Physical fitness is associated with anxiety levels in women with fibromyalgia: the al-Ándalus project

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Abstract

Purpose To assess the independent associations of individual physical fitness components with anxiety in women with fibromyalgia and to test which physical fitness component shows the greatest association.

Methods This population-based cross-sectional study included 439 women with fibromyalgia (age 52.2 ± 8.0 years). Anxiety symptoms were measured with the State Trait Anxiety Inventory (STAI) and the anxiety item of the Revised Fibromyalgia Impact Questionnaire (FIQR). Physical fitness was assessed through the Senior Fitness Test battery and handgrip strength test.

Results Overall, lower physical fitness was associated with higher anxiety levels (all, p < 0.05). The coefficients of the optimal regression model (stepwise selection method) between anxiety symptoms and physical fitness components adjusted for age, body fat percentage and anxiolytics intake showed that the back scratch test (b = -0.18), the chair sit-and-reach test (b = -0.12; p = 0.027) and the 6-min walk test (b = -0.02; p = 0.024) were independently and inversely associated with STAI. The back scratch test and the arm-curl test were associated with FIQR-anxiety (b = -0.05; p < 0.001 and b = -0.07; p = 0.021, respectively).

Conclusion Physical fitness was inversely and consistently associated with anxiety in women with fibromyalgia, regardless of the fitness component evaluated. In particular, upper-body flexibility was an independent indicator of anxiety levels, followed by cardiorespiratory fitness and muscular strength.

Keywords Chronic pain · Functional capacity · Mental health · Flexibility

Introduction

Anxiety, which is a key symptom in fibromyalgia [1], is associated with higher levels of pain and neuropsychological disorders in these patients [2]. Anxiety is also associated with higher fibromyalgia impact, and patients with high levels of anxiety usually present increased risk of severe fibromyalgia [3, 4].

The association of different components of physical fitness with anxiety levels in women with fibromyalgia is controversial. A number of studies showed that physical fitness is inversely associated with anxiety levels (as assessed with the Hospital Anxiety and Depression Scale and the State Trait Anxiety Inventory (STAI)) in fibromyalgia patients [6–8], while other studies reported no relationship between physical fitness and anxiety [5, 9].

Since physical fitness is a multicomponent modifiable factor powerfully related to health and disease in different...
populations and consistently associated with pain levels in fibromyalgia [10], it is important to comprehensively characterize the association of different fitness components (cardiorespiratory fitness, muscular strength, flexibility and motor agility) with anxiety symptoms in a large sample of women with fibromyalgia. In addition, it is of clinical interest to address whether different components of fitness are independently associated with anxiety levels.

Therefore, the aims of the present study were: (1) to assess the association of different physical fitness components with anxiety in women with fibromyalgia and (2) to study which fitness components are independently associated with anxiety in this population.

Methods

Participants and study design

The sampling procedures employed in this population-based cross-sectional study to recruit a representative sample of women with fibromyalgia from Andalusia (southern Spain), and the inclusion criteria, are described elsewhere [1]. A total of 439 women with fibromyalgia volunteered to participate and met the inclusion criteria. All participants were informed about the aims and study procedures (approved by the Ethics Committee of Hospital Virgen de las Nieves) and signed their written informed consent before taking part in the study.

Measures

Anthropometry and body composition

A portable eight-polar tactile-electrode impedanciometer (InBody R20, Biospace, Seoul, Korea) was used to measure body fat percentage.

Drug consumption

The intake of anxiolytics was registered as binary variable (yes/no).

Anxiety symptom assessment

The State Trait Anxiety Inventory-I (STAI) was used to assess the level of state anxiety [11, 12]. It is a 20-item self-administered questionnaire (range 20–80, where higher scores indicate greater state of anxiety).

We also employed the anxiety subscale from the FIQR [13] (FIQR-anxiety). This item assesses the anxiety level (visual analogue scale 0–10, where higher score indicates higher anxiety) in the context of the past 7 days.

