Factor structure of the Positive and Negative Affect Schedule (PANAS) in adult women with fibromyalgia from Southern Spain: the al-Ándalus project

Fernando Estevez-Lopez, Manuel Pulido-Martos, Christopher J Armitage, Alison Wearden, Inmaculada C Álvarez-Gallardo, Manuel Javier Arrayás-Grajera, María J Girela-Rejón, Ana Carbonell-Baeza, Virginia A Aparicio, Rinie Geenen, Manuel Delgado-Fernández, Víctor Segura-Jiménez

Background. Fibromyalgia is a syndrome characterized by the presence of widespread chronic pain. People with fibromyalgia report lower levels of positive affect and higher levels of negative affect than non-fibromyalgia peers. The Positive and Negative Affect Schedule (PANAS) –a widely used questionnaire to assess two core domains of affect; namely ‘positive affect’ and ‘negative affect’– has a controversial factor structure varying across studies. The internal structure of a measurement instrument has an impact on the meaning and validity of its score. Therefore, the aim of the present study was to assess the structural construct validity of the PANAS in adult women with fibromyalgia.

Methods. This population-based cross-sectional study included 442 adult women with fibromyalgia (age: 51.3 ± 7.4 years old) from Andalusia (Southern Spain). Confirmatory factor analyses were conducted to test the factor structure of the PANAS.

Results. A structure with two correlated factors (positive affect and negative affect) obtained the best fit ($\chi^2$ S-B = 288.49, $df = 155$, $p < .001$; RMSEA = .04; 90% CI of RMSEA = (.036, .052); SRMR = .05; CFI = .96; CAIC = -810.66).

Conclusions. The present study demonstrates that both positive affect and negative affect are core dimensions of affect in adult women with fibromyalgia. A structure with two correlated factors of the PANAS emerged from our sample of women with fibromyalgia from Andalusia (Southern Spain). In this model, the amount of variance shared by positive affect and negative affect was small. Therefore, our findings support to use and interpret the positive affect and negative affect subscales of the PANAS as separate factors that are associated but distinctive as well.
Factor structure of the Positive and Negative Affect Schedule (PANAS) in adult women with fibromyalgia from Southern Spain: the al-Ándalus project

Fernando Estévez-López1,2*, Manuel Pulido-Martos3, Christopher J. Armitage4, Alison Wearden4, Inmaculada C. Álvarez-Gallardo1, Manuel J. Arrayás-Grajera5, María J. Girela-Rejón1, Ana Carbonell-Baeza6, Virginia A. Aparicio7,8, Rinie Geenen2, Manuel Delgado-Fernández1, Víctor Segura-Jiménez6,1

1 Department of Physical Education and Sport, Faculty of Sport Sciences, University of Granada, Granada, Spain
2 Department of Psychology, Faculty of Social and Behavioural Sciences, Utrecht University, Utrecht, The Netherlands
3 Department of Psychology, Faculty of Humanities and Education Sciences, University of Jaén, Jaén, Spain
4 Manchester Centre for Health Psychology, Faculty of Psychological Sciences, University of Manchester, Manchester, Manchester, UK
5 Department of Physical Education, Music, and Fine Arts, Faculty of Sciences Education, University of Huelva, Huelva, Spain
6 Department of Physical Education, Faculty of Education Sciences, University of Cádiz, Cádiz, Spain
7 Department of Physiology and Institute of Nutrition and Food Technology, Faculty of Pharmacy, University of Granada, Granada, Spain
8 Department of Public and Occupational Health, EMGO+ Institute for Health and Care Research, VU University Medical Centre, Amsterdam, The Netherlands
*Corresponding author:

Fernando Estévez-López, MSc. Department of Physical Education and Sport, Faculty of Sport Sciences, University of Granada. Carretera de Alfacar, s/n, 18011, Granada, Spain. (+34) 958 244375 (phone); (+34) 958 244369 (fax); Email: festevez@ugr.es
ABSTRACT

Background. Fibromyalgia is a syndrome characterized by the presence of widespread chronic pain. People with fibromyalgia report lower levels of positive affect and higher levels of negative affect than non-fibromyalgia peers. The Positive and Negative Affect Schedule (PANAS) – a widely used questionnaire to assess two core domains of affect; namely ‘positive affect’ and ‘negative affect’ – has a controversial factor structure varying across studies. The internal structure of a measurement instrument has an impact on the meaning and validity of its score. Therefore, the aim of the present study was to assess the structural construct validity of the PANAS in adult women with fibromyalgia.

Methods. This population-based cross-sectional study included 442 adult women with fibromyalgia (age: 51.3 ± 7.4 years old) from Andalusia (Southern Spain). Confirmatory factor analyses were conducted to test the factor structure of the PANAS.

Results. A structure with two correlated factors (positive affect and negative affect) obtained the best fit ($\chi^2$ S-B = 288.49, $df = 155$, $p < .001$; RMSEA = .04; 90% CI of RMSEA = (.036, .052); SRMR = .05; CFI = .96; CAIC = -810.66).

Conclusions. The present study demonstrates that both positive affect and negative affect are core dimensions of affect in adult women with fibromyalgia. A structure with two correlated factors of the PANAS emerged from our sample of women with fibromyalgia from Andalusia (Southern Spain). In this model, the amount of variance shared by positive affect and negative...
affect was small. Therefore, our findings support to use and interpret the positive affect and negative affect subscales of the PANAS as separate factors that are associated but distinctive as well.

**Key words:** Affectivity; Chronic pain; Confirmatory factor analysis; Dimensional structure; Emotion; Mood; Psychometrics.

**Running head:** Factor structure of the PANAS in FM
The assessment of affect—subjectively experienced feeling or emotion—is important because affect is a primary cause and consequence of relevant phenomena such as coping, symptoms, social activity, and satisfaction among others (Watson, Clark, & Tellegen, 1988). The Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988) is probably the most extensively used instrument to measure affect (Buz, Pérez-Archaederra, Fernández-Pulido, & Urchaga, 2015). Overall, the PANAS often shows appropriate psychometric properties including internal consistency and test-retest reliabilities as well as convergent and discriminant validities (Watson et al., 1988). However, the structural construct validity of the PANAS is controversial; its factor structure varies across studies.

The original authors (Watson et al., 1988), in an adult sample and using exploratory factor analyses, indicated that the PANAS consists in a structure with two largely uncorrelated factors; namely ‘positive affect’ and ‘negative affect’. Subsequent research has been conducted across different populations and languages of the scale, using state or trait time-frame directions (i.e., about current or general feelings, respectively), and different statistical techniques (e.g., exploratory or confirmatory factor analyses). However, the structure that emerged as the most appropriate in each study did not seem to depend on the above-mentioned issues. For instance, different structures have emerged in two studies conducted among university students from Spain, using the Spanish version of the PANAS with trait time-frame directions, and with confirmatory factor analysis (CFA) (Sandin et al., 1999; Ortuño-Sierra, Santarén-Rosell, Albéniz, & Fonseca-Pedrero, 2015).
Several techniques are available to analyse the factor structure of a questionnaire. In the early phase of the PANAS, exploratory factor analyses (EFA) were used (Watson et al., 1988; Mehrabian, 1997; Killgore, 2000). In the next step, CFA allowed estimation and testing of a hypothesized model based on previous literature, of correlated uniqueness terms, factor variances, factor covariances, comparison of competing models, and selection of the best fitting model (Lloret-Segura, Ferreres-Traver, Hernández-Baeza, & Tomás-Marco, 2014). CFA and item-response theory (ITR) are often considered as complementary approaches; CFA is suggested to be a more appropriate approach when analysing multidimensional models (Wang, 2005) while ITR is better suited for testing equivalence of item parameters (Meade, 2004). Most studies tested the factor structure of the PANAS using CFA (Leue & Beauducel, 2011). Therefore, and for the sake of clarity, only CFA literature related with the PANAS is mentioned hereinafter.

