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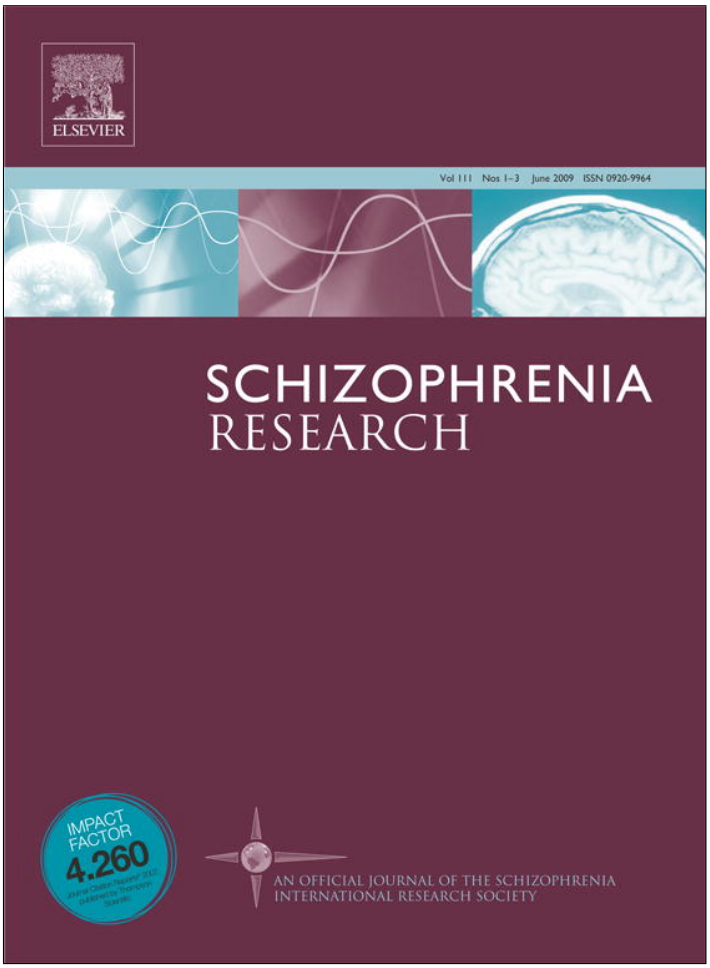

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Validation of the Schizotypal Personality Questionnaire—Brief Form in adolescents

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ABSTRACT

The main objective of the study was to validate the Schizotypal Personality Questionnaire—Brief (SPQ-B) in a sample of non-clinical adolescents. In addition, the schizotypal personality structure and differences in the dimensions of schizotypy according to gender and age are analyzed. The sample comprises 1683 students, 818 males (48.6%), with a mean age of 15.9 years (SD = 1.2). The results showed that the SPQ-B had adequate psychometric properties. Internal consistency of the subscales and total score ranged from 0.61 to 0.81. Confirmatory factor analyses indicated that the three-factor model (positive, negative, and disorganized) and the four-factor model (positive, paranoid, negative, and disorganized) fit reasonably well in comparison to the remaining models. With regard to gender and age, statistically significant differences were found due to age but not to gender. In line with previous literature, the results confirmed the multi-factor structure of the schizotypal personality in non-clinical adolescent populations. Future studies could use the SPQ-B as a screening self-report of rapid and efficient application for the detection of adolescents vulnerable to the development of schizophrenia-spectrum disorders in the general population, in genetically high-risk samples and in clinical studies.

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1. Introduction

The continuity hypotheses of the psychosis phenotype suggests that psychotic experiences, such as hallucinatory experiences and delusional ideation, are present in the general population as well as in clinical populations, and are not necessarily associated with impairment (Nelson and Yung, 2009). Subclinical psychotic experiences which do not meet the clinical criteria for psychosis are known as psychosis proneness, schizotypy, or at-risk mental states (Claridge, 1997; Chapman et al., 1995; Meehl, 1962; van Os et al., 2008; Yung et al., 2003). Empirical evidence indicates that subjects with high scores on schizotypy self-reports are at heightened risk for later development of schizophrenia-spectrum disorders (Gooding et al., 2005; Poulton et al., 2000). Kwapil (1998), in a ten-year follow-up study, reported that 24% of individuals scoring high on the Social Anhedonia Scale (Chapman et al., 1976) were diagnosed as having a schizophrenia-spectrum disorder, as compared to 1% of controls. Likewise, Poulton et al. (2000), in a birth study cohort from Dunedin, showed that children who had reported hallucinations and delusions at 11 years of age had more than a 16-fold higher risk for developing a schizophreniform disorder by the age of 26.