Physical fitness assessment

Physical fitness was assessed with the Senior Fitness Test battery [14] (6-min walk, chair stand, arm curl, chair sit-and-reach, back scratch and 8-foot up-and-go tests) and the handgrip strength test [15]. This battery is feasible and reliable in women with fibromyalgia, and a complete description of each test is described elsewhere [16].

Statistical analysis

The association of physical fitness with anxiety levels was assessed with multivariate linear regression (objective 1). Each anxiety measure (STAI or FIQR-anxiety) was included as dependent variable, and the different fitness tests as independent variables in separate models. The models were adjusted for age, body fat percentage [17] and anxiolytics intake [18], since these variables are potential confounders of the above-mentioned relationship.

Stepwise regression was used to address which fitness components were independently associated with anxiety (dependent variable, objective 2). Age, body fat percentage, anxiolytics intake and all the fitness tests were entered into the model using a stepwise procedure. This procedure introduces the variables step by step into the model (if \( p < 0.05 \)) according to the strength of the association with the outcome.

All the statistical analyses were performed with the Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, version 20.0; Armonk, NY, USA), and the level of significance was set at \( \alpha = 0.05 \).

Results

Table 1 shows the socio-demographic and clinical characteristics of the study participants. Of the participants, 43 % (\( n = 189 \)) and 28 % (\( n = 122 \)) had moderate and severe anxiety (i.e., STAI scores of \( \geq 30 \) and \( \geq 45 \), respectively) [11, 12].

The association of the different fitness tests with anxiety symptoms (objective 1) is displayed in Table 2. Overall, all the fitness tests were inversely associated with anxiety symptoms (all, \( p < 0.05 \)), with the exception of the 8-foot up-and-go test, which presented a positive association, since lower scores (time, in seconds) indicate better performance.

The coefficients of the optimal regression model (stepwise selection method) between anxiety symptoms and physical fitness components adjusted for age, body fat percentage and anxiolytics intake are presented in Table 3. The back scratch (STAI: \( b = -0.179; p = 0.001 \); FIQR-anxiety: \( b = -0.047; p < 0.001 \)), the chair sit-and-reach (\( b = -0.115; p = 0.025 \)) and the 6-min walk tests (\( b = -0.018; p = 0.024 \)) were independently associated
with STAI. The arm-curl test was associated with FIQR-anxiety \( (b = -0.068; p = 0.021) \).

## Discussion

The main findings of the present study show that physical fitness is consistently associated with anxiety symptoms in women with fibromyalgia, regardless of the fitness component evaluated. Flexibility, upper-body muscular strength and cardiorespiratory fitness were independently associated with anxiety levels.

Among the fitness components, upper-body flexibility was the most strongly associated with anxiety. In agreement with these results, Aparicio et al. [19] observed that the back scratch test and the FIQR-anxiety were significantly correlated. Interestingly, upper-body flexibility has shown to be an independent indicator of pain levels [10] and overall fibromyalgia severity [20], underlying the potential relevance of flexibility levels in this population.

Our results are in line with a previous randomized controlled trial which shows that flexibility exercise might simultaneously improve the range of motion and anxiety symptoms in women with fibromyalgia [8]. Gavi et al. [8]...
also observed a negative relationship between flexibility and anxiety, and improvements in anxiety symptoms after increasing flexibility. Future intervention studies to elucidate whether improvements in flexibility might lead to improvements in anxiety are warranted.

We speculate that the association between upper-body flexibility and anxiety symptoms may be due to the stiffness suffered by fibromyalgia patients. Anxiety and stiffness are mutually dependent variables and if patients perceive less muscular pain and stiffness, anxiety is likely to decrease [3]. It must be also taken into account that most people with anxiety exhibit increased muscle tension [21, 22] with special emphasis in the trapezius muscles [1], where some fibromyalgia tender points are located.

