Schizotypal traits and depressive symptoms in nonclinical adolescents

Eduardo Fonseca-Pedrero, Mercedes Paino, Serafín Lemos-Giráldez*, José Muñiz

Department of Psychology, University of Oviedo, Plaza Feijoo, s/n, 33003 Oviedo, Spain
Centro de Investigación Biomédica en Red de Salud Mental, CIBERSAM, Madrid, Spain

Abstract

The main goal of this study was to examine the relationship between schizotypal personality traits and depressive symptoms in a sample of nonclinical adolescents. The Schizotypal Personality Questionnaire-Brief (*J Personal Disord* 1995;9:346-355) and the Reynolds Depression Adolescent Scale (Reynolds WM. *Reynolds Adolescent Depression Scale. Professional Manual*. Odessa: Psychological Assessment Resources, Inc; 1987) were administered. The sample was made up of 1384 adolescents (48.6% boys), with a mean (SD) age of 15.7 (1.0) years. The results of the study indicate a high degree of overlap between schizotypal experiences and depressive symptoms at a nonclinical level. Canonical correlation between the Schizotypal Personality Questionnaire-Brief scales and the Reynolds Adolescent Depression Scale scales was 0.63, which represents 39.69% of the associated variance between the 2 sets of variables. Confirmatory factor analysis showed that the 4-dimensional model made up of the Positive, Interpersonal, Disorganized, and Depressive dimensions was that which best fit the data. Moreover, the dimensional structure underlying the schizotypal traits and depressive symptoms was found to be invariant across sex and age. These findings converge with data found in previous studies of both patients with schizophrenia and nonclinical adults and suggest that affective dysregulation is also present at a subclinical level. Future research should continue to make progress in the early detection of participants at risk of developing schizophrenia-spectrum disorders based on the early identification of these types of subclinical traits.
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1. Introduction

Adolescence seems to be a critical period for the emergence of psychotic [1,2] and depressive symptoms [3,4]. Furthermore, the presence of subclinical symptoms at early ages predicts the possible development of a clinical syndrome in adulthood [5-8]. For example, children and adolescents with high scores on schizotypal self-reports or who report psychotic-like experiences are at heightened risk for subsequent development of schizophrenia-spectrum disorders [5,6,9]. Likewise, the presence of subclinical depressive symptoms in children and adolescents has been associated with greater risk of developing a depressive disorder [7,8,10].

Schizotypal personality is a complex construct that has been associated with schizophrenia at different levels (eg, historical, conceptual, genetic, neurochemical, anatomical, and neurocognitive) [11]. The schizotypal organization of personality can be seen as an attenuated form of schizo-phrenia, constituting a premorbid or prodromal phase of that disorder [11], or as an organization of personality representing genetic vulnerability to psychosis [12]. Likewise, it is considered to involve a set of traits that is distributed within the general population along a dynamic continuum, with the clinical entity (psychosis) at the most extreme pole [13]. Variations regarding the position that a person occupies along this continuum would also be indicative of greater or less psychosis proneness. Moreover, this vulnerability would manifest itself in the form of diverse subtle alterations, qualitatively similar though quantitatively less severe than those found in patients with schizophrenia, at a cognitive, behavioural, affective, emotional, psychophysiological, and/ or neurobiochemical level [11,14-19]. Exploratory factor analyses and confirmatory factor analyses (CFAs) suggest that the schizotypal personality is a multidimensional construct, basically involving 3 (Cognitive-Perceptual, Interpersonal, and Disorganized) [20-23] or 4 (Cognitive-Perceptual, Interpersonal, Disorganized, and Paranoid) dimensions [24,25].

There is no doubt that affective alteration is a phenom-enon characteristic of patients with nonaffective psychosis

* Corresponding author.
E-mail address: slemos@uniovi.es (S. Lemos-Giráldez).

