Early Adolescence and Stress in the School Context: An Examination of the Student Stress Inventory - Stress Manifestations (SSI-SM)

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Abstract

Introduction. Stress suffered by adolescents is often neglected. In fact, there are very few measuring instruments that have been translated into Spanish for the assessment of stress manifestations in teenagers.

Method. The main purpose of this work was to analyze the psychometric properties of the Student Stress Inventory - Stress Manifestations (SSI-SM) in Spanish adolescents. The final sample comprised a total of 708 students, 308 were male, with a mean age of 13.61 years ($SD = 1.08$).

Results. The results indicated that the SSI-SM scores presented adequate psychometric properties. Cronbach's alpha coefficient for the subscales ranged between 0.69 and 0.90. Analysis of the internal structure of the SSI-SM scores, through confirmatory factorial analysis, showed that the three dimensional structure solution was the most satisfactory model. A total of 6 items of the SSI-SM showed differential item functioning by gender. SSI-SM subscales were correlated with emotional and behavioural symptoms and schizotypal traits. Statistically significant differences were found between mean scores of SSI-SM by gender and age.

Conclusions. These results provided new sources of validity evidence for the SSI-SM scores in an independent sample of non-clinical adolescents. The SSI-SM seems to be a useful, brief and easy to apply self-report instrument for the screening of stress manifestations in this sector of the population.

Adolescencia temprana y estrés en el contexto escolar: utilización de la Student Stress Inventory - Stress Manifestations (SSI-SM)

Resumen

Introducción. El estrés en adolescentes no recibe suficiente atención y, de hecho, existen pocos instrumentos de medida que se encuentren traducidos en la versión española para la evaluación de las manifestaciones de estrés en adolescentes.

Método. El objetivo principal de este trabajo fue analizar las propiedades psicométricas del Student Stress Inventory - Stress Manifestations (SSI-SM) in adolescentes Españoles. La muestra final estuvo compuesta por un total de 708 estudiantes, 308 hombres, con una media de edad de 13.61 años ($DT = 1.08$).

Resultados. Los resultados indicaron que las puntuaciones del SSI-SM presentaron adecuadas propiedades psicométricas**.** El coeficiente alfa de Cronbach para las subescalas osciló entre 0,69 y 0,90. El análisis de la estructura interna de las puntuaciones del SSI-SM, mediante análisis factorial confirmatorio mostró que la estructura de tres dimensiones fue el modelo más satisfactorio. Un total de 6 ítems mostraron funcionamiento diferencial atendiendo al género. Las subescalas del SSI-SM correlacionaron con los síntomas emocionales y comportamentales y con los rasgos esquizotípicos. Por otro lado, se encontraron diferencias estadísticamente significativas en función del género y la edad en las puntuaciones medias del SSI-SM.

Conclusiones. Los resultados contribuyen nuevas evidencias de validez sobre las puntuaciones del SSI-SM en una muestra independiente de adolescentes no-clínicos. El SSI-SM parece ser un instrumento de auto-informe útil, breve y de fácil aplicación para la detección de las manifestaciones de estrés es este sector de la población.

Palabras Clave: Estrés; Adolescentes; Evidencias de validez; Fiabilidad; Propiedades psicométricas; SSI-SM.

Introduction

Different transformations during adolescence generate stronger connections between orbitofrontal cortex and different structures of the limbic system such as hippocampus, caudate nucleus, and the amygdala. Such transformations have an impact on the improvement of cognitive control, inhibition of negative emotions, and in the management of social information (Gogtay et al., 2004; Steinberg, 2013). These structural transformations support cognitive changes that manifest throughout adolescence, and extend into adulthood. Hormonal changes on the other hand, appear suddenly, from early adolescence to middle adolescence. This lack of synchrony between brain and hormonal changes generates a gap or mismatch between cognitive and emotional changes, as well as in self-regulation capabilities, that proves to be particularly relevant during early and middle-adolescence, being compensated during late adolescence (Worthman, 2011).

