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The Wisconsin Schizotypy Scales are among the most widely used instruments for the assessment of psychosis proneness. The main goal of the present work was to study the dimensional structure underlying the Revised Physical Anhedonia Scale (RPhA), the Revised Social Anhedonia Scale (RSAS), the Magical Ideation Scale (MIS) and the Perceptual Aberration Scale (PAS). It was also explored whether the dimensions underlying these scales were invariant across gender and age. The sample was made up of 710 university students with a mean age of 19.8 years ($SD = 1.9$). The results showed that the dimensional structure of the Wisconsin scales was similar to that found in previous studies, displaying a Positive dimension and a Negative dimension, the Social Anhedonia Scale being related to both dimensions. Moreover, the factor structure of the schizotypy scales was found to be invariant across participants’ gender and age.

**Keywords:** schizotypy, psychosis proneness, invariance, Wisconsin Scales.

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Schizotypy may indeed be the most widely-studied exophenotypic risk marker of schizophrenia and may be interchangeable with other terms, such as at-risk mental state, psychosis proneness, and attenuated psychotic experiences (van Os, Linscott, Myin-Germeys, Delespaul, & Krabbe, 2009). Schizotypy can be understood as an attenuated form, premorbid or prodromal phase of schizophrenia (Raine, 2006), or as an organization of the personality that represents genetic vulnerability to psychosis (Meehl, 1962). From another point of view, Claridge (1997) considers schizotypy as a set of personality traits that is distributed along a continuum, from a state of well-being (health) to a state of illness (psychosis); on such a continuum, schizotypy would be an adaptive characteristic of personality which potentially connects with a disorder – schizophrenia– and which, under certain unfavourable conditions (e.g., stress, trauma or cannabis), would translate into clinical symptoms. It is assumed that the majority of schizotypal individuals will never make the transition to psychosis, however, they will exhibit neurocognitive, behavioural, emotional and social deficits, qualitatively similar to those found in patients with schizophrenia but quantitatively less severe (Fonseca-Pedrero, Lemos-Giráldez, Paino, Sierra-Baigrie, Villazón-García, & Muñiz, 2009; Fonseca-Pedrero, Lemos-Giráldez, Paino, Villazón-García, & Muñiz, 2010; Kwapiel, Barrantes-Vidal, & Silvia, 2008; Lenzenweger, Miller, Maher, & Manschreck, 2007; Raine, 2006).

The assessment of schizotypy through self-reports is a flexible, non-invasive and useful method of detecting individuals at heightened risk for schizophrenia-spectrum disorders, based on clinical signs and symptoms, or on score profiles (Gooding et al., 2005; Kwapiel et al., 2008). The following scales developed by the Chapman group at the University of Wisconsin in 1980s are the most widely used: the Revised Physical Anhedonia Scale (RPhA) (Chapman, Chapman, & Raulin, 1976), Revised Social Anhedonia Scale (RSAS) (Eckblad, Chapman, Chapman, & Mishlove, 1982), Magical Ideation Scale (MIS) (Eckblad & Chapman, 1983) and Perceptual Aberration Scale (PAS) (Chapman, Chapman, & Rawlin, 1978). Several reasons made these scales the best instruments for the assessment of schizotypy: a) their predictive validity for the detection of schizophrenia-spectrum disorders in independent longitudinal studies (Gooding, Tallent, & Matts, 2005; Kwapiel, 1998); b) their adequate psychometric properties (Fonseca-Pedrero, Paino et al., 2008); c) their rapid, effective, non-invasive administration, and straightforward interpretation of scores (Gooding et al., 2005; Kwapiel et al., 2008); and d) they were a basis for the construction of other more comprehensive self-reports for schizotypy assessment, such as the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE) (Mason & Claridge, 2006), or the Oviedo Schizotypy Assessment Questionnaire (ESQUIZO-Q) (Fonseca-Pedrero, Muñiz, Lemos-Giráldez, Paino, & Villazón-García, 2010).