[26,27] and related conditions such as schizotypal personality [11]. The relationship between affective dysregulation and psychotic or schizotypal experiences can emerge at different levels: (*a*) patients with schizophrenia and their biological relatives present high rates of depressive symptoms [28-30]; (*b*) depressive symptoms is present in the prodromal phases of at-risk individuals in the transition toward schizophrenia-spectrum disorders [31,32] and in nonpsychotic help seekers [33]; (*c*) longitudinal studies show that participants with high scores on the Wisconsin Schizotypy scales [34] or the Peters Delusion Inventory-21 [35] have greater likelihood of developing mood disorders in the future [36-38]; furthermore, the transition to clinical psychosis is more common among those who present not only hallucinatory experiences but also depressive symptoms than among those who present psychotic experiences without affective problems [39,40]; (*d*) factor studies have found a dimensional structure made up of the Positive, Negative, and Depression (or Negative Affect) dimensions [41,42]; and (*e*) schizotypal traits or psychotic-like experiences have been closely associated with depressive symptoms in nonclinical adolescents [43-46] and young adults [15,42,47].

Specifically, in adolescent populations, Scott et al [43] found that nonclinical adolescents with auditory and/or visual hallucinations presented greater levels of depressive symptoms compared with the control group. For their part, Yung et al [45] found that the psychotic-like experiences reported by adolescents were associated with self-reported depressive symptoms. However, despite the findings of these studies, the relationship between schizotypal experiences and depressive symptoms has not yet been examined exhaustively in a representative sample of adolescents, although it has been explored in clinical samples [48]. Moreover, the dimensional structure underlying the 2 constructs taken together has not been examined, nor whether these dimensions emerge as invariant across age and sex.

Analyzing the relationship between schizotypal traits and the emotional aspects involved in a nonclinical population may be an interesting method for gaining a deeper understanding of the possible etiological mechanisms underlying the psychotic phenotype. Such use of nonclinical samples would also allow for the examination of the links established between these groups of variables, thus avoiding the confounding effects frequently found in patients with schizophrenia (eg, medication or stigmatization). Within this research framework, the main goal of this study was to explore the relationship between schizotypal traits and depressive symptoms in a sample of nonclinical adolescents. Furthermore, the dimensional structure underlying schizotypal personality and depressive symptoms was examined, and whether it was invariant across sex and age was determined. In line with previous research, the starting hypothesis was that depressive symptoms were closely related to schizotypal traits at a subclinical level in nonclinical adolescents. Also, we hypothesize the existence of a 4-dimensional model that replicates the 3-dimensional model of schizotypal personality plus a depression dimension that is invariant across sex and age.

2. Method

2.1. Participants

Stratified random cluster sampling was conducted at the classroom level, in a population of approximately 37 000 students selected from the Principality of Asturias, a region in northern Spain. The students were from various public and grant-assisted secondary schools and vocational training centres, as well from a range of socioeconomic levels. The strata were created on the basis of geographical zone (East, West, and Center) and educational stage (compulsory [to age 16] and postcompulsory), and likelihood of inclusion depended on the number of students in the school. The sample was made up of 1384 students, 672 boys (48.6%) and 712 (51.4%) girls. Mean (SD) age was 15.7 (1.01) years, with a range of 14 to 17 years. Distribution by age was as follows: 14 years, n = 193; 15 years, n = 414; 16 years, n = 442; and 17 years, n = 335.

2.2. Measurement instruments

The Schizotypal Personality Questionnaire-Brief (SPQ-B) [49] is a 22-item self-report with true/false format developed for assessing schizotypal personality disorder according to the *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition* [50]. The SPQ-B is made up of 3 scales [49]: Cognitive-Perceptual (ideas of reference, suspiciousness, magical thinking, and strange perceptual experiences), Interpersonal (social anxiety, lack of close friendships, constricted affect, and suspiciousness), and Disorganized (odd behavior and speech). This self-report has been used in relatives of patients with schizophrenia [51], college students [52], nonclinical adolescents [23], and adolescent outpatients [53]. The psychometric properties of the SPQ-B have been studied previously. Internal consistency indices range from 0.75 to 0.83 (from 0.58 to 0.87 for the subscales); and test-retest reliability, from 0.82 to 0.90 [54]. In the present study, we used the Spanish version validated in a sample of nonclinical adolescents [23]. The internal consistency for the SPQ-B subscales found in Spanish populations ranges from 0.61 to 0.69, whereas for the total score, it ranges from 0.81 to 0.88 [16,23].

