of the present model. Fourth, to ensure the robustness and generalizability of our model, a replication study in an independent sample is desirable.

Conclusions

Our model accounted for a large proportion of variance in fibromyalgia severity ($R^2 = 0.83$), which suggests that the key potential correlates of severity (as measured by the FIQR) were considered, which may suggest that resilience, catastrophizing, active lifestyle, subjective fitness, objective fitness, psychological distress, and physical fatigue should be assessed and monitored when accounting for fibromyalgia severity. In particular, our findings emphasized the importance of 1) physical factors, psychological factors and their interconnections; 2) patients' experiences and clinical measurements; and 3) positive and negative signs such as physical fitness and distress. To elucidate the causality of our findings, future longitudinal and clinical-experimental research might confirm the clinical implications indicated by our study. If the hypothesised directionality of the present study associations is confirmed, then to reduce fatigue in fibromyalgia, therapy should focus on exercise to enhance objective fitness but also related perceptions because both are associated to fatigue. Also, reducing distress and fatigue seem crucial for lowering fibromyalgia severity. To ensure feasibility in daily clinical

practice, assessments of the factors included in present study should be simplified. In this context, validated brief self-reports combined with objective measurements based on information technology developments are needed, such as the visual analog scale and smartphone apps.

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Conflict of interest. None declared.

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Legends

Figure 1. Hypothesised model involving 2 core paths: a psychological path in yellow background and a physical path in blue background. Fibromyalgia severity is in green background because it is determined by both (psychological and physical) paths. The symbols + and – indicate positive and negative hypothesised associations, respectively.

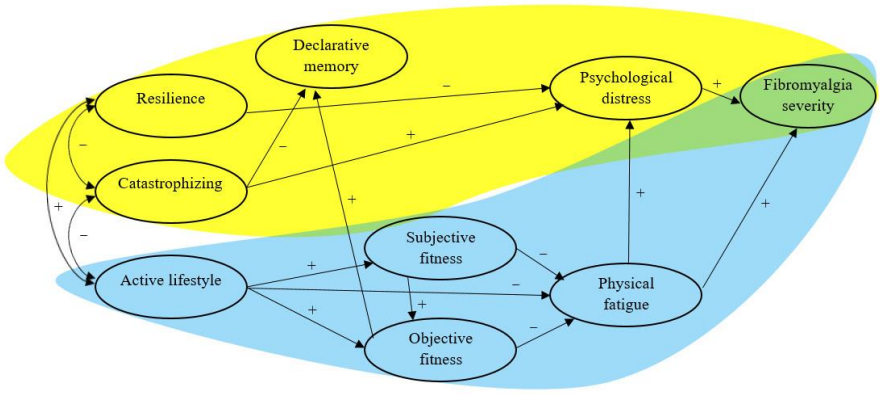
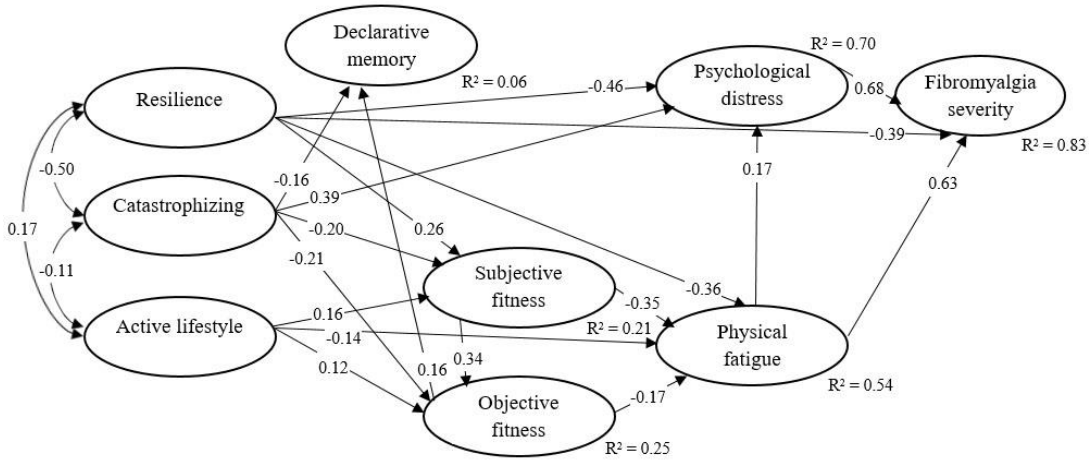


Figure 2. Estimated standardised regression and squared multiple regression (R^2) coefficients for the final model. All estimated standardised regression and squared multiple regression (R^2) coefficients were significant. R^2 reflects the amount of factor variance associated with variance of its predictors. For instance, a 25% of the variance of objective fitness was associated with the scores in catastrophizing, active lifestyle and subjective fitness.



Tables

Table 1. Sociodemographic and clinical characteristics of all participants and participants within each profile (n=569).