Schizotypy offers a multidimensional structure similar to that found in patients with schizophrenia (Lenzenweger & Dworkin, 1996), but the number of dimensions, their nature and content, have still to be clarified, due to the heterogeneity of the measurement instruments and of the samples used (gender, age, culture, etc.) (Fonseca-Pedrero, Muñiz, Lemos-Giráldez, García-Cueto, Campillo-Álvarez, & Villazón García, 2007); however, a review of factor studies carried out over the last decade reveals the constant presence of the Positive (Unusual Perceptual Experiences) and the Negative dimensions (Anhedonia) of schizotypy (Fonseca-Pedrero et al., 2007; Kwapiel et al., 2008). Kwapiel and cols. (2008), in a sample of 6137 undergraduates, found that the two-factor solution based on the Positive and Negative dimensions, in which the Social Anhedonia scale was related to both dimensions, was that which presented the best goodness-of-fit indices. This two-factor structure has also been found in relation to anxious-depressive symptoms and social anxiety (Brown, Silvia, Myin-Germeys, Lewandowski, & Kwapiel, 2008; Lewandowski, Barrantes-Vidal, Nelson-Gray, Clancy, Kepley, & Kwapiel, 2006).

Gender and age differences in the expression of the schizotypal phenotype have also been found (Bora & Arabaci, 2009; Fossati, Raine, Carretta, Leonard, & Maffei, 2003; Paino, Fonseca-Pedrero, Lemos-Giráldez, & Muñiz, 2008). Using the Wisconsin scales, males tend to score higher on the Negative dimension, or Anhedonia (RPhA, RSAS), whilst females score higher on the Positive dimension (PAS and MIS) (Kwapiel et al., 2008; Muntaner, García-Sevilla, Fernández, & Torrubia, 1988), even though some studies have failed to find differences in the PAS and MIS scales (Chmielewski, Fernandes, Yee, & Miller, 1995; Kwapiel, Crump, & Pickup, 2002; Wuthrich & Bates, 2006). In a recent meta-analysis, Miettunen and Jääskeläinen (2010), exploring gender differences in the Wisconsin scales, found that males tend to score higher than women on the Anhedonia (physical and social) scales but females do not score higher on the Perceptual Aberration and Magical Ideation scales. Concerning age, younger participants tend to score higher on the schizotypy dimensions than the older ones (Meyer & Hautzinger, 1999), but few studies explore this relationship with the Wisconsin scales, compared to other instruments (e.g., O-LIFE; SPQ) (Bora & Arabaci, 2009; Fossati et al. 2003; Fonseca-Pedrero, Lemos-Giráldez, Paino, Villazón-Garcia, & Muñiz, 2009; Mason & Claridge, 2006; Paino et al., 2008).

The study of gender or age differences in the schizotypy dimensions only makes sense if invariance of measurement is confirmed, that is to say, if the different groups involved interpret the construct in similar ways (Byrne, 2008). In this sense, when comparisons between groups are made, it is typically assumed that both the measurement instrument and the psychological construct underlying said instrument behave exactly in the same manner and have the same
significance across the groups which are being compared (Byrne, 2008; Byrne & Steward, 2006). However, from a methodological point of view this statement is completely untenable if measurement invariance is not previously tested. If the data do not hold measurement invariance, or if this has not been tested, the validity of the inferences and interpretations extracted from the data may be erroneous or unfounded (Rusticus, Hubley, & Zumbo, 2008). Therefore, it is crucial to examine measurement invariance of the assessment tool so that findings based on group comparisons can be valid. Thus, it would be inappropriate to compare raw scores on the schizotypy dimensions if, for example, males and females interpreted the content of the items in different ways, or if this construct does not behave in the same manner across groups (e.g., if female’s dimensional structure were different from that found in males).