There are different stressful situations that adolescents will be faced with from a development point of view. For instance, the acquisition of functional autonomy, academic challenges, new social situations, and decisions related to academic or professional future. These aspects, and others related to interpersonal conflicts may increase vulnerability to anxiety and stress (Forns, Abad, & Kirchner, 2011; Worthman, 2011) that can persist until adulthood (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). In this sense, the first years of adolescence are especially critical in evaluating their level of vulnerability to these kind of difficulties.

Different stressors during adolescence include the family, associated with changes in the relation between parent and teenagers (Byrne, Davenport, & Mazanov, 2007; Seiffge-Krenke, Aunola, & Nurmi, 2009), academic environment (Hjern, Alfven, & Östberg, 2008; Kouzma & Kennedy, 2004), and peer relationships (Nieder & Seiffge-Krenke, 2001; Seiffge-Krenke et al., 2010). Stress has been found to be related with internalizing and externalizing problems in school (Escobar, Trianes, & Fernández-Baena, 2008; Trianes et al., 2009).

The stress response, including physical (e.g., cold sweating, stomach-aches), emotional (e.g., fear, worries), and behavioural (e.g., negative attitudes or defensive attitudes) manifestation (Fimian, Fastenau, Tashner, & Cross, 1989), affects the adolescent's well-being and is related to problems in adaptation (Lee, Puig, Eunkyoung, & Lee, 2013). Some studies have revealed the negative relation between stress and life

satisfaction. Within this framework, it is noteworthy to mention that students reporting high satisfaction in life tend to show better levels of functioning in interpersonal and intrapersonal areas, as well as better school performance; whereas those students that report stress symptoms show lower levels of life satisfaction (Escobar et al., 2008; Suldo, Shaunessy, Thalji, Michalowski, & Shaffer, 2009).

Daily stress can be defined as irritating and frustrating demands that come with daily interaction with the environment (Kanner, Coyne, Schaefer, & Lazarus, 1981; Lin & Yusoff, 2013; Seiffge-Krenke et al., 2009). The repetition of these kind of stressors affects well-being and health in the very first stages of life (Trianes et al., 2009). The impact of this type of stress may have important emotional consequences affecting in a deeper negative way than stress due to negative life events (Seiffge-Krenke, 2000).

Some studies have reported that the prevalence of psychological problems in children and teenagers ranged between 5-20% (Belfer, 2008; Blanchard, Gurka, & Blackman, 2006; Costello, Egger, & Angold, 2005; Costello et al., 2003; Kessler et al., 2012; Patel, Flisher, Hetrick, & McGorry, 2007; Ravens-Sieberer et al., 2008). In this sense, studies in Spain showed similar results with non-clinical adolescents (Fonseca-Pedrero, Lemos-Giraldez, Paino-Pineiro, Villazon-Garcia, & Muniz, 2010; Sandoval, Lemos, & Vallejo, 2006). It is worth noting that many stressed youngsters grow to be stressed adults, and stress and anxiety disorders can persist throughout the lifetimes of youngsters identified as suffering from these disorders (Fonseca-Pedrero, Lemos-Giraldez, Paino-Pineiro, Villazon-Garcia, & Muniz, 2010; Sandoval, Lemos, & Vallejo, 2006). Due to the potential long-term negative consequences associated with stress and anxiety, the understanding and evaluation of these mental disorders and related phenomena has become a topic of optimal interest in public health systems.

Taking all of this into consideration, it would be of paramount importance to identify the factors associated with youngsters' stress in order to design specific and effective interventions. Stress is adolescents is nevertheless often neglected, and, in fact, there are very few measuring instruments for the assessment of stress manifestations in teenagers in the Spanish language, for instance: a) *Inventario de Acontecimientos Vitales en Infancia y Adolescencia* (Life events inventory in childhood and adolescence) (Moreno & Del Barrio, 1992); and b) *Inventario de Acontecimientos Vitales Estresantes* (Stressful life events inventory) (Oliva, Jiménez, Parra, & Sánchez-Queija, 2008). These two measurement instruments focus on stress as a perceived stimulus but do not take into account the stress response. Recently, Escobar et al., (2011) validated the Spanish