We found an inverse relationship between upper-body strength, as measured by the arm-curl test, and anxiety (confirmed only as measured by the FIQR-anxiety). In people without fibromyalgia, Khorvash et al. [23] studied the effect of strength and endurance training on anxiety levels and found that both reduced anxiety. Similarly, Van Milligen et al. [24] observed, in a larger sample size, an inverse relationship between strength and anxiety. Indeed, poorer strength was found to be a significant predictor of the persistence of anxiety disorders. Accordingly, Romero-Zurita et al. [25] demonstrated that Tai-chi training might result in concurrent improvements in muscle strength and anxiety levels in women with fibromyalgia.

Another major finding of the present study was that cardiorespiratory fitness was significantly associated with anxiety levels (as measured with the STAI). These results concur with intervention studies by Gowans et al. [7], who showed that anxiety (as measured with STAI) decreased by 10 % following aerobic exercise training, or Tomas-Carus et al. [6], who observed that anxiety decreased by 41 % after a warm water exercise program.

In the current study, the total score of the STAI questionnaire was inversely associated with the back scratch, 6-min walk and chair sit-and-reaching tests, whereas FIQR-anxiety dimension was inversely associated with the back scratch and the arm curl tests. These differences might be due to the characteristics of the STAI and FIQR: the STAI measures current anxiety, while the FIQR-anxiety measures anxiety for the past week. In addition, it must be noted that the STAI is a more specific and comprehensive

| Table 2 Linear regression analysis assessing the association of physical fitness with anxiety symptoms in women with fibromyalgia (n = 439) |

<table>
<thead>
<tr>
<th></th>
<th>( \beta )</th>
<th>( b )</th>
<th>95% CI</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STAI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chair sit-and-reach (cm)</td>
<td>(-0.22)</td>
<td>(-0.22)</td>
<td>((-0.31, -0.13))</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Back scratch (cm)</td>
<td>(-0.26)</td>
<td>(-0.26)</td>
<td>((-0.35, -0.17))</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Handgrip (kg)</td>
<td>(-0.17)</td>
<td>(-0.32)</td>
<td>((-0.49, -0.15))</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Chair stand (reps.)</td>
<td>(-0.17)</td>
<td>(-0.62)</td>
<td>((-0.95, -0.28))</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Arm curl (reps.)</td>
<td>(-0.14)</td>
<td>(-0.33)</td>
<td>((-0.55, -0.11))</td>
<td>0.004</td>
</tr>
<tr>
<td>8-foot up-and-go (s)</td>
<td>0.20</td>
<td>1.04</td>
<td>(0.56, 1.52)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>6-min walk (m)</td>
<td>(-0.22)</td>
<td>(-0.03)</td>
<td>((-0.05, -0.02))</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>FIQR-anxiety</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chair sit-and-reach (cm)</td>
<td>(-0.13)</td>
<td>(-0.03)</td>
<td>((-0.06, -0.01))</td>
<td>0.005</td>
</tr>
<tr>
<td>Back scratch (cm)</td>
<td>(-0.22)</td>
<td>(-0.06)</td>
<td>((-0.08, -0.03))</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Handgrip (kg)</td>
<td>(-0.13)</td>
<td>(-0.06)</td>
<td>((-0.10, -0.02))</td>
<td>0.006</td>
</tr>
<tr>
<td>Chair stand (reps.)</td>
<td>(-0.11)</td>
<td>(-0.10)</td>
<td>((-0.19, -0.01))</td>
<td>0.024</td>
</tr>
<tr>
<td>Arm curl (reps.)</td>
<td>(-0.15)</td>
<td>(-0.09)</td>
<td>((-0.15, -0.04))</td>
<td>0.002</td>
</tr>
<tr>
<td>8-foot up-and-go (s)</td>
<td>0.16</td>
<td>0.22</td>
<td>(0.09, 0.34)</td>
<td>0.001</td>
</tr>
<tr>
<td>6-min walk (m)</td>
<td>(-0.20)</td>
<td>(-0.01)</td>
<td>((-0.01, 0.00))</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The models were adjusted for age, body fat percentage and anxiolytics intake