The dimensional structure measured by means of the Wisconsin scales has been found to be invariant with respect to participants’ gender and culture (Kwapil et al., 2008; Lewandowski et al., 2006). Likewise, the Schizotypal Personality Questionnaire (SPQ) (Raine, 1991) has shown it to be invariant across gender, age, culture, psychopathology, and religious affiliation (Badcock & Dragovic, 2006; Fossati et al., 2003; Reynolds, Raine, Mellingen, Venables, & Mednick, 2000; Wuthrich & Bates, 2006). Nevertheless, it should be pointed out that few studies have used the Wisconsin schizotypy scales to explore the invariance of the factor structure of the schizotypy scales as a function of age.

The main purpose of this study was to examine the dimensional structure of the Wisconsin scales. Also, it was explored whether the dimensions underlying these scales were invariant across gender and age. Specifically, we start from the hypothesis that the two-factor solution for schizotypy, with a Positive and a Negative dimension, in which social anhedonia is related to both, will be that which presents the best goodness-of-fit indices. It was also hypothesized that the dimensional structure of the schizotypy scales would emerge as invariant across gender and age.

Method

Participants

The initial sample was made up of 770 participants from 9 degree courses at the University of Oviedo: Law, Psychology, Teacher Training, Philology, Philosophy, Tourism, Education, Mathematics and Speech Therapy. Once participants with more than 3 points on the infrequency scale had been removed, the final sample was made up of 710 students, of whom 539 (75.9%) were women. Mean age of participants was 19.8 years ($SD = 1.9$), with a range of 17 to 26. Mean number of years of education was 16.6 ($SD = 2.7$).

Measurement instruments

Spanish version of the Revised Social Anhedonia Scale (RSAS) (FONSECA-PEDRERO, PAINO, LEMOS-GIRALDEZ, GARCIA-CUETO, VILLAZON-GARCIA, & MUÑIZ, 2009), consisting of 40 items in a true/false format measuring schizoid indifference, associability, lack of pleasure in social relationships and indifference toward others. Internal consistency of the scale ranges from .81 to .89 and test-retest reliability from .75 to .84. The validity of the RSAS has good empirical guarantees (Chapman, Chapman, & Kwapil, 1995; Fonseca-Pedrero, Paino et al., 2008; Kwapil et al., 2008). An internal consistency level of .95 was found for the Spanish adaptation of the RSAS as well as a one-factor structure (FONSECA-PEDRERO, PAINO et al., 2009).

Spanish version of the Revised Physical Anhedonia Scale (RPhA) (FONSECA-PEDRERO, PAINO et al., 2009), which contains 61 items in True/False format, measuring the inability to experience pleasure from pleasant physical stimuli such as touching, smelling or listening to music. Internal consistency of the RPhA ranges from .77 to .86, and test-retest reliability from .65 to .84. Construct, convergent, divergent, predictive and criterion validity have been widely studied. The correlation between the RPhA and RSAS is around .40 (Chapman et al., 1995; Fonseca-Pedrero, Paino et al., 2008; Kwapil et al., 2008). For the Spanish adaptation of the RPhA, a level of internal consistency of .92 was found as well as a one-factor structure (FONSECA-PEDRERO, PAINO et al., 2009).

Spanish version of the Perceptual Aberration Scale (PAS) (FONSECA-PEDRERO, PAINO, LEMOS-GIRALDEZ, GARCIA-CUETO, VILLAZON-GARCIA, & MUÑIZ, 2009), exploring in a True/False format perceptual distortions related to body image (28 items) and to other objects (7 items). Internal consistency is between .84 and .90, with test-retest reliability ranging from .43 to .84. Validity of the PAS is backed up by a wide range of data (Chapman et al., 1995; Fonseca-Pedrero, Paino et al., 2008; Kwapil et al., 2008). In a Spanish population, a one-factor solution and a Cronbach’s alpha value of .96 were found (FONSECA-PEDRERO, PAINO, LEMOS-GIRALDEZ, GARCIA-CUETO et al., 2009).