The Reynolds Adolescent Depression Scale (RADS) [55] is a self-report used for assessing depressive symptoms in adolescents aged 11 to 20 years. It comprises a total of 30 statements in Likert-type format with 4 response options (1, "almost never" to 4, "nearly always"). Scores range from 30 to 120, with the cutoff point for judging the severity of the depressive symptoms being 77 points [55]. Recently,

Reynolds [56] proposed 4 scales: Anhedonia, Somatic Complaints, Negative Self-evaluation, and Dysphoria. The RADS has been widely used, showing adequate psychometric properties [57-59]. In the present study, we used the Spanish version validated in a sample of clinical and nonclinical adolescents [60]. Levels of internal consistency and test-retest reliability of the Spanish version ranged from 0.82 to 0.90 (nonclinical sample) and 0.84 to 0.91 (clinical sample) [60].

The Oviedo Infrequency Scale [23] is a self-report made up of 12 items with 5-point Likert-type response format (1, "totally disagree" to 5, "totally agree"), developed according to the guidelines for test construction [61]. Its purpose is to detect participants who respond randomly, pseudorandomly, or dishonestly in self-reports (an example of an item being "The distance between Madrid and Barcelona is greater than that between Madrid and New York"). Those answering more than 3 items incorrectly are removed from the sample. A total of 69 participants were excluded based on their responses to the Oviedo Infrequency Scale.

2.3. Procedure

This study is part of a broader research project whose objective is the early detection of individuals at heightened risk for schizophrenia-spectrum disorders (prevention program for psychosis; www.p3-info.es). The questionnaire was collectively administered in groups of 15 to 30 participants, in a classroom and within school hours. Given that all the participants were younger than 18 years, parents were asked to provide written informed consent for their child to participate in the study. Participants were informed of the confidentiality of their responses and the voluntary nature of the study, and no incentive was offered. Administration of the instruments took place under the supervision of the researchers. The study was approved by the research and ethics committees at the University of Oviedo and by the Department of Education of the Principality of Asturias.

2.4. Data analysis

First, we calculated the descriptive statistics of the scales and total scores of the SPQ-B and the RADS. Second, to study the degree of relationship between the SPQ-B and the RADS scales, a Pearson correlation analysis and a canonical correlation analysis (CCA) were performed. The CCA is a multivariate technique. The CCA was used to examine the relationship between 2 variable sets (SPQ-B and RADS scales). The squared canonical correlation is the simple square of the canonical correlation. It represents the proportion of variance shared by 2 synthetic variables. The contribution of each variable to the canonical correlation was carried out using the standardized canonical weights. Third, with the aim of exploring the relationship between schizotypal traits and depressive symptoms, we conducted CFAs. These CFAs were made using the variance-covariance matrix with the method of robust maximum-likelihood

estimation [62]. For each scale, we made up 2 parcels consisting of 3 or 4 selected items. The parcels were made up randomly following the recommendations of Little et al [63]. In the case of depressive symptoms, we used the scales proposed by Reynolds [56]. Correlation between the error terms was not allowed. The goodness-of-fit indices used were as follows: the χ^2 test, 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, and the Akaike Information Criterion (AIC).