version of the Student Stress Inventory Stress Manifestations (SSI-SM) (Fimian et al., 1989). The SSI-SM is composed of two different subscales. The first is composed of 20 items and evaluates the stress stimulus. The second is composed of 22 items and evaluates physical, emotional and behavioural stress response. This second subscale has a three-factor structure similar to the original proposed by Fimian et., (1989) even though it contains items that load in different factors (Moulds, 2003). The Spanish version, Escobar et al., (2011) found through confirmatory factor analysis (CFA) that the same three-factor structure (emotional, physiological and behavioural) with a second order factor of Stress showed the best goodness of fit indices with a Confirmatory Factor Index (CFI) = 0.96 and Root Mean Square Error of Aproximation (RMSEA) = 0.047. The analysis of the measurement invariance of the factor structure across different groups such as gender or age, however, has scarcely been studied.

The present study

Within this research context, the main purpose of the present study was thus to analyze the psychometric properties of the SSI-SM (Fimian et al., 1989) in Spanish adolescents. In order to do this, we therefore: a) examined the internal structure of the SSI-SM scores through CFA, b) studied the relationship with the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) and the Schizotypal Personality Questionnaire-Child (SPQ-C) (Raine, Fung, & Lam, 2011), c) estimated the reliability of the scores, d) studied new psychometric approaches such as DIF by gender, and e) studied the influence of gender and age in the SSI-SM scores.

Method

Participants

Participants volunteered to take part in the study (convenience sampling). Given the sample strategy, and in order to ensure accurate representability, different cities and different types of secondary schools – public, grant-assisted private and private – and from vocational/technical schools belonging to La Rioja (a region of the north of Spain) were included. The final sample comprised a total of 708 of which 308 were male (43.5%), belonging to seven schools. The age of the participants ranged from 11 to 15 years (M = 14.61; SD = 1.71). The age distribution of the sample was the following: 11

years (*n* = 165; 23.30%), 12 (*n* = 133; 18.79%), 13 years (*n* = 130; 18.36%), 14 years (*n* = 180; 25.43%), and 15 years (*n* = 100; 14.12%).

Instruments

Student Stress Inventory - Stress Manifestations (SSI-SM) (Fimian et al., 1989). It is composed of a total of 22 items in a Likert-type response format with five options (1 = *absolutely not*, 2 = *few times*, 3 = *some times*, 4 = *often*, and 5 = *a lot of times*). Items are grouped in three dimensions: Physiological responses (6 items), Emotional responses (10 items), and Behavioural responses (6 items). Total score of the subscales is the sum of each dimension. In this study we have used the Spanish version of the instrument (Escobar et al., 2011). The Cronbach's Alpha values ranged between 0.62 for Physiological subscale and 0.79 for the Emotional subscale.

Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997), self-reported form. This is a measuring instrument widely used in the assessment of different social, emotional and behavioural problems related to mental health in children and adolescents over the past six months. The SDQ is made up of a total of 25 statements distributed across five subscales (each with five items): Emotional Symptoms, Behavioural Problems, Hyperactive, Peer Problems, and Prosocial Behaviour. The first four subscales yield a Total Difficulties score. In this study we used a Likert-type response format with five options (1 = "*totally disagree*" to 5 = "*totally agree*"), so that the score on each subscale ranged from 5 to 25 points. In the present study we used the Spanish version of the SDQ (Fonseca-Pedrero, Lemos-Giráldez, Paino, & Muñiz, 2011). Internal consistency was accepTable in the present study with Cronbach's Alpha values ranging between 0.58 (Behavioural Problems) and 0.71 (Emotional Symptoms).

Schizotypal Personality Questionnaire-Child (SPQ-C) (Raine et al., 2011). The SPQ-C is a self-report composed of 22 modified items from the SPQ-Brief (Raine & Benishay, 1995) that allow for the evaluation of schizotypal traits in children and in the adolescent population. The SPQ-C has three different dimensions: Cognitive-Perceptual, Interpersonal, and Disorganized. A five Liker-type response format was used (1 = *completely disagree* to 5 = *completely agree*). In the present study we used the Spanish version of the SPQ-C (Fonseca-Pedrero, Ortuño, Paino, Lemos-Giraldez, & Muñiz, in press). The SPQ-C has shown adequate psychometric properties in this

version; the internal consistency of the SPQ-C through Cronbach's Alpha in the present study ranged between 0.61 and 0.69.