Spanish version of the Magical Ideation Scale (MIS) (FONSECA-PEDRERO, PAINO, LEMOS-GIRALDEZ, GARCIA-CUETO et al., 2009), made up of 30 items in a True/False format, assess superstitious and magical beliefs and thoughts (thought reading or thought broadcasting). Its internal consistency ranges from .78 to .92, and test-retest reliability from .41 to .84. Its correlation with the PAS is between .53 and .75. The validity of the MIS as a schizotypy measure is also endorsed by numerous studies (Chapman et al., 1995; Fonseca-Pedrero, Paino et al., 2008; Kwapil et al., 2008). For the Spanish adaptation of the MIS, an internal consistency level of .93 was found as well as a one-factor structure (FONSECA-PEDRERO, PAINO, LEMOS-GIRALDEZ, GARCIA-CUETO et al., 2009).

Additionally, we included the Infrequency Scale (INFS) (Chapman & Chapman, 1983), made up of 13
items in a True/False format, to detect participants that respond randomly, pseudo-randomly or dishonestly to the questionnaires. Participants scoring 3 or more items were removed from the sample. The INFS has also been used in other studies on schizotypy (Kwapil et al., 2008; Wuthrich & Bates, 2006). In this study, the version which was validated in university students was used (Fonseca-Pedrero, Paino, Lemos-Giráldez, García-Cueto et al., 2009).

Procedure

Administration of the questionnaire was carried out in groups of 25 to 50 participants. They were fully informed of the confidentiality of their responses, as well as the voluntary nature of their participation. Participants received no type of remuneration or reward for their involvement in the study. Ethical approval for the study was granted by the University of Oviedo.

Data analysis

Once the normality and sphericity assumptions had been checked, we calculated the mean scores, standard deviations and asymmetry and kurtosis indices for each one of the items and for the total scores on the four scales. Secondly, with the aim of studying the structure of schizotypy, we carried out confirmatory factor analyses (CFA), in which different factor models were tested. These CFAs were made using the variance-covariance matrix with the method of robust maximum-likelihood estimation (Jöreskog & Sörbom, 1993). Following the guidelines of Brown (2006) and Kline (2005), the goodness-of-fit indices were as follows: the χ2-test (χ2), the Comparative Fit Index (CFI), the General Fit Index (GFI), the Root Mean Square Error of Approximation (RMSEA) (and its confidence interval), the Standardized Root-Mean-Square Residual (SRMR) and the Akaike Information Criterion (AIC). To carry out the CFA we composed for each of the scales, three parcels comprised of items selected at random following the recommendations of Little, Cunningham, Shahar & Widaman (2002). Likewise, correlation of the error terms was allowed among the parcels constructed; while it is true that allowing correlation between the error terms is not a very common practice, in the present study we permitted covariation between them, as the items comprising each parcel had similar content. The covariation between parcels 1 and 3 of Physical anhedonia was not allowed because variance error of Physical 3 was negative.

Thirdly, measurement invariance is frequently tested by multigroup comparisons using structural equation modeling within the framework of a CFA. Basically, a hierarchical set of steps are followed when invariance is tested, typically starting with the determination of a well-fitting multigroup baseline model and continuing with the establishment of successive equivalence constraints in the model parameters across groups (Byrne, 2008; Byrne & Stewart, 2006). The baseline model is called the configural model, which is the first and least restrictive model to be tested and is important because it represents the baseline model against which all subsequent specified invariance models are compared. The configural model is established by specifying and testing the model for each group separately. Once the theoretical model has been validated in both groups, configural invariance is then examined requiring that the same pattern of fixed and freely estimated parameters is equivalent across groups, and therefore, that no equality constraints are imposed. When configural invariance is met, it suggests that the factor structure is similar, but not necessarily equivalent across groups. The next step is to impose equality constrains on the factor loadings across the groups to test metric or weak invariance. If the model fit with the constrained parameters is significantly worse than the baseline model, then weak invariance is not supported. When the metric invariance is met, it suggests that the same unit of measurement is being used for the item across the groups and that the participants interpret and respond to the measure in a similar manner (Horn & McArdle, 1992). The final step is to impose constrains on the item intercepts and factor loadings to test strong or scalar invariance across groups. The confirmation of the invariance of the intercepts permits comparison of the latent means in both groups (Meredith, 1993).