Finally, with the aim of exploring measurement invariance, successive multigroup CFAs were conducted [64]. When mean scores are used to compare groups (eg, male/female; young people/adults), it is important that the scores have the same meaning in each group; that is, the assessment is invariant across groups. In a classic study, Horn and McArdle [65] defined measurement invariance as "whether or not, under different conditions of observing and studying phenomena, measurement operations yield measures of the same attribute" (p 117). Basically, a hierarchical set of steps is followed when testing measurement invariance, 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 [64,66]. The analyzed models are nested insofar as the imposed constraints are progressively added. The fit of the nested models can be assessed by comparing the respective χ^2 fit statistics or goodness-of-fit indices between the model with additional constraints and the less restricted model [66,67]. Because of the limitations of the $\varDelta\chi^2$ regarding its sensitivity to sample size, Cheung and Rensvold [67] have proposed a more practical criterion, the change in CFI ($\varDelta$CFI), to determine whether nested models are practically equivalent. In this study, when $\varDelta$CFI is greater than 0.01 between 2 nested models, the more constrained model is rejected because the additional constraints have led to a poorer fit in practical terms. However, if the $\varDelta$CFI is less than or equal to 0.01, it is considered that all specified equal constraints are tenable, and therefore, we can continue with the next step in the analysis of measurement invariance. SPSS 15.0 and LISREL 8.73 [62] were used for all data analyses.

3. Results

3.1. Descriptive statistics

Mean, standard deviation, asymmetry, kurtosis, range of scores, and internal consistency scores for the scales and total scores of the RADS and SPQ-B are shown in Table 1. Asymmetry levels and kurtosis were within the range of normality, except in the case of the Negative Self-assessment scale and total score on the RADS. Internal consistency levels of the SPQ-B ranged from 0.62 to 0.81; and those of the RADS, from 0.60 to 0.87.

Table 1
Descriptive statistics for the scales and total score on the RADS and SPQ-B

	Mean	SD	Asymmetry	Kurtosis	Range	α
Dysphoria	13.94	3.49	0.98	1.41	8-31	.75
Anhedonia	19.23	2.86	0.99	1.49	14-34	.60
Negative Self-evaluations	10.90	3.39	1.93	4.61	8-31	.78
Somatic Complaints	13.42	3.39	0.64	0.51	7-27	.60
RADS total score	57.50	10.06	1.37	3.08	40-109	.87
Cognitive-Perceptual	1.63	1.66	1.11	0.82	0-8	.62
Interpersonal	2.82	2.01	0.42	−0.69	0-8	.70
Disorganized	1.55	1.54	0.86	−0.11	0-6	.65
SPQ-B total score	6.01	4.23	0.70	0.05	0-22	.81

3.2. Correlations between the RADS and SPQ-B scales

Pearson correlations between the RADS and SPQ-B scales are shown in Table 2. As can be seen, all the correlations were statistically significant. In the case of boys, correlations between the RADS and the SPQ-B scales ranged from 0.18 to 0.50, whereas the range was from 0.15 to 0.45 in girls. Canonical correlation between the SPQ-B scales (canonical variate 1) and the RADS scales (canonical variate 2) was 0.63, which represents 39.69% of variance shared. The scales that contributed the greatest standardized weights to this relationship were Dysphoria (RADS) (−0.38) and Disorganization (SPQ-B) (−0.44).

3.3. Confirmatory factor analysis of the SPQ-B and RADS scales

The goodness-of-fit indices of the models proposed are shown in Table 3. The first theoretical model proposes a general dimension of psychopathology that could explain the symptoms found in adolescents. This model presented poor goodness-of-fit indices. The second model proposed considered the presence of 2 dimensions, one general schizotypal dimension and one of depressive symptoms. This model substantially improves the goodness-of-fit indices compared with the 1-dimensional model. The third model postulated the existence of 2 schizotypal dimensions (Positive and Negative), in accordance with the model of Siever and Gunderson [68], and a general depression dimension. This model presented adequate goodness-of-fit

indices in comparison with the previous models. Finally, a 4-dimensional model was proposed that related the 3-factor model of Raine and Benishay [49] (Positive, Interpersonal, and Disorganized) with a general dimension of depressive symptoms. As can be seen, this was the model with the best fit to the data, compared with the rest of the theoretical models proposed. Goodness-of-fit indices were higher than 0.95 for both the CFI and the GFI, the RMSEA was lower than 0.05, and the AIC value was the lowest compared with the rest of the models proposed. All the standardized coefficients and error terms were statistically significant, as well as the covariances between the latent variables (Fig. 1). The proportion of explained variance ranged from 0.25 to 0.64. Correlation between the latent variables ranged from 0.65 to 0.84.