The term "schizotypy" is a complex concept that can be understood from two viewpoints. Some researchers, mainly North American, refer to it as a latent organization of the personality related to genetic vulnerability to schizophrenia (Meehl, 1962). In this model, it is assumed that the majority of schizotypal individuals will never make the transition to psychosis; however, they will exhibit neurocognitive, behavioural and social deficits, qualitatively similar to those found in patients with schizophrenia but quantitatively less severe

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(Aguirre et al., 2008; Fonseca-Pedrero et al., 2007a,b; Kwapil et al., 2008; Raine, 2006; Wilson et al., 2008). Conversely, European researchers consider schizotypy as an aggregate of cognitive and emotional traits which are expressed on a dynamic continuum, ranging from psychological well-being to schizophrenia-spectrum personality disorders and to full-blown schizophrenia (Claridge, 1997).

The use of psychometric inventories (psychometric high-risk method) has advanced considerably in the last three decades, and is considered a feasible, valid, inexpensive, and non-invasive technique for identifying individuals at risk for the later development of schizophrenia-spectrum disorders (Kwapil et al., 2008; Lenzenweger, 1994). This method allows the examination of symptoms similar to schizophrenia, while minimizing the confounding effects of medication and hospitalization present in patients with schizophrenia, and it can be used in combination with high-risk genetic studies to determine relevant aetiological factors. Among the most frequently employed self-reports for the assessment of schizotypal personality, based on the DSM diagnostic criteria (American Psychiatric Association, 1994), we find the Schizotypal Personality Questionnaire in its long (SPQ) and brief versions (SPQ-B) (Raine, 1991; Raine and Benishay, 1995). More specifically, the SPQ-B has been extensively investigated with a broad range of topics and samples (Aycicegi et al., 2005; Bedwell et al., 2006; Compton et al., 2007; Jahshan and Sergi, 2007; Mata et al., 2005). Analysis of the psychometric properties of the SPQ-B reveals that the internal reliabilities for the total score range from 0.75 to 0.83, and test–retest reliability ranges from 0.70 and 0.95. Evidence has also been found in relation to construct, convergent, discriminant, and criterion-related validity (Fonseca-Pedrero et al., 2008b; Mata et al., 2005; Raine and Benishay, 1995).

The schizotypal personality is not a monolithic construct, but rather a more multidimensional one (Fonseca-Pedrero et al., 2007b), whose factors vary depending on the self-report used and/or the sample characteristics. Using the SPQ, Raine et al.'s (1994) Disorganized Model, made up of the Cognitive-Perceptual (magical thinking, unusual experiences, ideas of reference, paranoid ideation), Interpersonal (no close friends, blunted affect, social anxiety, paranoid ideation) and Disorganized (odd behaviour, odd speech) dimensions, has been consistently replicated. Moreover, this structure appears to be invariant with regard to sex, age, religious affiliation and social background (Badcock and Dragovic, 2006; Chen et al., 1997; Fossati et al., 2003; Reynolds et al., 2000; Wuthrich and Bates, 2006), maintaining some parallels with the factorial structure found in patients with schizophrenia (Liddle, 1987). In the case of the SPQ-B, only a few factor studies have been carried out, and mainly of an exploratory nature, with college students and outpatient adolescents (Axelrod et al., 2001; Aycicegi et al., 2005; Mata et al., 2005), though some confirmatory factor analyses have also been made with schizophrenia-spectrum patients (Compton et al., 2007). The number and content of the schizotypal personality traits in outpatient adolescents and young adults, measured with the SPQ-B, are specified in two or three dimensions (Axelrod et al., 2001; Aycicegi et al., 2005; Mata et al., 2005), similar to those found with the SPQ in adolescents (Chen et al., 1997; Fossati et al., 2003).