The analyzed models can be seen as nested models to which constraints are progressively added. For the comparison of the nested models, we have proposed criteria such as the ∆CFI or chi-square difference tests (Δχ2) (Byrne & Stewart, 2006; Cheung & Rensvold, 2002). Both criteria have been extensively used in the literature, however, when they are used in conjunction they are clearly in disagreement causing researchers to reach completely contradictory conclusions (Rusticus et al., 2008). Due to the limitations of the χ2 regarding its sensitivity to sample size, Cheung and Rensvold (2002) have proposed a more practical criterion, the ACFI, to determine if nested models are practically equivalent. In this study, when ACFI is greater than .01 between two nested models, the more constrained model is rejected since the additional constrains have produced practically worse fit. However, if the change in CFI is less than or equal to .01, it is considered that all specified equal constrains are tenable; therefore, we can continue with the next step in the analysis of measurement invariance. For the data analysis we used SPSS 15.0 and LISREL 8.7 (Jöreskog & Sörbom, 1993).

Results

Descriptive statistics of the scales

Means and standard deviations, according to gender and age, are shown in Table 1. The asymmetry and kurtosis values are within the range of normality, except for the Social Anhedonia Scale (Asymmetry = 1.73;
kurtosis = 4.71). Internal consistency values for the total sample on each scale are shown in Table 2. Correlations between the total scores for the Wisconsin scales showed that the Magical Ideation and Perceptual Aberration scales correlated positively and strongly. On the other hand, the Physical Anhedonia scale correlated positively with that of Social Anhedonia, and negatively with the Magical Ideation and Perceptual Aberration scales. All the correlations found were statistically significant.

**Confirmatory factor analyses**

The goodness-of-fit indices of the confirmatory factor analyses carried out are shown in Table 3. The first model (model 1) postulated the existence of a single schizotypy dimension, which could explain the general psychopathology; the fit indices for this model were inadequate. The second model (model 2) explores the existence of two schizotypy dimensions (Positive and Negative), in which the PAS and MIS scales corresponded to the Positive dimension, and the RSAS and RPhA scales to the Negative dimension; this model presented better indices of fit in comparison to the one-factor model. Finally, we tested a third model (model 3) –similar to the previous one–, in which the Social anhedonia scale was related to both the Positive and the Negative dimension. This model presented better indices of fit to the data than the other two, obtaining a non-significant chi-squared value ($p = .11$).

The standardized coefficients for the two-factor model in which the Social anhedonia parcels were related to both dimensions are shown in Figure 1.

**Invariance of schizotypy dimensions across gender and age**

When measurement invariance for the two-factor model hypothesized by Kwapil et al. (2008) was explored across gender, the goodness-of-fit indices for the two-factor model were adequate in both groups. As can be seen in Table 3, the progressive incorporation of constraints in the factor loadings (metric invariance) and of the intercept values (strong invariance) did not produce an increase greater than .01 in CFI. The results support the configural, metric and strong invariance of the schizotypy dimensions measured by the Wisconsin Scales across gender. Invariance across age group was also examined, and the goodness-of-fit indices were also adequate in both groups, so that configural invariance can be confirmed. Also, the incorporation of constraints, both in the factor loadings and in the intercept values, did not produce an increase greater than .01 in CFI (see Table 3). Hence, the data support the configural, metric and strong invariance of the schizotypy dimensions across age. Therefore, we concluded that the factorial structure of the Wisconsin Scales was operating equivalently across gender and age.