3.4. Measurement invariance across sex and age

We next explored measurement invariance across sex and age for the 4-factor model hypothesized. Goodness-of-fit indices for this model were adequate in both groups. As can be seen in Table 3, the progressive incorporation of restrictions in the factor loadings (metric invariance) and the intercept values (strong invariance) did not lead ΔCFI to exceed 0.01. Subsequently, measurement invariance across age was analyzed. Regarding age, the configural model in which no equality constraints were imposed provided adequate fit to the data. As can be observed, when the equivalence of the factorial loadings and intercept values was introduced, the difference in the ΔCFI between the configural and the constrained models did not exceed 0.01. Therefore, we concluded that the factorial structure of the 4-dimensional model was operating equivalently across the 2 age groups.

4. Discussion and conclusions

The aim of the present work was to explore the relationship between schizotypal traits and depressive symptoms in nonclinical adolescents. Likewise, we examined which factor model best explained symptom differences and whether this model was invariant across sex and age. The results reveal a high degree of overlap between the schizotypal experiences

Table 2
Correlations between the scales of the RADS and the SPQ-B

Scales	Dysphoria	Anhedonia	Negative Self-evaluation	Somatic Complaints	Positive	Interpersonal	Disorganized
Dysphoria		0.39[a]	0.65[a]	0.57[a]	0.40[a]	0.45[a]	0.50[a]
Anhedonia	0.43[a]		0.45[a]	0.27[a]	0.18[a]	0.39[a]	0.24[a]
Negative Self-evaluation	0.64[a]	0.44[a]		0.58[a]	0.48[a]	0.42[a]	0.49[a]
Somatic Complaints	0.57[a]	0.28[a]	0.51[a]		0.46[a]	0.40[a]	0.46[a]
Positive	0.39[a]	0.14[a]	0.35[a]	0.41[a]		0.39[a]	0.52[a]
Interpersonal	0.45[a]	0.33[a]	0.39[a]	0.33[a]	0.35[a]		0.53[a]
Disorganized	0.45[a]	0.32[a]	0.43[a]	0.38[a]	0.42[a]	0.54[a]	

Upper diagonal, correlations for the boys. Lower diagonal, correlations for the girls.
[a] $P < .01$.

Table 3
Goodness-of-fit indices for the theoretical models proposed and configural, weak, and strong measurement invariance

	χ^2	df	GFI	CFI	RMSEA	RMSEA 90% CI	SRMR	AIC	⊿CFI
Model									
1-Dimensional	676.7	35	0.91	0.939	0.104	0.096-0.110	0.059	716.7	
2-Dimensional	299.0	34	0.96	0.974	0.069	0.061-0.077	0.041	341.7	
3-Dimensional	261.0	32	0.96	0.978	0.066	0.057-0.074	0.039	307.7	
4-Dimensional	153.9	29	0.98	0.988	0.051	0.042-0.060	0.031	205.9	
Sex									
Boys (n = 672)	104.8	29	0.97	0.987	0.056	0.043-0.069	0.036	156.9	
Girls (n = 712)	86.9	29	0.98	0.988	0.048	0.035-0.061	0.033	139.0	
Configural invariance	191.5	58	0.97	0.987	0.052	0.043-0.061	0.033	295.8	
Metric invariance	204.5	64	0.97	0.987	0.050	0.042-0.059	0.037	296.6	−0.01
Strong invariance	285.2	70	0.97	0.979	0.061	0.053-0.069	0.037	405.5	−0.01
Age									
14-15 y (n = 607)	76.6	29	0.97	0.991	0.046	0.031-0.061	0.033	128.6	
16-17 y (n = 777)	100.6	29	0.97	0.988	0.050	0.038-0.063	0.033	152.6	
Configural invariance	177.2	58	0.97	0.989	0.049	0.039-0.058	0.033	281.3	
Metric invariance	185.7	64	0.97	0.989	0.046	0.037-0.055	0.036	277.7	−0.01
Strong invariance	220.3	70	0.97	0.986	0.050	0.042-0.059	0.036	340.3	−0.01