Procedure

The measuring instruments were administered collectively, in groups of 10 to 35 students, during normal school time in a classroom prepared for this purpose. The study was presented to participants as part of a research project about different characteristics of personality. For subjects under 18, parents were asked to provide written informed consent in order to allow their child to participate in the study. Participants were informed of the confidentiality of their responses and the voluntary nature of the study. No incentive was provided for their collaboration. The administration took place under the supervision of the researchers. This study is part of a broader research on the detection of psychological disorders in adolescence and early intervention.

Data Analysis

First, we calculated descriptive statistics (mean, standard deviation, skewness and kurtosis) for the SSI-SM subscales and Total score. Second, we examined Pearson's correlations between SSI-SM subscales and Total score. Third, in order to analyze the internal structure of the SSI-SM scores, several confirmatory factor analyses were conducted. The parameters were estimated using Weighted Least Squares Means and Variance adjusted (WLSMV) for ordinal data. Several hypothetical factor models were tested. The following goodness-of-fit indexes were used: Chi-square (χ^2), Comparative Factor Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Weighted Root Mean Square Residual (WRMR). According to Marsh, Hau and Wen (2004), RMSEA and WRMR scores obtaining 0.05 or less are preferred; however, values below 0.08 are considered accepTable. The CFI values over 0.95 are preferred and values close to 0.90 are considered accepTable. Fourth, we estimated the reliability of the SSI-SM scores via Cronbach's Alpha. Fifth, we examined the relation between SSI-SM subscales, the SDQ and the SPQ-C through Pearson's correlations. We then examined the Differential Item Functioning (DIF) by gender. DIF occurs when examinees from different groups show differing probabilities of success on (or endorsing) the item after matching on the underlying ability that the item is intended to measure. Given its simplicity of calculation and interpretation, the Mantel-Haenszel procedure is among the most widely used methods in the evaluation of

DIF. In the present study we have applied the Generalized Mantel-Haenszel test (GMH) (Mantel & Haenszel, 1959), namely the Generalized Ordinal MH statistic (1) - QGMH(1)-. The statistical significance level was set at 0.01.

Finally, in sixth place, and with the aim of analyzing the relation between mean scores of SSI-SM and gender and age, a multivariate analysis of the variance was conducted. Age was dichotomized in order to simplify the analysis, taking into account the different stages of adolescence. As an index of size effect, *eta* partial square (partial η^2) was employed. For the data analysis we used SPSS 15.0 (Statistical Package for the Social Sciences, 2006), GHMDIF (Fidalgo, 2011), and Mplus 5.2 (Muthen & Muthen, 1998-2007).

Results

Descriptive statistics of the scales and items

The descriptive statistics regarding mean, standard deviation, skewness and kurtosis for the SSI-SM are shown in Table 1. Pearson's correlation between the three dimensions and the Total score of the SSI-SM are shown in Table 1. Pearson's correlation coefficients between the dimensions were statistically significant ($p < 0.01$) and ranged between 0.62 (Physiological with Behavioural and Emotional with Behavioural) and 0.93 (Emotional with Total score).

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Table 1. **Descriptive statistics and Pearson's correlation coefficients for the Student Stress Inventory - Stress Manifestations (SSI-SM)**

SSI-SM	*M*	*SD*	Skewness	Kurtosis	Cronbach Alpha	Physiological	Emotional	Behavioural
Physiological	5.21	3.93	1.02	1.23	0.67			
Emotional	10.78	7.39	0.79	0.23	0.86	0.65*		
Behavioural	4.35	4.01	1.58	2.95	0.73	0.62*	0.62*	
Total score	20.52	13.54	1.07	1.07	0.90	0.84*	0.93*	0.82*

* $p \leq 0.01$

Confirmatory factor analysis of the items

The three dimensional model proposed by Fimian et al., (1989) was tested. In addition, we examined the second order factor solution with a general stress factor and three first-order factors (Escobar et al., 2011). As is shown in Table 2, the goodness-of-fit indices for the hypothetical three-dimensional model were adequate. The range of the

estimated factor loadings for the three-factor model was between 0.41 (item 2) of the Physiological subscale to 0.82 (item 19) of the Emotional subscale, all being statistically significant.