### Table 1

Descriptive statistics for the Wisconsin scales according to gender and age

<table>
<thead>
<tr>
<th>Scales</th>
<th>Gender</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men (Mean (SD)</td>
<td>Women (Mean (SD))</td>
</tr>
<tr>
<td></td>
<td>(n = 171)</td>
<td>(n = 539)</td>
</tr>
<tr>
<td>Physical anhedonia</td>
<td>17.6 (7.5)</td>
<td>14.4 (6.3)</td>
</tr>
<tr>
<td>Social Anhedonia</td>
<td>7.7 (5.5)</td>
<td>5.3 (4.1)</td>
</tr>
<tr>
<td>Perceptual Aberration</td>
<td>6.3 (4.6)</td>
<td>6.7 (5.6)</td>
</tr>
<tr>
<td>Magical Ideation</td>
<td>7.0 (4.8)</td>
<td>7.1 (4.7)</td>
</tr>
</tbody>
</table>

### Table 2

Correlations between the Wisconsin scales and reliability coefficients

<table>
<thead>
<tr>
<th>Physical Anhedonia</th>
<th>Social Anhedonia</th>
<th>Perceptual Aberration</th>
<th>Magical Ideation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical anhedonia</td>
<td>.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Anhedonia</td>
<td>.30*</td>
<td>.81</td>
<td></td>
</tr>
<tr>
<td>Perceptual Aberration</td>
<td>- .13*</td>
<td>.18*</td>
<td>.87</td>
</tr>
<tr>
<td>Magical Ideation</td>
<td>- .13*</td>
<td>.14*</td>
<td>.60*</td>
</tr>
</tbody>
</table>

Note: Alpha coefficients of the scales are shown on the main diagonal. * $p < .01$
### Table 3

**Goodness-of-fit indices for the theoretical models proposed and measurement of invariance**

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>GFI</th>
<th>CFI</th>
<th>RMSEA</th>
<th>RMSEA 90 % CI</th>
<th>SRMR</th>
<th>AIC</th>
<th>$\Delta$CFI</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-factor</td>
<td>569.2</td>
<td>43</td>
<td>.88</td>
<td>.889</td>
<td>.13</td>
<td>.12-.14</td>
<td>.12</td>
<td>639.2</td>
<td></td>
</tr>
<tr>
<td>Two-factor</td>
<td>118.7</td>
<td>42</td>
<td>.97</td>
<td>.984</td>
<td>.05</td>
<td>.04-.06</td>
<td>.09</td>
<td>190.7</td>
<td></td>
</tr>
<tr>
<td>Two-factor (social anhedonia)</td>
<td>49.9</td>
<td>39</td>
<td>.99</td>
<td>.997</td>
<td>.02</td>
<td>.01-.03</td>
<td>.02</td>
<td>127.9</td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men ($n = 171$)</td>
<td>58.1</td>
<td>39</td>
<td>.95</td>
<td>.990</td>
<td>.05</td>
<td>.02-.08</td>
<td>.05</td>
<td>136.5</td>
<td></td>
</tr>
<tr>
<td>Women ($n = 539$)</td>
<td>33.2</td>
<td>39</td>
<td>.98</td>
<td>.985</td>
<td>.01</td>
<td>0-.02</td>
<td>.02</td>
<td>111.2</td>
<td></td>
</tr>
<tr>
<td><strong>Multigroup comparisons</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Configural invariance</td>
<td>90.8</td>
<td>78</td>
<td>.99</td>
<td>.997</td>
<td>.02</td>
<td>0-.04</td>
<td>.02</td>
<td>246.8</td>
<td></td>
</tr>
<tr>
<td>Metric invariance</td>
<td>107.4</td>
<td>91</td>
<td>.99</td>
<td>.997</td>
<td>.02</td>
<td>0-.04</td>
<td>.02</td>
<td>237.4 -0.01</td>
<td></td>
</tr>
<tr>
<td>Strong invariance</td>
<td>144.3</td>
<td>101</td>
<td>.99</td>
<td>.991</td>
<td>.03</td>
<td>0-.05</td>
<td>.03</td>
<td>302.3 -0.01</td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-19 years ($n = 364$)</td>
<td>32.9</td>
<td>39</td>
<td>.98</td>
<td>.999</td>
<td>.01</td>
<td>0-.03</td>
<td>.02</td>
<td>110.9</td>
<td></td>
</tr>
<tr>
<td>20-26 years ($n = 346$)</td>
<td>58.9</td>
<td>39</td>
<td>.97</td>
<td>.993</td>
<td>.04</td>
<td>0-.06</td>
<td>.04</td>
<td>136.9</td>
<td></td>
</tr>
<tr>
<td><strong>Multigroup comparisons</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Configural invariance</td>
<td>93.9</td>
<td>78</td>
<td>.97</td>
<td>.997</td>
<td>.02</td>
<td>0-.04</td>
<td>.04</td>
<td>312.0</td>
<td></td>
</tr>
<tr>
<td>Metric invariance</td>
<td>116.3</td>
<td>91</td>
<td>.96</td>
<td>.995</td>
<td>.03</td>
<td>0-.04</td>
<td>.04</td>
<td>246.3 -0.01</td>
<td></td>
</tr>
<tr>
<td>Strong invariance</td>
<td>151.6</td>
<td>101</td>
<td>.95</td>
<td>.990</td>
<td>.04</td>
<td>0-.05</td>
<td>.06</td>
<td>309.6 -0.01</td>
<td></td>
</tr>
</tbody>
</table>