SRMR indicates standardized root-mean-square residual; CI, confidence interval.
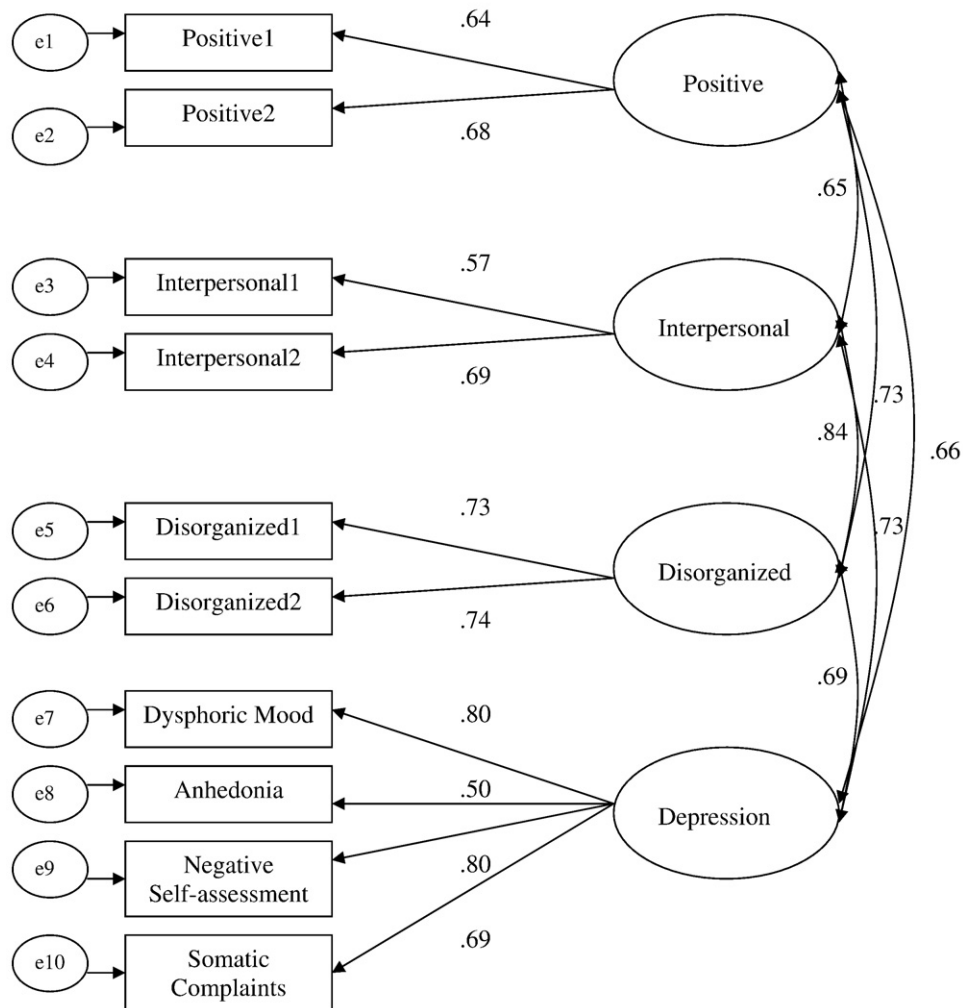

Fig. 1. Standardized coefficients for the 4-dimensional model.

and depressive symptoms in nonclinical adolescents. The 4-dimensional model made up of the Positive, Interpersonal, Disorganized, and Depressive dimensions was the hypothetical model with the best fit to the data and was invariant across sex and age.