After the original work (Watson et al., 1988), most of research has provided further evidence of a structure with two factors of the PANAS. However, the correlation between positive affect and negative affect is still under debate, with studies supporting (Crocker, 1997; Sandin et al., 1999; Tuccitto, Giacobbi, & Leite, 2009) or rejecting (Crawford & Henry, 2004; Lim, Yu, Kim, & Kim, 2010) the original relatively independent relation between the two dimensions of affect. A few studies reported more complex structures (Leue & Beauducel, 2011; Ortuño-Sierra et al., 2015) or did not obtain a good fit to the data with any of the models that were assessed (Melvin & Molloy, 2000; Molloy, Pallant, & Kantas, 2001; Beck et al., 2003), including the original structure.

To date, most studies have examined the factor structure of the PANAS among student
and community samples, while affect also plays an important role in clinical and forensic samples (Leue & Beauducel, 2011). Our review of the literature elicited just two studies (Beck et al., 2003; Lim et al., 2010) that have addressed the factor structure of the PANAS with CFA in clinical samples. Both studies failed to replicate the original structure. Beck et al. (2003) showed a poor fit to the original structure in a sample of older adults with generalized anxiety disorder. Lim et al. (2010) found a structure with two correlated factors in a sample of psychiatric patients. Although two other studies did include people with clinical disorders in their samples, unfortunately, the CFA was conducted in the whole sample instead of in the patient subsample (Gyollai, Simor, Koteles, & Demetrovics, 2011; Leue & Beauducel, 2011). To know the nature of the association between the two dimensions of the PANAS in clinical populations is important because it shows how the PANAS should be used and interpreted in clinical settings.

Fibromyalgia is a chronic pain condition characterised by high sensitivity to painful stimuli and lowered pain threshold; namely ‘hyperalgesia’ and ‘allodynia’, respectively (Kosek, Ekholm, & Hansson, 1996). Recent research has focussed on the emotional lives of people with fibromyalgia and its associated factors (Córdoba-Torrecilla et al., 2015; Soriano-Maldonado, Amris, et al., 2015; Soriano-Maldonado, Estévez-López, et al., 2015) showing that they have lower levels of positive affect and higher levels of negative affect than control peers (Hassett et al., 2008; van Middendorp, Lumley, Jacobs, Bijlsma, & Geenen, 2010). Additionally, negative affect and positive affect are associated to fibromyalgia severity, fatigue, and pain (van Middendorp et al., 2008; Estévez-López et al., 2015).

The Dynamic Model of Affect (Reich, Zautra, & Potter, 2001; Reich, Zautra, & Davis, 2003) posits that the structure of affect varies from ordinary circumstances—in which people
experience low stress– to stressful conditions. When stress is low, people are able to focus their
cognitive resources –and, therefore, process more information– on their affective complexity.
However, when stress is high, there is a competition for cognitive resources implying a depletion
of cognitive resources that are available for processing affective information. Consequently,
when stress is high, positive affect and negative affect become increasingly and inversely
correlated. Evidence from chronic pain populations has corroborated the assumption of less
differentiation of positive affect and negative affect when people experience increased levels of
stress (Zautra, Smith, Affleck, & Tennen, 2001; Davis, Zautra, & Smith, 2004; Zautra, Fasman,
Parish, & Davis, 2007).

The reliable and valid measurement of affect in fibromyalgia is important because –
according to the Dynamic Model of Affect– in this group that is characterized by pain and stress,
positive affect and negative affect may correlate more than in the general population (Reich et
al., 2001; Reich et al., 2003). Thus, it is possible that the two factors of the PANAS may
 correlate more clearly in fibromyalgia than in pain-free populations. To the best of our
knowledge, no studies have yet assessed the internal structure of the PANAS in people with
fibromyalgia. Given that the PANAS may be sensitive to sampling (Crawford & Henry, 2004;
Tuccitto et al., 2009) and is frequently used in studies of fibromyalgia (Zautra, Johnson, &
Davis, 2005; Sturgeon, Zautra, & Arewasikporn, 2014; Estévez-López et al., 2015), it seems
necessary to examine its structure in this particular population to properly use and interpret the
PANAS score. Therefore, the aim of the present study was to assess the structural construct
validity of the PANAS in adult women with fibromyalgia from Andalusia (Southern Spain)
using CFA.
METHODS

Participants

We focused to recruit a representative sample of people with fibromyalgia from Andalusia (Southern Spain). To achieve this representativeness, calculations of sample size were conducted as elsewhere (Segura-Jiménez et al., 2015). Through the Andalusian Federation of Fibromyalgia, we contacted the main local associations of people with fibromyalgia in all provinces of Andalusia (Southern Spain) –i.e., those with the largest number of people. All interested participants \( n = 616 \) received an invitation to participate in this study. Potentially eligible participants who were interested in participating in the study attended a meeting where we provided information about the study aims and procedures. Those taking part in the study signed a written informed consent form.

Inclusion criteria for the present study were: (i) to be an adult woman (aged 18 to 65 years old), (ii) to have a medical diagnosis of fibromyalgia by a rheumatologist (participants were requested to provide their medical records to confirm their diagnosis) and (iii) to meet the American College of Rheumatology fibromyalgia criteria (Wolfe et al., 1990), namely, widespread pain for more than 3 months, and pain with 4 kg/cm of pressure reported for 11 or more of 18 tender points. Additionally, participants with acute or terminal illness or severe cognitive impairment (i.e., Mini Mental State Examination (MMSE) \( \geq 10 \)) were excluded.
All participants were assessed by the same research group to reduce inter-examiner error. The research protocol was reviewed and approved by the Ethics Committee of the Hospital Virgen de las Nieves (Granada, Spain).

**Measures**

**Sociodemographic data.** Sociodemographic information was recorded using a self-report instrument that included date of birth, time since fibromyalgia diagnosis, and marital, educational, and current occupational status. Additionally, participants were asked: ‘Have you ever been diagnosed with an acute or terminal illness?’, to assess a exclusion criterion.

**Tenderness.** The 18 tender points were assessed in accordance to the American College of Rheumatology criteria (Wolfe et al., 1990; Segura-Jiménez et al., 2014) for diagnosis and classification of fibromyalgia. A standard pressure algometer (FPK 20; Wagner Instruments, Greenwich, CT, USA) was used. Total tender points count was recorded for each participant.

**The MMSE** (Folstein, Folstein, & McHugh, 1975; Lobo, Ezquerra, Gómez Burgada, Sala, & Seva Díaz, 1979) was used to evaluate severe cognitive impairment, an exclusion criterion.

**The PANAS** (Watson et al., 1988; Sandin et al., 1999) is a questionnaire designed to assess positive and negative affect. This questionnaire has 20 items, 10 to positive (e.g., enthusiastic) and 10 to negative affect (e.g., scared). Participants responded to each item on a 5-point Likert-type scale: 1) *very slightly or not at all*, 2) *a little*, 3) *moderately*, 4) *quite a bit*, and 5) *extremely*. The time-frame adopted was in ‘general’. The items of the PANAS are: Interested, distressed, excited, upset, strong, guilty, scared, hostile, enthusiastic, proud, irritable, alert, ashamed,
inspired, nervous, determined, attentive, jittery, active, and afraid. The scores range is 10-50 for both positive affect and negative affect.