*Note:* GFI: General Fit Index; CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of Approximation; CI: Confidence Interval; SRMR: Standardized Root Mean Square Residual; AIC: Akaike Information Criterion
Figure 1. Standardized coefficients for the two-factor model of schizotypy
Note: Physical Anh.: Physical Anhedonia; Social Anh.: Social Anhedonia; Mag. Ideation: Magical Ideation; Perceptual Ab: Perceptual Aberration.
Neither values for correlation between error terms nor error terms values are shown.
The covariation between parcels 1 and 3 of Physical anhedonia was not allowed because variance error of Physical 3 was negative and models did not converge.
Next, latent mean differences across groups were estimated fixing the latent mean values to zero, first in the male group and then in the 17-19 year-old group. For comparisons among groups in the latent means, statistical significance was based on the z statistics. The comparison of the gender groups on the latent means, indicated that, on average, women scored 1.159 units below males in Negative dimensions and that this difference was statistically significant (-1.159; \( p < .01 \)), however, no statistically significant differences were found in the Positive dimension (.017; \( p > .05 \)). The comparison of the age groups on the latent means, indicated that, on average, the 20-26 year-old group scored 1.961 units below the 17-19 year-old group in the schizotypy Negative dimension, with this difference being statistically significant (-1.961; \( p < .01 \)). In the Positive dimension of schizotypy statistically significant differences were also found, with the 20-26 year-old group scoring .920 units below the 17-19 year-old group (-.920; \( p < .01 \)).

Discussion

The aim of this study was to explore the dimensional structure and measurement invariance of the Wisconsin psychosynthesis scales across gender and age. The results, concurring with those found in the literature (Kwapil et al., 2008), indicate that the two-factor solution for schizotypy based on the Positive and Negative dimensions, in which the social anhedonia facet is related to the two dimensions equally, is that which presents the best indices of fit, compared to the proposed theoretical models. Likewise, the dimensional structure of the Wisconsin schizotypy scales was found to be invariant across gender and age.