Age (years), mean (SD)		52.1	(8.6)
Sex, n (%)			
	Men	32	(5.6)
	Women	537	(94.4)
Education level, n (%)			
	Unfinished studies	128	(22.5)
	Primary	247	(43.4)
	Secondary (and vocational)	124	(21.8)
	University	66	(11.6)
	Missing data	4	(0.7)
Marital status, n (%)			
	Married	422	(74.2)
	Single	48	(8.4)
	Separated/divorced	75	(13.2)
	Widow(ed)	23	(4.0)
	Missing data	1	(0.2)
Working status, n (%)			
	Working	151	(26.5)
	Houseworker	167	(29.3)
	Incapacity pension or sick leave	131	(23.0)
	Unemployed	92	(16.2)
	Others	27	(4.7)
	Missing data	1	(0.2)
Fibromyalgia criteria, n (%)			
	Only 1990 ACR criteria	47	(8.2)
	Only m-2011 criteria	68	(12.0)
	Both 1990 and 2011 criteria	454	(79.8)

ACR, American College of Rheumatology; m-2011, modified 2011 preliminary criteria questionnaire for fibromyalgia diagnosis

Table 2. Reliability, validity and estimates of the measurement model and direct effects estimates of the structural model (n=569).

Measurement model								
Indicator variable		**Factor**	**CR**	**AVE**	**R^2**	**B**	**S.E.**	**β**
Emotional repair		Resilience	0.78	0.54	0.65	1.19	0.08	0.81***
Positive affect					0.54	1		0.73***
Optimism					0.43	0.35	0.03	0.66***
Rumination		Catastrophizing	0.91	0.76	0.72	1		0.85***
Magnification					0.69	0.71	0.03	0.83***
Helplessness					0.88	1.45	0.05	0.94***
Sedentary behaviour		Active lifestyle	0.80	0.58	0.85	1		0.92***
Light activity					0.60	0.77	0.06	0.77***
Moderate activity					0.29	0.16	0.01	0.53***
Recognition memory		Declarative memory	0.82	0.61	0.39	1.51	0.11	0.62***
Delayed recall					0.65	1		0.81***
Verbal learning					0.80	3.53	0.20	0.89***
30-s arm curl test		Objective fitness	0.81	0.52	0.64	1.48	0.07	0.80***

30-s chair stand test					0.73	1		0.86***
6-min walk test					0.47	20.79	1.32	0.69***
Chair sit-and-reach test					0.25	2.19	0.19	0.50***
Speed agility		Subjective fitness	0.75	0.44	0.74	1.27	0.08	0.86***
Muscular strength					0.46	1		0.68***
Flexibility					0.35	0.96	0.08	0.59***
Cardiorespiratory fitness					0.21	0.71	0.07	0.46***
Physical fatigue		Physical fatigue	0.77	0.41	0.48	1.24	0.09	0.70***
General fatigue					0.43	1		0.66***
Vitality					0.39	6.49	0.55	0.62***
Reduced activity					0.33	1.61	0.18	0.57***
Physical role					0.40	7.95	0.83	0.64***
Anxiety state		Psychological distress	0.87	0.53	0.68	1.13	0.06	0.82***
Mental health					0.64	1.84	0.10	0.80***
Negative affect					0.56	0.73	0.04	0.75***
Emotional role					0.46	2.17	0.13	0.68***

Depression					0.59	1		0.77***
Sleep quality					0.24	0.22	0.02	0.49***
Fibromyalgia function		Fibromyalgia severity	0.81	0.58	0.50	1		0.71***
Fibromyalgia overall impact					0.54	0.86	0.05	0.74***
Fibromyalgia symptoms					0.71	1.40	0.09	0.84***
Structural model								
Predictor variable		**Criterion variable**				**B**	**S.E.**	**β**
Resilience	→	Subjective fitness				0.03	0.01	0.26***
Resilience	→	Physical fatigue				-0.12	0.02	-0.36***
Resilience	→	Psychological distress				-0.80	0.10	-0.46***
Resilience	→	Fibromyalgia severity				-0.35	0.08	-0.39***
Catastrophizing	→	Declarative memory				-0.10	0.03	-0.16**
Catastrophizing	→	Subjective fitness				-0.03	0.01	-0.20***
Catastrophizing	→	Objective fitness				-0.15	0.03	-0.21***

Catastrophizing	→	Psychological distress				0.88	0.09	0.39***
Active lifestyle	→	Objective fitness				0.01	0.01	0.12*
Active lifestyle	→	Subjective fitness				0.01	0.01	0.16**
Active lifestyle	→	Physical fatigue				-0.01	0.01	-0.14**
Subjective fitness	→	Objective fitness				1.66	0.25	0.34***
Subjective fitness	→	Physical fatigue				-1.07	0.22	-0.35***
Objective fitness	→	Declarative memory				0.14	0.05	0.16**
Objective fitness	→	Physical fatigue				-0.11	0.03	-0.17***
Physical fatigue	→	Psychological distress				0.85	0.28	0.17**
Physical fatigue	→	Fibromyalgia severity				1.66	0.26	0.63***
Psychological distress	→	Fibromyalgia severity				0.35	0.04	0.68***

$*p<0.05$, $**p<0.01$, $***p<0.001$

CR, composite reliability; AVE, average variance extracted; R^2, squared multiple correlation; B, unstandardised coefficient; β, standardised coefficient; S.E., standard error.