Procedure

During a single evaluation session participants filled out sociodemographic data and answered questions of the MMSE. Then, a physical examination was conducted to assess tender points. Finally, the PANAS was completed at home the following day and delivered to the research team two days after the evaluation session.

Statistical analysis

Preliminary analysis

The Statistical Package for Social Sciences (IBM SPSS for Mac, version 20.0; Armonk, NY, USA) was used to: (a) examine the pattern of missing data and (b) obtain descriptive data. Structural Equation Modeling Software (EQS 6.1 for Windows; Encino, CA, USA) was used to evaluate potential violations of normality assumptions. Mardia’s coefficient was calculated to check multivariate normality.

Measurement model

Factor structure and fit models were obtained with CFA using EQS 6.1. We chose those goodness-of-fit indices that were the most insensitive to sample size, model misspecification and parameter estimates (Hooper, Coughlan, & Mullen, 2008). Specifically, we based our decisions on the following absolute fit indices: (i) the Satorra-Bentler scaled $\chi^2$ statistic ($\chi^2$ S-B) and its degree of freedom ($df$) and $p$ values, (ii) the Root Mean Square Error of Approximation
(RMSEA) with the 90% confidence interval (90% CI) (Steiger, 1990), and (iii) the Standardized Root Mean Squared Residual (SRMR), (iv) the Comparative Fix Index (CFI), as an incremental fit index, and (v) the Consistent version of Akaike’s Information Criterion (CAIC) (Bozdogan, 1987), as a parsimony fit index to compare the fit of non-nested models. As some indicators were non-normally distributed, we decided to use Robust Maximum Likelihood (MLM) analyses. An acceptable model fit was defined by: $\chi^2$ S-B (lower values of $\chi^2$ indicate a good fit if $p > .05$) (Bollen, 1989); RMSEA (values $\leq .08$ indicate acceptable; $< .05$ indicate relatively good fit) (Browne & Cudeck, 1992); SRMR (values $\leq .05$ indicate well-fitting model); CFI (values $.90-.94$ indicate acceptable fit; $\geq .95$ relatively good fit) (Hu & Bentler, 1999); and a small value of CAIC when comparisons among non-nested model are done (Hu, Bentler, & Hoyle, 1995).

Although, the comparison between nested models assesses by $\chi^2$ S-B is not distributed like $\chi^2$ (Satorra, 2000), it has been suggested that a scaled difference $\chi^2$ can be used to compare $\chi^2$ S-B from nested models (Satorra & Bentler, 2001).

**CFA-based scale reliability**

When correlated error terms are allowed, conventional estimates of reliability (e.g., Cronbach's Alpha) may be biased (Hankins, 2008). Therefore, internal consistency of positive affect and negative affect were computed with composite reliability ($\rho$) (Raykov, 2001; Raykov, 2004). A $\rho > .70$ was considered as a minimum acceptable cut-off value, which is in line with the interpretation of Cronbach’s alpha (Nunnally & Bernstein, 1994).
CFA was used to test the factor structure of the PANAS in the present dataset against all previous models that have assessed the factor structure of the PANAS using CFA.

Model 1 was a general model, with the 20 items hypothesized to load onto a single factor.

Model 2a was proposed originally by Watson et al. (1988), and was a structure with two uncorrelated factors, positive affect and negative affect (Crocker, 1997; Schmukle, Egloff, & Burns, 2002; Terracciano, McCrae, & Costa, 2003; Tuccitto et al., 2009; Gyollai et al., 2011; Buz et al., 2015). Model 2a(1) was the same as Model 2a, except that error terms from some items was permitted to intercorrelate, following the Zevon and Tellegen’s (1982) mood subcategories\(^1\). Model 2a(2) was the same as Model 2a, but allowing to covary the error terms of the items: hostile and irritable; ashamed and guilty; scared and afraid; nervous and jittery; and ashamed and determined (Sandin et al., 1999). Model 2b was a structure with two correlated factors (Schmukle et al., 2002). Model 2b(1) was the same as Model 2b, except that error terms from some items was permitted to intercorrelate, following Zevon and Tellegen’s (1982) mood subcategories (Crawford & Henry, 2004). Model 2b(2) was the same as Model 2b, with different error terms correlated: guilty and ashamed; scared and afraid; attentive and alert; interested and excited; and inspired and strong (Lim et al., 2010). Model 2b(3) was proposed by the authors of the present work, based on the results of Lagrange Multiplier (LM) test, and it was the same that Model 2b(1) adding a correlation of the error terms of the items distressed and nervous.

---

\(^1\) As Tuccitto, Giacobbi and Leite (2009) indicated, the items of the PANAS were taken from the mood subcategories (Zevon & Tellegen, 1982): attentive (e.g., interested, alert, attentive), excited (e.g., enthusiastic, inspired, excited), proud (e.g., determined, proud), strong (e.g., active, strong), distressed (e.g., upset, distressed), guilty (e.g., ashamed, guilty), angry (e.g., hostile, irritable), jittery (e.g., nervous, jittery), and fearful (e.g., scared, afraid).
Model 3a was a structure with three first-order uncorrelated factors: (i) the positive affect factor with the original 10 items, (ii) the NA-1 factor eight of the original 10 items, without guilty and ashamed, and (iii) the NA-2 factor with only two items: guilty and ashamed (Beck et al., 2003). Model 3a(1) was a structure with three first-order uncorrelated factors: (i) the positive affect factor with the original 10 items, (ii) the Afraid factor with 5 items: distressed, scared, nervous, jittery, and afraid, and (iii) the Upset factor with 5 items: upset, guilty, hostile, irritable, and ashamed (Gaudreau, Sanchez, & Blondin, 2006; Ortuño-Sierra et al., 2015). Model 3a(2) was the same as Model 3a(1), except that cross-loading to some items were allowed: nervous and jittery onto PA, excited onto Afraid (see (Gaudreau et al., 2006), ‘calibration sample’). Model 3a(3) was the same as Model 3a(1), except that cross-loading to some items were allowed: active and alert (originally from PA), and hostile (originally from Upset) onto Afraid (see (Gaudreau et al., 2006), ‘cross-validation sample’). Models 3b(1), 3(b)2, and 3b(3) were the same as Models 3a(1), 3a(2), and 3a(3), respectively, except that it was a correlated three first-order factor structure (Leue & Beauducel, 2011).

Model 4 was a bifactor model with positive affect and negative affect as independent factors as well as an additional general one, Affective Polarity factor, with all 20 items of the questionnaire (Leue & Beauducel, 2011; Lopez-Gomez, Hervas, & Vazquez, 2015).
RESULTS

From 616 potentially eligible people with fibromyalgia, a number of participants were excluded because they were men (n = 21), older than 65 years old (n = 25), did not provide evidence of a medical diagnosis of fibromyalgia (n = 39), did not meet the diagnosis criteria (n = 83), or showed severely impaired cognitive performance (n = 1). Five participants failed to complete the PANAS and their data were subsequently excluded leaving a final sample of 442 people for analysis.

Preliminary analyses

Characteristics of the sample are displayed in Table 1. The mean for positive affect was 23.06 (SD = 6.79) and the mean for negative affect was 24.06 (SD = 8.42).

Univariate normal analysis showed values between 0.04 and 2.01 in asymmetry, and between -1.02 and 2.01 in kurtosis, both within the recommended range (Chou & Bentler, 1995). Mardia’s coefficient was 117.71 and a critical proportion of 41.71, which showed that the data were not distributed normally (Bentler & Wu, 2005).