Upon examining the phenotypical expression of schizotypal traits as a function of sex, just as with schizophrenia patients (Goldstein and Link, 1988), it was found that women tend to score higher than men in the positive (ideas of reference, magical thinking) and in social anxiety dimensions of schizotypy, whereas men score higher than women in the negative (anhedonia) and disorganized dimensions (Fonseca-Pedrero et al., 2007b; Fossati et al., 2003; Mata et al., 2005; Miller and Burns, 1995; Raine, 1992; Wuthrich and Bates, 2006). Similar results are found in adolescent population (Fonseca-Pedrero et al., 2008a; Fossati et al., 2003; Venables and Bailes, 1994). On comparing age groups, it is found that adolescents score higher than older people in schizotypal traits (Chen et al., 1997; Fossati et al., 2003; Venables and Bailes, 1994), though other studies find, on analyzing only homogeneous groups of adolescents, that the younger ones tend to score lower than the older ones (Fonseca-Pedrero et al., 2008a,b,c).

There is no doubt that adolescence is a particularly important developmental stage, marked by the emergence of mental health problems, specifically, psychotic disorders (Walker and Bollini, 2002). Likewise, it is an appropriate time for studying possible risk markers for schizophrenia (Keshavan et al., 2005) and for the promotion of detection and early intervention strategies previous to the development of the syndrome (e.g., prodromes) (Cannon et al., 2008). It is important to have available self-reports with adequate psychometric properties to use in the adolescent population that will allow rapid detection of participants at risk for psychosis or who present schizotypal traits. However, the psychometric properties of the SPQ-B have not yet been examined, and nor has its factor structure in non-clinical adolescent population been exhaustively studied. Within the framework of research, the main objective of the current study was the validation of the SPQ-B in a representative sample of non-clinical adolescents by analyzing the dimensions of schizotypy according to gender and age.

2. Method

2.1. Participants

Stratified random cluster sampling was carried out at the classroom level, in a population of approximately 37,000 students selected from the Principality of Asturias, a region in northern Spain. This sample selection guarantees the representativeness of the sample of adolescents belonging to this geographical region. The students came from various public and grant-assisted secondary schools and vocational training colleges, as well from a range of socio-economic levels. The layers were created according to geographical zone (East, West, and Centre) and educational stage (compulsory and post-compulsory), and the probability of a school being selected depended on its student numbers. Thus, the final sample was made up of 1683 students, 818 males (48.6%) and 865 females (51.4%), from 41 institutions and 95 classrooms. Mean age of the sample was 15.9 (SD = 1.2), with a range of 14 to 19. Distribution by age was: 14-year olds ($n = 210$), 15-year olds ($n = 441$), 16-year olds ($n = 486$), 17-year olds ($n = 358$), 18-year olds ($n = 158$) and 19-year olds ($n = 30$).

2.2. Procedure

The questionniare was applied collectively in groups of 15–25 participants. They were informed of the confidentiality

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Table 1
Proposed models for the confirmatory factor analysis of the items of the Schizotypal Personality Questionnaire—Brief.

Model	Factor	IR	MT	UPE	PA	SA	NCF	CA	OB	OS
Unidimensional	General [a]	5, 10	4, 12	2, 16	7, 9, 14, 17	11, 21	15, 18	1, 22	3, 6, 19	8, 13, 20
Siever and Gunderson (1983)	Positive	X	X	X	X				X	X
	Negative					X	X	X		
Raine and Benishay (1995) [b]	Positive	X	X	X	9, 17					
	Negative				7, 14	X	X	X		
	Disorganized								X	X
Raine et al. (1994)	Positive	X	X	X	X					
	Negative				X	X	X	X		
	Disorganized								X	X
Battaglia et al. (1997)	Positive	X	X	X	X					
	Negative					X	X	X		
	Disorganized								X	X
Bergman et al. (1996)	Positive		X	X						
	Negative						X	X	X	X
	Paranoid	X			X	X				
Stefanis et al. (2004) [c]	Positive		X	X						
	Negative				X	X	X	X		
	Disorganized								X	X
	Paranoid	X			X	(X)				

IR = ideas of reference; MT = magical thinking; UPE = unusual perceptual experiences; PA = paranoia/suspiciousness; SA = social anxiety; NCF = no close friends; CA = constricted affect; OB = odd behaviour; OS = odd speech.

[a] Items corresponding to each factor are shown.