***Table 2.* Goodness-of-fit indices for the hypothetical models tested**

Models	χ^2	*df*	CFI	TLI	RMSEA	WRMR
1 factor	468.335	96	0.887	0.953	0.087	1.410
3 factors	337.289	96	0.912	0.967	0.073	1.165
3 factor with modification indices	338.463	96	0.927	0.970	0.070	1.124
1 general factor + 3 factors	373.286	96	0.912	0.967	0.073	1.165

Note. χ^2 = Chi square; *df* = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; WRMR = Weighted Root Mean Square Residual.

Reliability estimation of the SSI-MI scores

Internal consistency levels were 0.65 for Physiological, 0.85 for the Emotional, 0.72 for the Behavioural, and 0.89 for the SSI-MI Total score. Discrimination Indices were all over 0.30

Evidence of Validity based on relationship with external variables

We calculated the Pearson's correlation between the SDQ, the SPQ-C, and the SSI-SM subscales. As shown in Table 3, most of the relations between SSI-SM and the SDQ and SPQ-C subscales are statistically significant. Correlations between SSI-SM and SDQ ranged between 0.01 for Physiological and Prosocial subscales and 0.65 for the Emotional subscales. Correlations between SSI-SM and SPQ-C ranged between 0.12 for Physiological and Interpersonal subscales and 0.46 for Emotional and Disorganized subscales.
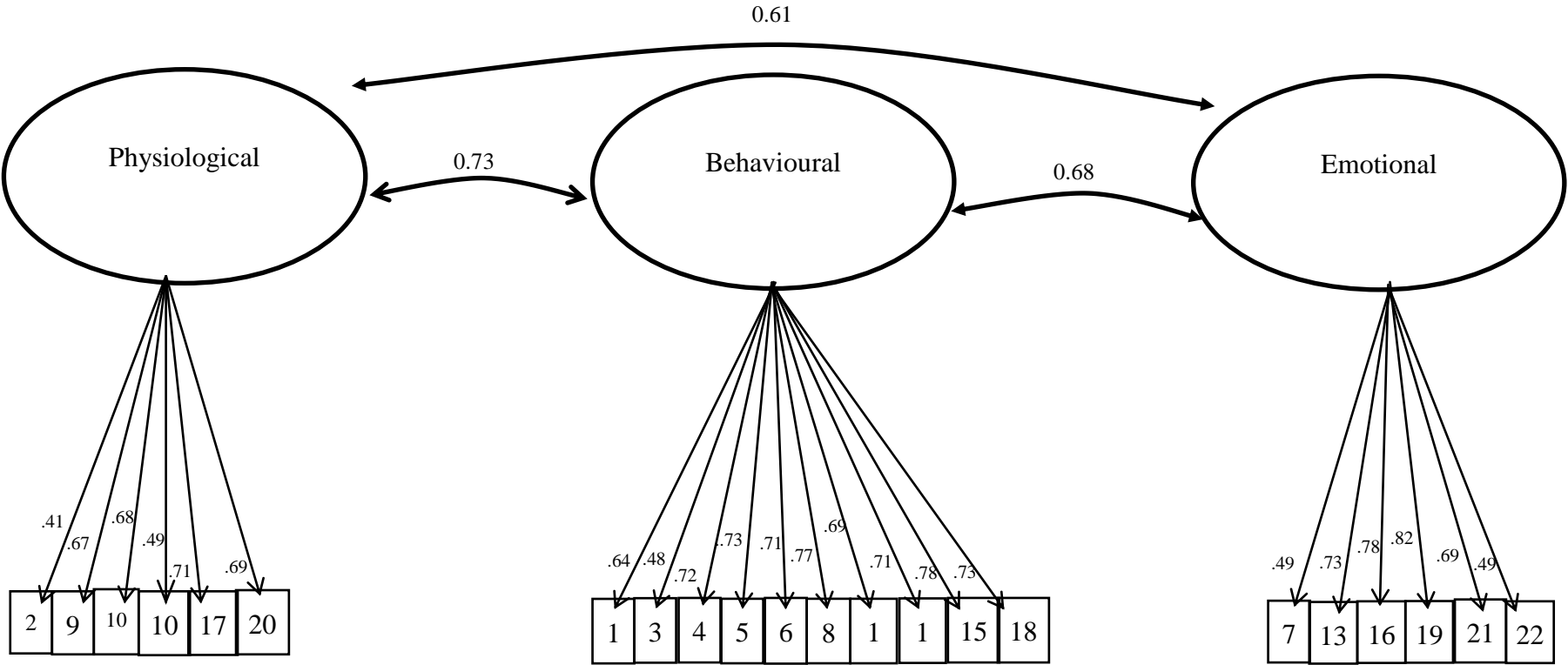
Figure 1. **Path diagram of the confirmatory factor analysis**