Confirmatory Factor Analyses

Although, based on CFI, the fit of various models would be considered adequate, a less parsimonious strategy based on the use of absolute misfit indices (Browne & Cudeck, 1992) like
RMSEA and SRMR was established. When RMSEA and SRMR are used together, rejecting models with good fit is avoided (Hu & Bentler, 1998; Hu & Bentler, 1999).

The fit statistics for the CFA models are presented in Table 2. It can be seen that the general factor model (Model 1) showed a poor fit in all indices.

Model 2a reflected the original hypothesis that the PANAS consists of a structure with two uncorrelated factors, positive affect and negative affect. The fit of this model was poor, though better when error terms were allowed to correlate following mood subcategories (Zevon & Tellegen, 1982) or the results of a Spanish adaptation (Sandin et al., 1999): Models 2a(1) and 2(a)2, respectively. Finally, both models were rejected because values of SRMR (0.13) were inadequate.

Overall, better fit indices emerged when positive affect and negative affect were considered as correlated factors (Model 2b). Additionally, the fit of the models improved when the errors terms from some items were allowed to intercorrelate: Models 2b(1), 2b(2), and 2b(3). Specifically, Model 2b(1) followed mood subcategories (Zevon & Tellegen, 1982), Model 2b(2) was based on the results reported by Lim et al. (2010), and Model 2b(3) was a proposal by the authors of the present research based on the results of LM test. Specifically, Model 2b(3) added a new correlation of the error terms of the items distressed and nervous to the Model 2b(1). Model 2b(3), permitting these correlated errors, possessed markedly superior fit compared with their more constrained counterparts.
Models with a structure with three factors (i.e., 3a, 3a(1), 3a(2), 3a(3), 3b(1), 3b(2), and 3b(3)) or with the bifactor structure (Model 4) suggested by Leue and Beauducel (2001) and by Lopez-Gomez et al. (2015) did not show an optimal fit to the data.

To select the best fitting model based on statistical grounds, comparisons between nested models were performed to assess the relative fit of each model that showed optimal goodness-of-fit indices to the data. Table 3 shows values of $\chi^2$ S-B per comparison of models. Models 2b(2) and 2b(3) obtained better fit values and differed statistically significant as compared to more restrictive models. The CAIC index was used to compare non-nested models and assess the parsimony of the models, taking into account the number of estimate parameters and the sample size. Model 2b(3) obtained a better value (i.e., a lower number) than Model 2b(2) (Table 2). Figure 1 illustrates Model 2b(3); i.e., the model that obtained the best fit indices: $\chi^2$ S-B = 288.49, $df = 155$, $p < .001$; RMSEA = .04; 90% CI of RMSEA = (.036, .052); SRMR = .05; CFI = .96; CAIC = -810.66.

**CFA-based scale reliability**

The values of $\rho$ were .79 for the positive affect subscale and .76 for the negative affect subscale.
DISCUSSION

Although the PANAS is extensively used in people with fibromyalgia, its structural construct validity has never been assessed in this population. This is an important omission because the internal structure of a measurement instrument impacts on the validity of its score interpretations (Messick, 1980). Thus, the aim of present research was to assess the fit of different hypothesized factor structures of the PANAS to the data from a sample of adult women with fibromyalgia from Andalusia (Southern Spain) using CFA. The results of previous CFA with the Spanish version of the PANAS showed a structure with two uncorrelated factors in women attending a program for the prevention of breast cancer (Joiner, Sandín, Chorot, Lostao, & Marquina, 1997), university students (Sandin et al., 1999), and in older adults (Buz et al., 2015). These findings were congruent with the original proposed structure (Watson et al., 1988). However, another study also conducted among university students rejected such original structure and suggested a structure with three factors: positive affect, negative affect-upset, and negative affect-afraid (Ortuño-Sierra et al., 2015). Recently, a bifactor structure has emerged from the Spanish general population (Lopez-Gomez et al., 2015). Our current study provided an alternative model (i.e., a structure with two correlated factors) in which the two factors of the PANAS are associated but distinctive as well. This suggests that people with fibromyalgia may experience affect differently than non-fibromyalgia peers, which is in agreement with previous literature (Zautra, Fasman, et
The best fit was obtained with the Model 2b(3): a structure with two correlated factors allowing intercorrelation of error terms from some items: attentive, interested, and alert; enthusiastic, excited, and inspired; proud and determined; strong and active; distressed and upset; hostile and irritable; scared and afraid; ashamed and guilty; nervous and jittery, and, distressed and nervous. Except the last one, all of them were based on mood subcategories (Zevon & Tellegen, 1982). Following a post-hoc modification suggested from our results, the error terms of the items distressed and nervous was allowed. In everyday Spanish language, distressed and nervous are often used interchangeably and are regarded as close synonyms. Thus, the correlation between the error terms of the items distressed and nervous was accepted given that it was justified and interpreted substantively (Jöreskog, 1967). The structure that emerged from the data is very close to the model that was obtained by Crawford and Henry (2004). Additionally, composite reliability of the positive affect and negative affect subscales showed an acceptable internal consistency of the PANAS; which is in line with Tuccitto, Giaboabbi and Leite (2009) who computed the composite reliability of positive affect and negative affect using data from previous studies (Lonigan, Hooe, David, & Kistner, 1999; Crawford & Henry, 2004).

The present structure with two correlated factors has emerged in other investigations, even when they have used different type of samples and time-frame directions (Lonigan et al., 1999; Schmukle et al., 2002; Terracciano et al., 2003). It would be valuable to investigate the circumstances in which the present factor structure is replicated in future research. This is important because Watson et al. (1988) argued that positive affect and negative affect reflect separate behavioural inhibition and behavioural engagement systems that the present study
confirms by adding that there is an overlap between the two systems as well (Diener, Smith, & Fujita, 1995; Tellegen, Watson, & Clark, 1999).

The present findings are in support of the Dynamic Model of Affect (Reich et al., 2003; Davis et al., 2004; Zautra et al., 2007), which suggests that the relationship between positive affect and negative affect depends on the level of stress. It is plausible that in people with high levels of stress, the inverse correlation between positive affect and negative affect is strong, whereas this correlation is weaker in people with low stress levels. This could be an adaptive process whereby people with fibromyalgia receive both positive affect and negative affect information during stress episodes to allow simpler and more rapid information processing than in more relaxed situations.

Besides being bothered by widespread chronic pain and other symptoms that are uncertain and difficult to understand (Wright, Zautra, & Going, 2008), in the population of people with fibromyalgia, stress and distress levels are relatively high (Finan, Zautra, & Davis, 2009), emotions are experienced more intensely (van Middendorp et al., 2008), and many patients report to be confronted with socially invalidating responses (Kool, van Middendorp, Boeije, & Geenen, 2009; Kool, van Middendorp, Bijlsma, & Geenen, 2011; Kool et al., 2014). Experience sampling (Finan et al., 2009) showed that people with fibromyalgia struggled to differentiate between positive affect and negative affect after a stressful stimulus. Moreover, patients with fibromyalgia have greater difficulty differentiating between emotions (alexithymia) and more frequently use emotionally avoidant strategies (e.g., emotion suppression) than non-fibromyalgia peers (van Middendorp et al., 2008), which is considered maladaptive (Wiebe & Korbel, 2003; Geenen, van Ooijen-van der Linden, Lumley, Bijlsma, & van Middendorp, 2012).
The poor ability to discriminate between emotions and the use of avoidant emotion regulation responses might explain the structure with two correlated factors that emerged in the present study (van Middendorp et al., 2008; Lumley et al., 2011).