In accordance with previous literature, the results support that schizotypal traits (or psychotic-like experiences) and subclinical depressive symptoms are highly frequent phenomena among the nonclinical adolescent population [2-4,69] and are closely related within this age group [43-46]. For example, Wigman et al [46] found that the positive dimensions of schizotypy were associated with distress and general measures of psychopathology (eg, emotional problems). For their part, Scott et al [43], using a sample of Australian adolescents, found that the participants who reported auditory and/or visual hallucinations presented higher levels of depressive symptoms compared with the control group. Similar data were found on exploring the relationship between mood and psychotic disorders in genetic, psychometric, and clinical high-risk studies [30,31,36,42], in clinical samples [48], and in the general population [39,41,42]. Such empirical evidence highlights the role of affect in the ontogenesis of schizophrenia and related conditions [70] and is a clear indication of the high degree of comorbidity and overlap of the 2 constructs at both the clinical and subclinical levels. Several authors have referred to the possibility of a continuum between affective symptoms and psychosis [28,71]. Likewise, the presence of schizotypal traits during adolescence is not a necessary or sufficient condition for the later development of a psychotic disorder, although it is true that in a small group of adolescents, such subclinical experiences can interact synergetically and additively with genetic, environmental (eg, stress), and/or psychosocial (eg, depression) factors, becoming abnormally persistent and clinically relevant and leading to the development of clinical psychosis [9,17].

The 4-dimensional model made up of the Positive, Negative, Disorganized, and Depressive dimensions is the theoretical model that showed the best fit to the data. The relationship between the dimensions had a value of greater than 0.65, being stronger between the Interpersonal and Depressive dimensions than between the Positive and Depressive dimensions. This dimensional model is similar to that found in previous studies [41,42], even though strict comparison between studies is difficult in view of the sample and measurement instruments used. For instance, Lewandowsky et al [42], using the Wisconsin schizotypy scales in a sample of college students, found the Negative Positive and, Negative Affect dimensions, in which the positive dimension was closely related to depressive symptoms (0.57). Stefanis et al [41], using the Community Assessment of Psychotic Experiences in a nonclinical sample, found the Positive, Negative, and Depressive dimensions, with a high correlation between them (around 0.70). In patients with schizophrenia, research has also found a strong relationship between depressive symptoms and positive symptoms [72]. On the other hand, Hanssen et al [28] found a stronger association of depressive symptoms with the Negative dimension than with the Positive dimension in a patient sample.

The 4-dimensional model that relates the schizotypal features with depressive symptoms was seen to be invariant across sex and age. Previous studies have found, using the Wisconsin scales [34] or the SPQ [73], that the dimensional structure underlying schizotypal personality, whether related to affect or not, also displays such invariance across sex and age [15,21,22,42]. The results found support for the replicability of the Raine et al [74] Disorganized model of schizotypal personality [21-23], even when they are analyzed jointly with those for depressive symptoms. Nevertheless, it is worth mentioning that although this study replicated the Raine et al Disorganization model, the use of the SPQ-B did not allow us to test other hypothetical dimensional models, such as the 4-dimensional model proposed by Stefanis et al [24]. This was due to the small number of items making up the SPQ-B, so that future studies should use comprehensive measures for the assessment of schizotypy in this age group.

On interpreting the results of the present study, the following limitations should be borne in mind: (*a*) adolescence is a stage involving neurodevelopmental changes due to processes of maturation, which may be playing a relevant role in the phenotypic expression of schizotypal traits and of depressive symptoms; (*b*) assessment of the schizotypal traits and depression symptoms was based exclusively on the use of self-report measures, and it would indeed be advantageous to use reports by others or structured interviews; (*c*) although the presence of subclinical phenomena in the sample suggests that there is continuity of such experiences, the results from the CFA do not support the notion that the distribution of these experiences in the population is continuous, because factor analysis will always identify factors, but its results do not exclude a possible discontinuous distribution of the variables in the population [12]; and (*d*) the dimensional structure found is determined by the self-report measure used, so that it cannot be ruled out that other theoretical models would emerge as plausible through the use of different measurement instruments.

Future research lines should focus on the study of schizotypal traits in relation to affective symptoms in adolescents, in follow-up designs, as well as involving the combined use of other neurocognitive, social-functioning, and/or biobehavioral measures, with a view to increase sensitivity and specificity in the detection of individuals at risk for schizophrenia-spectrum disorders.

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