Our results on the reliability and construct validity of the Wisconsin scales are similar to those found by Kwapil et al. (2008), as these scales show adequate psychometric properties in this age group. The Psychometric High-risk paradigm offers several advantages with respect to other assessment methods being a valid, reliable, non-invasive method that is quick to apply, score and interpret, and whose ultimate aim could be primary prevention (Gooding et al., 2005). Concerning construct validity, the results show that the model with the best indices of fit was the two-factor model proposed by Kwapil and cols. (2008). Thus, we find a faithful replication of the results previously obtained by Kwapil et al. (2008) in an independent sample of young adults in a different cultural context, supporting the solidity and consistency of the two-factor model. As far as the role of social anhedonia is concerned, in accordance with Brown et al. (2008), it appears to be a multidimensional construct related to both positive and negative symptoms of schizotypy in non-clinical young adults. In this sense, social anhedonia is more than purely a measure for the assessment of the Negative dimension of schizotypy.

Concerning measurement invariance, the results indicate that the dimensional structure underlying the Wisconsin scales is invariant across gender, as had been found in some previous works (Kwapil et al., 2008; Lewandowski et al., 2006). Kwapil et al. (2008), found that the two-factor solution based on the Positive and Negative dimensions, in which the Social Anhedonia scale was related to both dimensions, was invariant across gender. Using the Schizotypal Personality Questionnaire (Raine, 1991) the structure of schizotypy was also found to be invariant across gender, age, culture and religious affiliation (Badcock & Dragovic, 2006; Fossati et al., 2003; Reynolds et al., 2000; Wuthrich & Bates, 2006).

For the variable gender, and again in accordance with previous literature (Chmielewski et al., 1995; Kwapil et al., 2002; Wuthrich & Bates, 2006), the results show that males tend to score higher than females in the Negative dimension or Anhedonia (RPHa, RSAS), and that women do not score higher than men in the Positive dimension (PAS, MIS). Similar results were found by Miettunen and Jääskeläinen (2010) in a recent meta-analysis, exploring gender differences on the Wisconsin scales; however, it should be pointed out that other studies have indeed found higher scores in females for the Positive dimension (PAS and MIS) (Kwapil et al., 2008; Muntaner et al., 1988). With regard to age, younger participants tend to score higher than the older ones in the positive and negative dimensions of schizotypy (PAS), though this variable requires further research. Similar results were found with other instruments (e.g., O-LIFE, SPQ) (Bora & Arabaci, 2009; Fonseca-Pedrero, Lemos-Giráldez, Muñiz, García-Cueto, & Campillo-Álvarez, 2008; Fossati et al., 2003; Mason & Claridge, 2006); however, several studies have found that the Negative dimension is positively correlated with age (Mason & Claridge, 2006). Nevertheless, it is worth mentioning that in this study participants’ raw scores are not compared, that is, the total scores on the scales, but rather based on the factorial model with the best fit indices, the means on the latent variables are compared.

In the interpretation of these findings some limitations should be borne in mind. Firstly, the sample is made up of university students, with unequal representation of men and women, even though the proportions are similar to those found in previous studies. Likewise, the reduced age range limits the generalizability of the results. Secondly, schizotypy is a multidimensional construct (Fonseca-Pedrero et al., 2007), the positive and negative dimensions found in this study being widely endorsed, even though research in the field has considered other relevant dimensions, such as Paranoid Ideation, Impulsive Nonconformity, Disorganization or Social Anxiety. Thirdly, it is also important to underline the limitations inherent to any type of self-report, referring basically to participants’ ability to report on their own behaviour and thoughts. Finally,
individuals with high scores on measures of schizotypy would require the contribution of other factors such as stressful events, coping strategies, genetic background or hormonal changes, for the development of a psychotic disorder, as proposed in the diathesis-stress model.

Future research could involve the longitudinal study of participants with high scores, in an attempt to determine the sensitivity and specificity of this set of scales. Likewise, it is important to continue to make progress in understanding the nature of schizotypy in other populations and age groups, and with other self-reports (Fonseca-Pedrero, Paino, Lemos-Giráldez, Villazón-García et al., 2009). Furthermore, the question that remains open is whether schizotypy measured through the Wisconsin scales is invariant across culture. Fortunately, the incorporation of new technologies and advances in the field of psychological and educational measurement will permit the opening up of new horizons and research lines in the assessment of schizotypy.

References