The present findings show that the fit of the model with a single factor (Model 1) and the fit of the most complex models (i.e., structures with three factors and the bifactor structure; Models 3a(1)–3b(3) and Model 4, respectively) were the poorest fitting structures. The models with structures with two uncorrelated factors were improved when correlation between error terms of some items was allowed (Models 2a(1) and 2a(2)). The highest fit indices were obtained with structures with two correlated factors and when correlation among error terms of some items was allowed (Models 2b(1)–2b(3)). The Model 2b(3) showed the best fit. Therefore, the present study demonstrates that both positive affect and negative affect are core dimensions of affect in adult women with fibromyalgia and highlights the relevance of a structure with correlated factors.

The present study has limitations that must be noted. A first limitation is related to our decision to allow the error terms from some items to intercorrelate, which is controversial. These correlation errors represent the common variance of the items that it is unexplained by the latent common factor. However, authors of previous studies have suggested that in the PANAS its use is appropriate because theory and previous findings support them (Tuccitto et al., 2009) and the number of correlations established is reduced (Crawford & Henry, 2004). It would be valuable to check whether the new correlation between the error terms of the items distressed and nervous, established in the model that has obtained the best fit to the data in the present study, could be replicated with data from other samples of the fibromyalgia population (MacCallum & Austin,
A second limitation is lack of a representative sample of free-pain controls. Due to a limited budget, we were not able to recruit such a group to conduct further research into the factor invariance of affect structure between fibromyalgia participants (i.e., a clinical population) and the general population (Crawford & Henry, 2004). Similarly, we believe that it would be valuable to test this invariance across chronic pain conditions. Third, according to the dynamic model of affect, the correlation between positive affect and negative affect in a person with fibromyalgia could vary from time to time depending on his or her levels of stress induced by pain. The cross-sectional design of the present study did not allow us to performance more sophisticated analyses such as multifactor level analyses (Merz & Roesch, 2011). Also, experimental research addressing this question is warranted. Fourth, only women with fibromyalgia were included. Previous studies have showed that adult women are characterized by higher negative affect scores in both, state and trait measurements (Terracciano et al., 2003). Thus, it could be interesting to assess the structural equivalence of positive affect and negative affect scores in men and women with fibromyalgia. The major difficulty to conduct this kind of studies in fibromyalgia is the small number of men with fibromyalgia, the reported women to men prevalence ratio is 9:1 (Branco et al., 2010). Fifth, this study was conducted in a sample of Spanish-speakers and, therefore, further research with other language versions of the PANAS would be valuable.

The present study demonstrates that both positive affect and negative affect are core dimensions of affect in adult women with fibromyalgia from Andalusia (Southern Spain). A structure with two correlated factors of the PANAS emerged from our sample of women with fibromyalgia. In this model, the amount of variance shared by positive affect and negative affect was small. Therefore, our findings support to use and interpret the positive affect and the
negative affect subscales of the PANAS as separate factors that are associated but distinctive as well. It would be valuable to conduct further research into the invariance of the PANAS factor structure between people with fibromyalgia and pain-free peers, across chronic pain conditions, and between women and men with fibromyalgia. Additionally, experimental studies and multifactor level analyses addressing whether the correlation between positive affect and negative affect varies depending on current levels of stress induced by pain would be of interest.
REFERENCES

Beck, J. G., Novy, D. M., Diefenbach, G. J., Stanley, M. A., Averill, P. M., & Swann, A. C. (2003). Differentiating anxiety and depression in older adults with generalized anxiety disorder. *Psychological Assessment, 15*(2), 184–192. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12847778

Bentler, P., & Wu, E. (2005). *EQS 6.1 for Windows. Encino, CA: Multivariate Software*. Encino, CA, USA: Multivariate Software. Retrieved from http://down.cenet.org.cn/upfile/83/200931814911118.pdf

Bollen, K. A. (1989). *Structural Equations with Latent Variables*. Oxford, England: Wiley.

Bozdogan, H. (1987). Model selection and Akaike’s Information Criterion (AIC): The general theory and its analytical extensions. *Psychometrika, 52*(3), 345–370. doi:10.1007/BF02294361

Branco, J. C., Bannwarth, B., Failde, I., Abello Carbonell, J., Blotman, F., Spaeth, M., … Matucci-Cerinic, M. (2010). Prevalence of fibromyalgia: a survey in five European countries. *Seminars in Arthritis and Rheumatism, 39*(6), 448–453. doi:10.1016/j.semarthrit.2008.12.003

Browne, M. W., & Cudeck, R. (1992). Alternative Ways of Assessing Model Fit. *Sociological Methods & Research, 21*(2), 230–258. doi:10.1177/0049124192021002005

Buz, J., Pérez-Arechaederra, D., Fernández-Pulido, R., & Urchaga, D. (2015). Factorial Structure
and Measurement Invariance of the PANAS in Spanish Older Adults. *The Spanish Journal of Psychology, 18*(e3), 1–11. doi:10.1017/sjp.2015.6

Chou, C. P., & Bentler, P. M. (1995). Estimates and tests in structural equation modeling. In R. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 37–55). Nwebury CA, US: Sage Publications Inc.

Córdoba-Torrecilla, S., Aparicio, V. A., Soriano-Maldonado, A., Estévez-López, F., Segura-Jiménez, V., Álvarez-Gallardo, I., … Delgado-Fernández, M. (2015). Physical fitness is associated with anxiety levels in women with fibromyalgia: the al-Ándalus project. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. doi:10.1007/s11136-015-1128-y

Crawford, J. R., & Henry, J. D. (2004). The positive and negative affect schedule (PANAS): construct validity, measurement properties and normative data in a large non-clinical sample. *The British Journal of Clinical Psychology / the British Psychological Society, 43*, 245–265. doi:10.1348/0144665031752934

Crocker, P. R. E. (1997). A confirmatory factor analysis of the positive affect negative affect schedule (PANAS) with a youth sport sample. *Journal of Sport & Exercise Psychology, 19*(1), 91–97. Retrieved from http://www.cabdirect.org/abstracts/19981806137.html;jsessionid=AC27ABC73607A288A0FA6FF64E6F72B4

Davis, M. C., Zautra, A. J., & Smith, B. W. (2004). Chronic pain, stress, and the dynamics of affective differentiation. *Journal of Personality, 72*(6), 1133–1159. doi:10.1111/j.1467-6494.2004.00293.x
Diener, E., Smith, H., & Fujita, F. (1995). The personality structure of affect. *Journal of Personality and Social Psychology, 69*(1), 130–141. doi:10.1037/0022-3514.69.1.130

Estévez-López, F., Gray, C. M., Segura-Jiménez, V., Soriano-Maldonado, A., Álvarez-Gallardo, I. C., Arrayás-Grajera, M. J., … Pulido-Martos, M. (2015). Independent and combined association of overall physical fitness and subjective well-being with fibromyalgia severity: the al-Andalus project. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation, 24*(8), 1865–1873. doi:10.1007/s11136-015-0917-7

Finan, P. H., Zautra, A. J., & Davis, M. C. (2009). Daily affect relations in fibromyalgia patients reveal positive affective disturbance. *Psychosomatic Medicine, 71*(4), 474–482. doi:10.1097/PSY.0b013e31819e0a8b

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*(3), 189–98. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/1202204

Gaudreau, P., Sanchez, X., & Blondin, J.-P. (2006). Positive and Negative Affective States in a Performance-Related Setting. *European Journal of Psychological Assessment, 22*(4), 240–249. doi:10.1027/1015-5759.22.4.240

Geenen, R., van Ooijen-van der Linden, L., Lumley, M. A., Bijlsma, J. W. J., & van Middendorp, H. (2012). The match-mismatch model of emotion processing styles and emotion regulation strategies in fibromyalgia. *Journal of Psychosomatic Research, 72*(1), 45–50. doi:10.1016/j.jpsychores.2011.09.004

Gyollai, A., Simor, P., Koteles, F., & Demetrovics, Z. (2011). Psychometric properties of the
Hungarian version of the original and the short form of the Positive and Negative Affect Schedule (PANAS). *Neuropsychopharmacologia Hungarica: A Magyar Pszichofarmakológiai Egyesület Lapja = Official Journal of the Hungarian Association of Psychopharmacology, 13*(2), 73–79. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/21677320

Hankins, M. (2008). The reliability of the twelve-item general health questionnaire (GHQ-12) under realistic assumptions. *BMC Public Health, 8*(1), 355. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/18854015.