\( \beta \) Standardized coefficients, \( b \) unstandardized regression coefficients, CI confidence interval, STAI State Trait Anxiety Inventory subscale, FIQR Revised Fibromyalgia Impact Questionnaire

\( a \) Lower scores indicate better performance

| Table 3 Coefficients of the optimal regression model (stepwise selection method) between anxiety symptoms (assessed by the STAI and FIQR-anxiety) and physical fitness components adjusted for age, body fat percentage and anxiolytics intake in women with fibromyalgia (n = 439) |

<table>
<thead>
<tr>
<th></th>
<th>( b ) (SE)</th>
<th>( p )</th>
<th>95% CI</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STAI</strong></td>
<td></td>
<td></td>
<td></td>
<td>FIQR-anxiety</td>
</tr>
<tr>
<td>(Intercept)</td>
<td>50.55 (6.22)</td>
<td>&lt;0.001</td>
<td>(38.32, 62.79)</td>
<td>8.19 (1.10)</td>
</tr>
<tr>
<td>Anxiolytics intake</td>
<td>5.25 (1.12)</td>
<td>&lt;0.001</td>
<td>(3.05, 7.45)</td>
<td>1.03 (0.29)</td>
</tr>
<tr>
<td>Back scratch (cm)</td>
<td>(-0.18) (0.05)</td>
<td>0.001</td>
<td>((-0.28, -0.08))</td>
<td>(-0.05) (0.01)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>(-0.25) (0.07)</td>
<td>0.001</td>
<td>((-0.39, -0.11))</td>
<td>(-0.04) (0.02)</td>
</tr>
<tr>
<td>6-min walk (m)</td>
<td>(-0.02) (0.01)</td>
<td>0.024</td>
<td>((-0.03, -0.00))</td>
<td>Excluded ( p &gt; 0.10 )</td>
</tr>
<tr>
<td>Chair sit-and-reach (cm)</td>
<td>(-0.12) (0.05)</td>
<td>0.027</td>
<td>((-0.22, -0.01))</td>
<td>Excluded ( p &gt; 0.10 )</td>
</tr>
<tr>
<td>Arm curl (reps.)</td>
<td>Excluded ( p &gt; 0.10 )</td>
<td></td>
<td></td>
<td>(-0.07) (0.03)</td>
</tr>
</tbody>
</table>

\( b \) Unstandardized regression coefficients, SE standard error, CI confidence interval, STAI State Trait Anxiety Inventory subscale, FIQR Revised Fibromyalgia Impact Questionnaire

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questionnaire for assessing anxiety than the FIQR (anxiety) subscale, which is only a visual analogue scale.

This study has limitations. Its cross-sectional design precludes establishing causality. Moreover, due to the lower prevalence of fibromyalgia among men and the consequently small sample size of men recruited, this study was carried out only in women and the results might not apply to men with fibromyalgia. On the other hand, the large sample size, the rigorous study protocol undertaken and the consistency of our findings are strengths of the study.

Conclusions

Physical fitness is inversely associated with anxiety levels in women with fibromyalgia, regardless of the fitness component evaluated. Upper-body flexibility, cardiorespiratory fitness and muscular strength were independent indicators of anxiety levels.

Future intervention studies aimed to elucidate whether women with fibromyalgia with high levels of anxiety might particularly benefit from exercise programs aimed at developing upper-body joint range of motion and flexibility (e.g., Tai-chi, yoga or exercise performed in warm water) are warranted.

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Compliance with ethical standards

Conflict of interests None of the authors have any conflict of interests.

Ethical approval All procedures performed in this study were reviewed and approved by the Ethics Committee of the “Hospital Virgen de las Nieves” (Granada, Spain) and were done in accordance with the 1964 Helsinki declaration and its later amendments.

References