***Table 3.* Factor loadings for Student Stress Inventory - Stress Manifestations (SSI-SM) items**

SSI-SM items	Factors		
	Physiological	Behavioural	Emotional
2	0.41		
9	0.67		
10	0.68		
14	0.49		
17	0.71		
20	0.69		
1		0.64	
3		0.48	
4		0.72	
5		0.73	
6		0.71	
8		0.77	
11		0.69	
12		0.71	
15		0.78	
18		0.73	
7			0.49
13			0.73
16			0.78
19			0.82
21			0.69
22			0.49

Analysis of Differential Item Functioning (DIF) by gender

Analysis showed that six items of the SSM-SI (7, 12, 13, 19, 20, and 21) displayed DIF by gender.

Mean scores comparisons in SSI-SM for gender and age

The λ Wilks revealed statistically significant differences by gender (λ = 0.927, $F_{(3,502)}$ = 9.680, $p \leq 0.001$, η^2 partial = 0.061), and age λ = 0.899, $F_{(3,503)}$ = 19.871, $p \leq 0.001$, η^2 partial = 0.112). Mean scores and standard deviation for gender in the three SSI-SM subscales and Total score are shown in Table 4. Statistically significant differences were found in Physiological and Emotional subscales and in the Total score, where women showed higher mean scores than men. Statistically significant differences were found in all subscales and Total score of the SSI-SM, where the group of 14-15 years revealed highest scores than the younger group.

Table 4. Pearson's Correlations between subscales of the Student Stress Inventory - Stress Manifestations (SSI-SM), the Strengths and Difficulties Questionnaire (SDQ) and the Schizotypal Personality Questionnaire-Child (SPQ-C)

	SDQ					*SPQ-C*		
SSI-SM	Peer Problems	Hyperactive	Prosocial	Emotional	Behavioural	Cognitive-perceptual	Interpersonal	Disorganized
Physiological	0.24*	0.26*	0.01	0.38*	0.24*	0.28*	0.12*	0.24*
Emotional	0.32*	0.33*	-0.03	0.65*	0.33*	0.37*	0.34*	0.46*
Behavioural	0.29*	0.36*	-0.22*	0.24*	0.38*	0.16*	0.16*	0.25*

*$p \leq 0.01$

Table 5. **Mean score comparisons on the subscales of the Student Stress Inventory - Stress Manifestations (SSI-SM) by gender and age**

	Gender							Age						
	Male		Female					11-13 years		14-15 years				
							η^2							η^2
SSI-SM	M	SD	M	SD	F	p	partial	M	SD	M	SD	F	p	partial
Physiological	4.69	4.27	5.72	5.76	4.97	0.025	0.010	4.45	3.75	5.86	4.33	13.27	$\leq$0.001	0.027
Emotional	9.47	7.15	11.83	6.93	10.75	$\leq$0.001	0.021	8.22	6.82	12.66	7.23	48.67	$\leq$0.001	0.089
Behavioural	4.52	4.25	4.33	3.46	1.18	0.284	0.002	3.14	2.54	5.27	4.62	41.59	$\leq$0.001	0.078
Total score	19.88	14.05	21.55	12.88	3.73	0.028	0.009	15.92	10.86	23.91	14.24	47.49	$\leq$0.001	0.081