Hassett, A. L., Simonelli, L. E., Radvanski, D. C., Buyske, S., Savage, S. V, & Sigal, L. H. (2008). The relationship between affect balance style and clinical outcomes in fibromyalgia. *Arthritis and Rheumatism, 59*(6), 833–40. doi:10.1002/art.23708

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural Equation Modelling: Guidelines for Determining Model Fit. *Electronic Journal of Business Research Methods, 6*(1), 53–60. Retrieved from http://eprints.maynoothuniversity.ie/6596/1/JC-Structural-Equation.pdf

Hu, L., Bentler, P., & Hoyle, R. (1995). Structural equation modeling: Concepts, issues, and applications. In R. H. L Hu, PM Bentler (Ed.), *Structural Equation Modeling: Concepts, issues, and applications* (pp. 76–99). Thousand Oaks, CA, US: Sage Publications Inc. Retrieved from https://scholar.google.es/scholar?hl=es&q=Evaluating+model+fit.+In%3A+Hu+L%2C+Bentler+PM%2C+Hoyle+RH%2C+editors.+Structural+equation+modeling%3A+Concepts%2C+issues%2C+and+applications&btnG=&lr=#0

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to
underparameterized model misspecification. *Psychological Methods*, 3, 424–253.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. doi:10.1080/10705519909540118

Joiner, T. E., Sandín, B., Chorot, P., Lostao, L., & Marquina, G. (1997). Development and factor analytic validation of the SPANAS among women in Spain: (more) cross-cultural convergence in the structure of mood. *Journal of Personality Assessment*, 68(3), 600–615. doi:10.1207/s15327752jpa6803_8

Jöreskog, K. G. (1967). A general approach to confirmatory maximum likelihood factor analysis. *ETS Research Bulletin Series*, 1967(2), 183–202. doi:10.1002/j.2333-8504.1967.tb00991.x

Killgore, W. D. (2000). Evidence for a third factor on the Positive and Negative Affect Schedule in a college student sample. *Perceptual and Motor Skills*, 90(1), 147–152. doi:10.2466/pms.2000.90.1.147

Kool, M. B., van de Schoot, R., López-Chicheri García, I., Mewes, R., Da Silva, J. A. P., Vangronsveld, K., … Geenen, R. (2014). Measurement invariance of the Illness Invalidation Inventory (3*I) across language, rheumatic disease and gender. *Annals of the Rheumatic Diseases*, 73(3), 551–556. doi:10.1136/annrheumdis-2012-201807

Kool, M. B., van Middendorp, H., Bijlsma, J. W. J., & Geenen, R. (2011). Patient and spouse appraisals of health status in rheumatoid arthritis and fibromyalgia: discrepancies and associations with invalidation. *Clinical and Experimental Rheumatology*, 29(6 Suppl 69), S63–S69. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/22243550

Kool, M. B., van Middendorp, H., Boeije, H. R., & Geenen, R. (2009). Understanding the lack of
understanding: invalidation from the perspective of the patient with fibromyalgia. *Arthritis and Rheumatism, 61*(12), 1650–1656. doi:10.1002/art.24922

Kosek, E., Ekholm, J., & Hansson, P. (1996). Sensory dysfunction in fibromyalgia patients with implications for pathogenic mechanisms. *Pain, 68*(2), 375–383. doi:10.1016/S0304-3959(96)03188-0

Leue, A., & Beauducel, A. (2011). The PANAS structure revisited: on the validity of a bifactor model in community and forensic samples. *Psychological Assessment, 23*(1), 215–225. doi:10.1037/a0021400

Lim, Y. J., Yu, B. H., Kim, D. K., & Kim, J. H. (2010). The positive and negative affect schedule: psychometric properties of the korean version. *Psychiatry Investigation, 7*(3), 163–169. doi:10.4306/pi.2010.7.3.163

Lloret-Segura, S., Ferreres-Traver, A., Hernández-Baeza, A., & Tomás-Marco, I. (2014). [Exploratory Item Factor Analysis: A practical guide revised and up-dated]. *Anales de Psicología, 30*(3), 1151–1169. doi:10.6018/analesps.30.3.199361

Lobo, A., Ezquerra, J., Gómez Burgada, F., Sala, J. M., & Seva Díaz, A. (1979). [Cognocitive mini-test (a simple practical test to detect intellectual changes in medical patients)]. *Actas luso-españolas de neurología, psiquiatría y ciencias afines*, 7(3), 189–202. Retrieved from http://europepmc.org/abstract/med/474231

Lonigan, C. J., Hooe, E. S., David, C. F., & Kistner, J. A. (1999). Positive and negative affectivity in children: confirmatory factor analysis of a two-factor model and its relation to symptoms of anxiety and depression. *Journal of Consulting and Clinical Psychology, 67*(3), 374–386. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10369058
Lopez-Gomez, I., Hervas, G., & Vazquez, C. (2015). [An adaptation of the Positive and Negative Affect Schedules (PANAS) in a Spanish general sample]. *Psicologia Conductual*, 23(3), 529–548.

Lumley, M. A., Cohen, J. L., Borszcz, G. S., Cano, A., Radcliffe, A. M., Porter, L. S., … Keefe, F. J. (2011). Pain and emotion: a biopsychosocial review of recent research. *Journal of Clinical Psychology*, 67(9), 942–968. doi:10.1002/jclp.20816

MacCallum, R. C., & Austin, J. T. (2000). Applications of structural equation modeling in psychological research. *Annual Review of Psychology*, 51, 201–226. doi:10.1146/annurev.psych.51.1.201

Meade, A. W. (2004). A Comparison of Item Response Theory and Confirmatory Factor Analytic Methodologies for Establishing Measurement Equivalence/Invariance. *Organizational Research Methods*, 7(4), 361–388. doi:10.1177/1094428104268027

Mehrabian, A. (1997). Comparison of the PAD and PANAS as models for describing emotions and for differentiating anxiety from depression. *Journal of Psychopathology and Behavioral Assessment*, 19(4), 331–357. doi:10.1007/BF02229025

Melvin, G. A., & Molloy, G. N. (2000). Some psychometric properties of the Positive and Negative Affect Schedule among Australian youth. *Psychological Reports*, 86(3 Pt 2), 1209–1212. doi:10.2466/pr0.2000.86.3c.1209

Merz, E. L., & Roesch, S. C. (2011). Modeling trait and state variation using multilevel factor analysis with PANAS daily diary data. *Journal of Research in Personality*, 45(1), 2–9. doi:10.1016/j.jrp.2010.11.003

Messick, S. (1980). Test validity and the ethics of assessment. *American Psychologist*, 35(4), 314–329.
Molloy, G. N., Pallant, J. F., & Kantas, A. (2001). A psychometric comparison of the positive and negative affect schedule across age and sex. *Psychological Reports, 88*(3 Pt 1), 861–862. doi:10.2466/pr0.2001.88.3.861