[b] For this model, items 9 and 17 correspond to the Paranoid factor and items 7 and 14 to the Negative factor.

[c] In this original study, the social anxiety dimension loaded below 0.3 on the Paranoid factor; therefore, it was included in the Negative dimension in the present study.

of their responses and of the voluntary nature of their participation. Written informed consent to participate in the study was obtained from all participants. For those under 18, parents' written informed consent for their children's participation was required. Participants did not receive any kind of incentive for taking part. The application took place under the supervision of the researchers.

2.3. Measurement instruments

2.3.1. The Schizotypal Personality Questionnaire—Brief Form (SPQ-B)

The Schizotypal Personality Questionnaire—Brief Form (SPQ-B) (Raine and Benishay, 1995) is a 22-item self-report, with Yes/No format (Appendix A), based on the SPQ (Raine, 1991). In this study, a Spanish version previously validated in college students was used (Mata et al., 2005). Raine's SPQ-B consists of the Cognitive-Perceptual (8 items), Interpersonal (8 items), and Disorganization (6 items) subscales; in addition, a total score is obtained. The psychometric properties of the SPQ-B have been extensively studied. Internal reliabilities for the total score range from 0.75 to 0.83 (0.58 and 0.87 for the subscales). Test–retest reliability ranges from 0.70 to 0.95. We obtained evidence about construct, convergent, discriminant, and criterion-related validity (Fonseca-Pedrero et al., 2008b). The correlation between the SPQ-B and the Structured Clinical Interview for DSM-III-R Personality Disorders (SCID-II) (Spitzer et al., 1987) obtained a mean value of 0.62 (Raine and Benishay, 1995). The SPQ-B has been studied using patients with schizophrenia and first-degree relatives of patients with schizophrenia-spectrum disorders (Compton et al., 2007), non-clinical patients (Hergovich et al., 2008), adolescent outpatients (Axelrod et al., 2001), and college students (Aycicegi et al., 2005).

2.3.2. The Oviedo Infrequency Scale (INF-OV)

The Oviedo Infrequency Scale (INF-OV) (Fonseca-Pedrero et al., 2008c) is a 12-item self-report that uses a 5-point Likert-type scale format similar to those of others employed in the schizotypy literature, and which was developed following international guidelines for test construction (see Appendix B). Its goal is to detect participants who respond randomly, pseudorandomly or dishonestly. Students with more than 3 incorrect responses on this test were removed from the sample. Based on their scores on the scale, a total of 69 participants were excluded. No differences were found in any demographic variables between the sample of participants removed due to their high score on the INF-OV and the final sample.

2.4. Data analysis

After checking the normality and sphericity assumptions, the mean scores, standard deviations, asymmetry and kurtosis indices were calculated for each item, as well as the total score for both original scales (Raine and Benishay, 1995). The internal consistency was calculated for both subscales and total score. With the aim of studying the dimensionality of the SPQ-B, a series of confirmatory factor analyses (CFA) were carried out to test the different models (see Table 1). The estimation method was weighted least squares (WLS). Given that the item scores were non-normally distributed, as they are dichotomous variables, the CFA was conducted on the polychoric correlation matrix and asymptotic covariance matrix (Jöreskog and Sörbom, 1993). The matrix of polychoric correlations allows the correct estimation of the correlation when the variables are ordinal, whereas the asymptotic covariance matrix represents the estimated sample variances and covariances under arbitrary non-normal distribution. Seven fit statistics were used to assess best model fit (Brown,

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Table 2
Descriptive statistics (mean and SD) for the Schizotypal Personality Questionnaire—Brief items and standardized coefficients and percentage of explained variance for Raine et al.'s (1994) three-factor model.

Items	Mean	SD	Positive λ	Negative λ	Disorganized λ	R^2
1	0.48	0.50		0.71		0.51
2	0.16	0.37	0.77			0.41
3	0.43	0.49			0.65	0.43
4	0.24	0.43	0.50			0.25
5	0.19	0.39	0.70			0.49
6	0.22	0.42			0.93	0.87
7	0.22	0.41	0.40	0.46		0.57
8	0.22	0.41			0.71	0.50
9	0.25	0.43	0.45	0.24		0.39
10	0.21	0.41	0.63			0.40
11	0.39	0.49		0.91		0.82
12	0.09	0.29	0.71			0.50
13	0.36	0.48			0.52	0.27
14	0.40	0.49	0.25	0.48		0.43
15	0.42	0.49		0.62		0.39
16	0.31	0.46	0.59			0.35
17	0.21	0.41	0.38	0.32		0.38
18	0.12	0.32		0.68		0.47
19	0.12	0.32			0.91	0.82
20	0.22	0.41			0.78	0.61
21	0.32	0.47		0.89		0.79
22	0.50	0.50		0.64		0.41

Note: SD: standard deviation; λ: standardized coefficients; R^2: proportion of explained variance.