Nunnally, J., & Bernstein, I. (1994). *Psychometric Theory, 3rd edn, 1994*. McGraw-Hill, New York (Vol. 3). Retrieved from http://scholar.google.com.vn/scholar?q=Psychometric+Theory+3rd&btnG=&hl=vi&as_sdt=0,5#0

Ortuño-Sierra, J., Santarén-Rosell, M., Albéniz, A. P. de, & Fonseca-Pedrero, E. (2015). Dimensional structure of the Spanish version of the Positive and Negative Affect Schedule (PANAS) in adolescents and young adults. *Psychological Assessment, 27*(3), e1–9. doi:10.1037/pas0000107

Raykov, T. (2001). Bias of Coefficient α for Fixed Congeneric Measures with Correlated Errors. *Applied Psychological Measurement, 25*(1), 69–76. doi:10.1177/01466216010251005

Raykov, T. (2004). Behavioral scale reliability and measurement invariance evaluation using latent variable modeling. *Behavior Therapy, 35*(2), 299–331. doi:10.1016/S0005-7894(04)80041-8

Reich, J. W., Zautra, A. J., & Potter, P. T. (2001). Cognitive Structure and the Independence of Positive and Negative Affect. *Journal of Social and Clinical Psychology, 20*(1), 99–115. doi:10.1521/jscp.20.1.99.22255

Reich, J., Zautra, A., & Davis, M. (2003). Dimensions of affect relationships: Models and their integrative implications. *Review of General Psychology*. Retrieved from
Sandin, B., Chorot, P., Lostao, L., Joiner, T. E., Santed, M. A., & Valiente, R. M. (1999). The PANAS scales of positive and negative affect: Factor analytic validation and cross-cultural convergence. *Psicothema, 11*(1), 37–51.

Satorra, A. (2000). Scaled and Adjusted Restricted Tests in Multi-Sample Analysis of Moment Structures. In R. D. H. Heijmans, D. S. G. Pollock, & A. Satorra (Eds.), *Innovations in Multivariate Statistical Analysis* (pp. 233–247). Boston, MA: Springer US. doi:10.1007/978-1-4615-4603-0

Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika, 66*(4), 507–514. doi:10.1007/BF02296192

Schmukle, S. C., Egloff, B., & Burns, L. R. (2002). The relationship between positive and negative affect in the Positive and Negative Affect Schedule. *Journal of Research in Personality, 36*(5), 463–475. doi:10.1016/S0092-6566(02)00007-7

Segura-Jiménez, V., Álvarez-Gallardo, I. C., Carbonell-Baeza, A., Aparicio, V. A., Ortega, F. B., Casimiro, A. J., & Delgado-Fernández, M. (2015). Fibromyalgia has a larger impact on physical health than on psychological health, yet both are markedly affected: the al-Ándalus project. *Seminars in Arthritis and Rheumatism, 44*(5), 563–570. doi:10.1016/j.semarthrit.2014.09.010

Segura-Jiménez, V., Aparicio, V. A., Álvarez-Gallardo, I. C., Soriano-Maldonado, A., Estévez-López, F., Delgado-Fernández, M., & Carbonell-Baeza, A. (2014). Validation of the modified 2010 American College of Rheumatology diagnostic criteria for fibromyalgia in a Spanish population. *Rheumatology (Oxford, England), 53*(10), 1803–1811.
Soriano-Maldonado, A., Amris, K., Ortega, F. B., Segura-Jiménez, V., Estévez-López, F., Álvarez-Gallardo, I. C., … Ruiz, J. R. (2015). Association of different levels of depressive symptoms with symptomatology, overall disease severity, and quality of life in women with fibromyalgia. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. doi:10.1007/s11136-015-1045-0

Soriano-Maldonado, A., Estévez-López, F., Segura-Jiménez, V., Aparicio, V. A., Álvarez-Gallardo, I. C., Herrador-Colmenero, M., … Delgado-Fernández, M. (2015). Association of Physical Fitness with Depression in Women with Fibromyalgia. *Pain Medicine (Malden, Mass).* doi:10.1093/pm/pnv036

Sturgeon, J. A., Zautra, A. J., & Arewasikporn, A. (2014). A multilevel structural equation modeling analysis of vulnerabilities and resilience resources influencing affective adaptation to chronic pain. *Pain, 155*(2), 292–8. doi:10.1016/j.pain.2013.10.007

Tellegen, A., Watson, D., & Clark, L. A. (1999). On the Dimensional and Hierarchical Structure of Affect. *Psychological Science, 10*(4), 297–303. doi:10.1111/1467-9280.00157

Terracciano, A., McCrae, R. R., & Costa, P. T. (2003). Factorial and construct validity of the Italian Positive and Negative Affect Schedule (PANAS). *European Journal of Psychological Assessment: Official Organ of the European Association of Psychological Assessment, 19*(2), 131–141. doi:10.1027//1015-5759.19.2.131

Tuccitto, D. E., Giacobbi, P. R., & Leite, W. L. (2009). The Internal Structure of Positive and Negative Affect: A Confirmatory Factor Analysis of the PANAS. *Educational and Psychological Measurement, 70*(1), 125–141. doi:10.1177/0013164409344522
van Middendorp, H., Lumley, M. A., Jacobs, J. W. G., Bijlsma, J. W. J., & Geenen, R. (2010). The effects of anger and sadness on clinical pain reports and experimentally-induced pain thresholds in women with and without fibromyalgia. *Arthritis Care & Research, 62*(10), 1370–6. doi:10.1002/acr.20230

van Middendorp, H., Lumley, M. A., Jacobs, J. W. G., van Doornen, L. J. P., Bijlsma, J. W. J., & Geenen, R. (2008). Emotions and emotional approach and avoidance strategies in fibromyalgia. *Journal of Psychosomatic Research, 64*(2), 159–167. doi:10.1016/j.jpsychores.2007.08.009

Wang, M. (2005). Measurement Equivalence of the Job Descriptive Index Across Chinese and American Workers: Results from Confirmatory Factor Analysis and Item Response Theory. *Educational and Psychological Measurement, 65*(4), 709–732. doi:10.1177/0013164404272494

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063–70.

Wiebe, D. J., & Korbel, C. (2003). Defensive denial, affect, and the self-regulation of health threats. In H. L. LD Cameron (Ed.), *The Self-regulation of Health and Illness Behaviour* (pp. 184–203). New York, US: Routledge.

Wolfe, F., Smythe, H. A., Yunus, M. B., Bennett, R. M., Bombardier, C., Goldenberg, D. L., … Clark, P. (1990). The American College of Rheumatology 1990 Criteria for the Classification of Fibromyalgia. Report of the Multicenter Criteria Committee. *Arthritis and Rheumatism, 33*(2), 160–172. doi:10.1002/art.1780330203
Wright, L. J., Zautra, A. J., & Going, S. (2008). Adaptation to early knee osteoarthritis: the role of risk, resilience, and disease severity on pain and physical functioning. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine, 36*(1), 70–80. doi:10.1007/s12160-008-9048-5

Zautra, A. J., Fasman, R., Parish, B. P., & Davis, M. C. (2007). Daily fatigue in women with osteoarthritis, rheumatoid arthritis, and fibromyalgia. *Pain, 128*(1-2), 128–135. doi:10.1016/j.pain.2006.09.004

Zautra, A. J., Fasman, R., Reich, J. W., Harakas, P., Johnson, L. M., Olmsted, M. E., & Davis, M. C. (2005). Fibromyalgia: evidence for deficits in positive affect regulation. *Psychosomatic Medicine, 67*(1), 147–155. doi:10.1097/01.psy.0000146328.52009.23

Zautra, A. J., Johnson, L. M., & Davis, M. C. (2005). Positive affect as a source of resilience for women in chronic pain. *Journal of Consulting and Clinical Psychology, 73*(2), 212–220. doi:10.1037/0022-006X.73.2.212

Zautra, A., Smith, B., Affleck, G., & Tennen, H. (2001). Examinations of chronic pain and affect relationships: applications of a dynamic model of affect. *Journal of Consulting and Clinical Psychology, 69*(5), 786–795. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11680555

Zevon, M. a., & Tellegen, A. (1982). The structure of mood change: An idiographic/nomothetic analysis. *Journal of Personality and Social Psychology, 43*, 111–122. doi:10.1037/0022-3514.43.1.111
Figure 1. Graphical representation of the correlated two-factor model of the PANAS, Model 2b(2); the factor loadings are standardized loadings.