2006; Kline, 2005): the chi-square, the chi-square/*df* ratio, the goodness-of-fit index (GFI), the root mean square error of approximation (RMSEA) and its 90% confidence interval (CI), the comparative fit index (CFI), the Akaike Information Criterion (AIC), and the standardized root mean square (SRMR). The chi-square test assesses the magnitude of the discrepancy between the sample and the fitted covariance matrix. A non-statistically significant chi-square value ($p > 0.05$) indicates good model fit. Unfortunately, chi-square is very sensitive to sample size. It is advisable for the chi-square/*df* ratio to have a value close to 2; however, values below 5 have also been proposed as valid. GFI is a fit measure that reduces dependence on sample size. Varying from 0 to 1, GFI value >0.90 indicates good model fit. An RMSEA value of 0.05 or less indicates a reasonable error of approximation in the population. CFI provides a measure of proportional increase in fit over a null model. CFI varies from 0 to 1; values between 0.92 and 0.95 are considered well-fitting. The AIC permits the comparison of non-nested models; generally, models with the lowest AIC are judged to fit the data better than alternative solutions. Lastly, SRMR is the average discrepancy between the correlations observed in the input matrix and the correlation predicted by the model. SRMR can take a range of values between 0 and 1, with 0 indicating a perfect fit.

Next, in order to examine the influence of sex and age in the schizotypal traits, we carried out a Multivariate Analysis of Variance (MANOVA), with the subscales as dependent variables and age and gender as fixed factors recoded in two groups: Group 1 (14–16 years old) and Group 2 (17–19 years old). We used Wilk's lambda to check whether there were significant differences in any of the dependent variables. In the cases where Wilk's lambda was significant ($p < 0.05$) we examined the individual results of the Analysis of Variance (ANOVA). As an index of effect size we used η^2. When $\eta^2 > 0.15$ the effect is large in magnitude, and when $\eta^2 > 0.06$ it is moderate. SPSS 15.0, and LISREL 8.7 (Jöreskog and Sörbom, 1993) were used for all data analyses.

3. Results

3.1. Descriptive statistics of the items and subscales

The descriptive statistics for each item are presented in Table 2. The means and standard deviations for the subscales and the SPQ-B total score are shown in Table 3. A total of 139 (8.4%) of the participants scored higher than 12 points, whereas 377 (22.4%) scored 2 points or lower. Of the total sample, 93.6% responded affirmatively to at least one item of the SPQ-B. The internal consistency indices for the subscales were, respectively: 0.61 (Cognitive-Perceptual), 0.69 (Interpersonal), 0.65 (Disorganized) and 0.81 (Total).

3.2. Confirmatory factor analyses

The fit indices for the proposed models are summarized in Table 4. As can be observed, the models presenting a better fit were Raine et al.'s (1994) three-factor model and Stefanis et al.'s (2004) four-factor model. In both cases, the fit indices obtained were adequate, all standardized coefficients were statistically significant, and the proportion of explained variance was high. In the case of the disorganized model by Raine et al. (1994), the standardized weights ranged from 0.24 to 0.93, and the percentage of explained variance from 0.25 to 0.87 (see Table 2). In this model, the correlation between latent variables ranged between 0.55 (Positive–Negative) and 0.86 (Negative–Disorganized). Stefanis et al.'s (2004) four-factor model displayed more parallels with Raine's disorganized model as regards the standardized weights and the percentage of explained variance, which ranged from 0.22 to 0.93, and from 0.27 to 0.87, respectively. The correlation between the latent variables ranged from 0.50 (Positive–Negative) to 0.92 (Paranoid–Positive). According to (1) the parsimony criterion (fewer number of dimensions), (2) the consistency of the three-factor model across samples (clinical, outpatients, and community), the statistical model, and the measurement instrument and (3) the high correlation between the Paranoid and Positive factors in the four-factor model (Paranoid), Raine et al.'s (1994) disorganized model was selected as the most pertinent.

Table 3
Descriptive statistics (mean and standard deviation) for the Schizotypal Personality Questionnaire—Brief subscales and total score by age and gender.

	Gender		Age	
	Males	Females	14–16 years	17–19 years
SPQ-B	($n = 818$)	($n = 865$)	($n = 1137$)	($n = 546$)
Cognitive-Perceptual	2.21 (2.10)	2.36 (1.98)	2.26 (2.09)	2.33 (1.93)
Interpersonal	3.24 (2.39)	3.28 (2.39)	3.20 (2.42)	3.54 (2.32)
Disorganized	1.59 (1.58)	1.54 (1.49)	1.53 (1.52)	1.64 (1.55)
Total	5.98 (4.34)	6.18 (4.08)	5.95 (4.29)	6.37 (4.03)

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Table 4
Comparison of models and goodness-of-fit indices.

Model	χ^2	*df*	χ^2/df	GFI	CFI	RMSEA	RMSEA 90% CI	SRMR	AIC
One-factor	1189.5	209	5.7	0.97	0.87	0.053	0.050/0.056	0.21	1277.5
Siever and Gunderson (1983)	1122.4	208	5.4	0.98	0.88	0.051	0.048–0.054	0.19	1202.4
Two-factor									
Raine et al. (1994) [a]	960.7	202	4.7	0.98	0.90	0.047	0.044–0.050	0.16	1062.7
Three-factor (disorganization)									
Raine and Benishay (1995) [b]	1074.8	206	5.2	0.98	0.88	0.050	0.047–0.053	0.19	1168.8
Three-factor									
Bergman et al. (1996)	1081.2	206	5.2	0.98	0.88	0.050	0.047–0.053	0.19	1175.2
Three-factor (paranoia)									
Battaglia et al. (1997)	1005.5	206	4.9	0.98	0.89	0.048	0.045–0.051	0.17	1099.5
Three-factor (oddness)									
Stefanis et al. (2004)	946	199	4.7	0.98	0.90	0.047	0.044–0.050	0.16	1054
Four-factor (paranoia)									

Note: GFI = goodness-of-fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; AIC = Akaike Information Criterion.

[a] Items 7, 9, 14 and 17 belong to both the negative and positive factors.

[b] Items 9 and 17 correspond to the positive factor; items 7 and 14 to the disorganized factor.

3.3. Differences as a function of gender and age

The means and standard deviations for the SPQ-B subscales and total score can be seen in Table 3. The MANOVA revealed no significant differences due to gender (Wilk's $\lambda = 0.996$, $p > 0.05$); whereas significant differences were found due to age (Wilk's $\lambda = 0.994$, $p = 0.047$). With regard to gender, although no statistically significant differences were found in any of the subscales or total score, women obtained higher scores in the Cognitive-Perceptual dimension and in the total score of the SPQ-B in comparison to men. Statistically significant age differences were found for the Interpersonal subscale ($F = 6.96$, $p = 0.008$, $\eta^2 = 0.008$), with adolescents over 17 years of age scoring higher than those under 16. No statistically significant differences were found for the remaining SPQ-B subscales and total score; however, a slight tendency to score higher with increasing age was observed. The correlation between the total score and age was statistically significant ($r = 0.06$, $p < 0.05$). Finally, no statistically significant interactions were found between age and gender.

4. Discussion and conclusions

Adolescence is a development stage involving risk for the emergence of psychotic disorders, and a large number of adolescents exhibit diverse psychological, affective and behavioural changes some time before the development of schizophrenia, which indicate their high-risk mental state. The availability of self-reports with adequate psychometric properties for early detection and effective intervention in adolescents with vulnerability to schizophrenia is very important. The main objective of the current study was to validate the SPQ-B in a sample of non-clinical adolescents randomly selected from the general population, as well as to study the factor structure (number and content) of the schizotypal personality and differences in the dimensions of schizotypy according to gender and age. In general, the SPQ-B showed adequate psychometric properties. The levels of internal consistency ranged from 0.61 to 0.81. The study of construct validity showed that the schizotypal personality has a multidimensional structure, similar to that found in previous studies with adults (Badcock and Dragovic, 2006; Fonseca-Pedrero et al., 2007b; Fossati et al., 2003; Mata et al., 2005; Reynolds et al., 2000), and adolescents (Axelrod et al., 2001; Chen et al., 1997; Fossati et al., 2003).