Table 1. Sociodemographic and clinical characteristics of the study sample of adult women with fibromyalgia ($n = 442$).

Table 2. Goodness of fit indices for the models assessed ($n = 442$).

Table 3. Comparison of the nested models using Satorra–Bentler $\chi^2$ statistic ($n = 442$).
Table 1 (on next page)

Sociodemographic and clinical characteristics of the study sample of adult women with fibromyalgia (n = 442)

Note. Values expressed as frequency (percentage) unless otherwise indicated. SD = Standard deviation.
Table 1. Sociodemographic and clinical characteristics of the study sample of adult women with fibromyalgia (n = 442).

| Characteristic                              | Value                  |
|---------------------------------------------|------------------------|
| **Demographic**                             |                        |
| Age (years), mean (SD)                      | 51.31 (7.42)           |
| Marital status                              | n (%)                  |
| Married                                     | 335 (75.8)             |
| Single                                      | 36 (8.1)               |
| Separated/Divorced/Widow                    | 71 (16.1)              |
| **Educational status**                      |                        |
| No studies                                  | 40 (9.0)               |
| Primary school                              | 213 (48.2)             |
| Secondary school                            | 126 (28.5)             |
| University degree                           | 63 (14.3)              |
| **Current occupational status**            |                        |
| Working full time                           | 70 (15.8)              |
| Working part time                           | 46 (10.4)              |
| Housewife                                   | 138 (31.2)             |
| Student                                     | 5 (1.1)                |
| Sick leave                                  | 32 (7.2)               |
| Unemployed                                  | 81 (18.3)              |
| Retired/pensioner/incapacity pension        | 70 (15.8)              |
| **Fibromyalgia diagnosis**                 |                        |
**Time since diagnosis**

- Less than 1 year: 29 (6.6)
- Between 1 and less than 5 years: 149 (33.7)
- More than 5 years: 251 (56.8)
- No answer: 13 (2.9)

**Time from first symptoms until diagnosis**

- Less than 1 year: 9 (2.0)
- Between 1 and less than 5 years: 214 (48.4)
- More than 5 years: 206 (46.6)
- No answer: 13 (2.9)

**Total tender points count, mean (SD)**: 16.79 (1.94)

---

*Note.* Values expressed as frequency (percentage) unless otherwise indicated.

*SD = Standard deviation.*
**Table 2** (on next page)

Goodness of fit indices for the models assessed \((n = 442)\)

*Note.* For all \(\chi^2\) S-B, \(p < .001\). CAIC = Consistent version of Akaike’s Information Criterion; CFI = comparative fit index; CI = confidence interval; \(df\) = degrees of freedom; NNFI = non-normed fit index; RMSEA = root mean-square error of approximation; SRMR = standardized root mean-square residual; S-B\(\chi^2\) = Satorra-Bentler \(\chi^2\) statistic.
| Model          | $\chi^2$ S-B | df  | RMSEA | 90% CI of RMSEA | SRMR | CFI  | CAIC |
|----------------|-------------|-----|-------|----------------|------|------|------|
| Model 1        | 1400.09     | 170 | .13   | (.122, .134)   | .14  | .61  | 194.57 |
| Model 2a       | 637.74      | 170 | .08   | (.072, .085)   | .13  | .85  | -567.88 |
| Model 2a(1)    | 361.23      | 157 | .05   | (.047, .062)   | .13  | .93  | -752.10 |
| Model 2a(2)    | 430.57      | 165 | .06   | (.053, .067)   | .13  | .92  | -739.50 |
| Model 2b       | 587.76      | 169 | .07   | (.068, .081)   | .06  | .87  | -610.67 |
| Model 2b(1)    | 315.38      | 156 | .05   | (.040, .056)   | .05  | .95  | -790.86 |
| Model 2b(2)    | 436.28      | 162 | .06   | (.055, .069)   | .05  | .91  | -712.50 |
| Model 2b(3)    | 288.49      | 155 | .04   | (.036, .052)   | .05  | .96  | -810.66 |
| Model 3a       | 739.13      | 170 | .09   | (.081, .093)   | .17  | .82  | -466.39 |
| Model 3a(1)    | 778.58      | 170 | .09   | (.084, .096)   | .20  | .81  | -426.94 |
| Model          | S-B $\chi^2$ | df  | $p$ value | CI             | RMSEA | SRMR | Note |
|---------------|--------------|-----|-----------|----------------|-------|------|------|
| Model 3a(2)   | 763.07       | 167 | .09       | (.083, .096)   | .19   | .81  | -421.18 |
| Model 3a(3)   | 768.58       | 167 | .09       | (.084, .097)   | .20   | .81  | -415.67 |
| Model 3b(1)   | 548.02       | 169 | .07       | (.065, .078)   | .13   | .88  | -650.41 |
| Model 3b(2)   | 534.04       | 166 | .07       | (.064, .078)   | .12   | .88  | -643.12 |
| Model 3b(3)   | 533.20       | 166 | .07       | (.064, .077)   | .13   | .88  | -643.95 |
| Model 4       | 498.69       | 150 | .07       | (.066, .080)   | .13   | .89  | -565.00 |

Note. For all $\chi^2$ S-B, $p < .001$. CAIC = Consistent version of Akaike’s Information Criterion; CFI = comparative fit index; CI = confidence interval; $df$ = degrees of freedom; RMSEA = root mean-square error of approximation; SRMR = standardized root mean-square residual; S-B$\chi^2$ = Satorra–Bentler $\chi^2$ statistic.
Table 3 (on next page)

Comparison of the nested models using Satorra–Bentler $\chi^2$ statistic ($n = 442$)

Note. * $p < .01$; $df$ = degrees of freedom; S-B$\chi^2$ = Satorra–Bentler $\chi^2$ statistic.
Table 3. Comparison of the nested models using Satorra–Bentler $\chi^2$ statistic ($n = 442$)

|               | Model 2a(1) | Model 2a(2) | Model 2b(1) | Model 2b(3) | Model 2b(2) |
|---------------|-------------|-------------|-------------|-------------|-------------|
| $\Delta S-B\chi^2$ | 219.03*     | 150.57*     | 258.57*     | 302.55*     | 181.02*     |
| $\Delta df$   | 13          | 5           | 14          | 15          | 8           |
| $\Delta \chi^2$ S-B | 92.44*      | 4           | 220.33*     | 243.63      | 121.10*     |
| $\Delta df$   |             | 4           | 13          | 14          | 7           |
| $\Delta S-B\chi^2$ |             |             |             |             |             |
| $\Delta df$   |             |             |             |             |             |

Note. * $p < .01$; $df$ = degrees of freedom; $S-B\chi^2$ = Satorra–Bentler $\chi^2$ statistic.
Graphical representation of the correlated two-factor model of the PANAS, Model 2b(2); the factor loadings are standardized loadings.