The results of the study indicate that the structure underlying the schizotypal personality in adolescents fits both Raine et al.'s (1994) three-factor model and Stefanis et al.'s (2004) four-factor model reasonably well, and that there are considerable paralls between them. Similar results were found by Wuthrich and Bates (2006) in a sample of students on comparing the two models using the SPQ scales. However, for this study, due to the parsimony criterion, the high replicability of Raine's disorganized model in the literature, the high correlation between the Paranoid and Positive factors in the four-factor model (0.92) and the fact that Stefanis' model was validated in a large population of conscripts, Raine et al.'s disorganized model (1994) was chosen as the most adequate. Two aspects merit special mention: (a) in the disorganized model, the items that measure paranoid ideation saturate in the Interpersonal dimension as well as in the Positive factor, though with different weights; (b) the high correlation found between the dimensions, which is similar to that obtained in previous studies (Reynolds et al., 2000), and even higher those of other works (Stefanis et al., 2004; Wuthrich and Bates, 2006). These findings suggest a large degree of overlap between these dimensions in non-clinical adolescent populations.

Likewise, on comparing the factor structure found in this work with those from previous studies, a clear convergence is found; nevertheless, the strict comparison of studies is hindered by the heterogeneity of the self-reports and the samples used (sex, age, clinical/non-clinical). For example, using the SPQ-B in adolescent outpatients and college students, a dimensional solution was found based on the Positive, Negative (Interpersonal), and Disorganized factors (Axelrod et al., 2001; Mata et al., 2005). Thus, various studies using the SPQ with adults and adolescents have found Raine et al.'s (1994) disorganized model to be the most adequate and consistent, and also invariant with regard to sex, age, religious affiliation and social background (Badcock and

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Dragovic, 2006; Chen et al., 1997; Fossati et al., 2003; Reynolds et al., 2000; Wuthrich and Bates, 2006), reflecting some degree of parallelism with the factor structure found in schizophrenia patients (Liddle, 1987). These data indicate the consistency and replicability of the three-dimensional model of the schizotypal personality across the diverse studies and different samples, as well as its temporal stability between adolescence and the adult stage.

With regard to gender and age, the results obtained partially support the differentiation of the schizotypal personality dimensions in adolescent populations across gender and age. Previous studies have found that women tend to score higher than men on the Positive dimensions and Total score, whereas men score higher on the Interpersonal and Disorganized dimensions (Badcock and Dragovic, 2006; Fossati et al., 2003; Mata et al., 2005; Paino et al., 2008; Wuthrich and Bates, 2006). In this study, females were found to score higher on the SPQ-B Positive dimension and Total score, whereas males did not score higher than females in the Interpersonal or Disorganized dimensions, although these differences were not significant. The absence of findings could be due to the small number of items in the SPQ-B (which makes it difficult to collect great amounts of information), the dichotomous response format, which does not detect variability in the adolescents' responses, and/or the influence of puberty in the expression of schizotypal traits (Gruzelier and Kaiser, 1996). With regard to age, in the present study, statistically significant differences were only found as a function of age in the Interpersonal dimension, with an observed tendency to score higher as age increases. Previous studies have found that younger adolescents present higher scores on the schizotypal subscales in comparison to older subjects (Badcock and Dragovic, 2006; Fossati et al., 2003; Mata et al., 2005; Wuthrich and Bates, 2006), although in other studies, when age groups of only adolescents are compared, as age increases the score in schizotypal traits also increases (Fonseca-Pedrero et al., 2008a). These data could be partially explained by the fact that in the present work we used only two age groups, and with unequal numbers of participants; however, when the data were re-analyzed considering five age groups, the same results were obtained. Likewise, it should be taken into account that also in this study a homogeneous age group was compared (age interval of 5 years), and that age comparisons of samples of adults and adolescents were not carried out (Chen et al., 1997; Fossati et al., 2003), the comparisons made having involved only adolescents. Future studies should replicate these findings in other samples and continue to advance in the understanding of the dimensions of the schizotypal personality in this developmental stage, which is considered to be of high risk for the future development of schizophrenia-spectrum disorders.

The results found in this study should be interpreted in the light of some possible limitations. Firstly, we only assessed schizotypal traits; it would have been interesting to use hetero-reports of parents or teachers, as well as to collect information about other clinical–functional variables (e.g., depression). Secondly, the use of self-reports is not free from limitations: on the one hand, adolescents' capacity to self-report or their self-awareness regarding their own behaviour and feelings must be considered and, on the other, the exclusive use of paper-and-pencil self-reports could be identifying a combination of schizotypal and non-schizotypal participants; therefore, the simultaneous employment of laboratory measures would be interesting (e.g., Continuous Performance Tests). Thirdly, and related to the former point, it must be taken into account that the use of the SPQ-B as a screening method may be associated with the detection of false positives and stigma (Loewy et al., 2007). Finally, no information about the presence of psychological problems in the family antecedents of participants was obtained. The combined use of those with high scores on the SPQ-B and a family history of psychosis within the studies of ultra-high risk would have been advantageous.

To conclude, this study represents an attempt to solve some of the previous limitations present in schizotypy personality assessment, regarding the characteristics of the sample and the understanding of this construct in non-clinical adolescents. The validation of the SPQ-B in adolescent populations improves our understanding of the number, structure, and content of the dimensions underlying the schizotypal personality. Likewise, it favours the availability of instruments with adequate psychometric guarantees, which can be administered in a rapid, efficient, easy, and non-invasive manner as screening instruments for the detection of and prompt intervention with psychosis-prone individuals.

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Contributors

All authors participated in the design of the study and in statistical analyses; and helped in editing the manuscript.

Conflict of interest

The authors have no conflicts of interest to report in relation to the research presented in this manuscript; and the research study was not supported by a corporate sponsor.

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Appendix A. The Schizotypal Personality Questionnaire-Brief Form (SPQ-B) (Raine and Benishay, 1995)

1. People sometimes find me aloof and distant.
2. Have you ever had the sense that some person or force is around you, even though you cannot see anyone?
3. People sometimes comment on my unusual mannerisms and habits.
4. Are you sometimes sure that other people can tell what you are thinking?
5. Have you ever noticed a common event or object that seemed to be a special sign for you?
6. Some people think that I am a very bizarre person.
7. I feel I have to be on my guard even with friends.
8. Some people find me a bit vague and elusive during a conversation.
9. Do you often pick up hidden threats or put-downs from what people say or do?

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10. When shopping, do you get the feeling that other people are taking notice of you?
11. I feel very uncomfortable in social situations involving unfamiliar people.
12. Have you had experiences with astrology, seeing the future, UFOs, ESP, or a sixth sense?
13. I sometimes use words in unusual ways.
14. Have you found that it is best not to let other people know too much about you?
15. I tend to keep in the background on social occasions.
16. Do you ever suddenly feel distracted by distant sounds that you are not normally aware of?
17. Do you often have to keep an eye out to stop people from taking advantage of you?
18. Do you feel that you are unable to get "close" to people?
19. I am an odd, unusual person.
20. I find it hard to communicate clearly what I want to say to people.
21. I feel very uneasy talking to people I do not know well.
22. I tend to keep my feelings to myself.

Scoring key: All items endorsed Yes score 1 point.

Appendix B. The Oviedo Infrequency Scale (INF-OV) (Fonseca-Pedrero et al., 2008c)

1. I have sometimes been alone at home.
2. I have never been to the cinema.
3. When I am tired or ill I sometimes feel like going to bed early.
4. I know people who wear glasses.
5. You get from Madrid to Moscow quicker by car than by plane.
6. I have sometimes travelled by bus.
7. Sometimes, when making a phone call, I have found that the number was engaged.
8. The distance between Madrid and Barcelona is greater than the distance between Madrid and New York.
9. Some people have a talent for languages.
10. I have sometimes seen films on TV.
11. I have sometimes seen children playing in the park.
12. I have never been in a bar.

Scoring key: 1 = definitely disagree; 5 = definitely agree.

Note: Participants with more than 3 incorrect responses on this test (either 1–2 or 4–5, according to the positive or negative formulation of items) were removed from the sample.

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