Mean scores comparisons on Student Stress Inventory - Stress Manifestations (SSI-SM) subscales by gender and age

Conclusion and Discussion

The main goal of this work was to study the psychometric properties of the Student Stress Inventory - Stress Manifestations (SSI-SM) (Fimian et al., 1989) in a sample of non-clinical adolescents. For this purpose, we examined the internal structure of the SSSI-SM through confirmatory factor analysis (CFA) and we estimated the reliability of the scores. In addition, we examined the Differential Item Functioning (DIF) by gender, the relation with external variables, and the influence of gender and age in the expression of SSI-SM scores. The results of the present study indicate that the SSI-SM is a brief and easy measurement instrument, with adequate psychometric properties for the assessment of stress manifestations in adolescence population.

Analysis of the internal structure through CFA showed that the hypothetical model with three factors (Physiological, Emotional, and Behavioural) yielded appropriate goodness-of-fit indices, similar to the three-factor model with a second order factor. Items grouped in these three factors did not show high cross-loadings and the weight of the estimated factor loadings was high. These results are similar to those found by Escobar et al., (2011) with Spanish adolescents, and to other international studies (Fimian et al., 1989; Moulds, 2003). For instance, Moulds et al., (2003), found a three-factor structure as the most appropriate through principal component analysis but with some cross-loadings.

Cronbach's alpha coefficients were moderate for the Physiological (0.65) and Behavioural (0.72) subscales and appropriate for the Emotional (0.85) and the Total score (0.89). Values were appropriate, and revealed that the instrument measures accurately. In addition, correlations between subscales were all significant. Previous studies have found similar reliability values to those found in this study (Escobar et al., 2011; Moulds, 2003). For instance, Escobar et al., (2011), in a sample with 1002 Spanish teenagers found Cronbach's Alpha values ranging between 0.62 for the Physiological and 0.79 for the Emotional subscales, whereas the value for the Total score was 0.86. As can be shown, these values are similar to those found in the present study with Physiological subscale showing the lower value and the Total score the higher.

Sources of validity in relation to external variables showed a significant Pearsons' correlation between the SSI-SM and the SDQ and SPQ-C. First of all, a

positive association between all the SSI-SM dimensions and the difficulties subscales of the SDQ was found. These results are congruent with other studies showing a strong relation between adolescents' stress levels and behavioural and emotional problems (Moksnes, Moljord, Espnes, & Byrne, 2010; Trianes, Blanca, Fernández-Baena, Escobar, & Maldonado, 2011; Trianes et al., 2009).

Furthermore, all the dimensions of the SSI-SM displayed a statistically significant association with all the dimensions of the SPQ-C. Schizotypal traits have been related to affective psychopathology like, for example, high levels of anxiety, stress, dysphoria or depression in non-clinical adolescents (Armando et al., in press; Debbané, Van der Linden, Gex-Fabry, & Eliez, 2009; Fonseca-Pedrero et al., 2010; Scott, Martin, Bor et al., 2009; Wigman et al., in press; Yoshizumi, Murase, Honjo, Kanedo, & Murakami, 2004) and high risk for psychosis (Dominguez, Wichers, Lieb, Wittchen, & van Os, in press; Poulton et al., 2000; Scott, Martin, Welham et al., 2009; Werbeloff et al., 2012). For instance, the combination between a high score in schizotypy and perceived stress, could lead to high levels of emotional and behavioural symptoms, and, as a result, to an increased probability to transit towards serious mental disorders. It is also possible that emotional and behavioural problems and stress manifestations, in adolescents that report schizotypal experiences and traits, work as moderating factors and can contribute to an increased risk of psychosis. These results point out the appropriate external validity of the SSI-SM scores and highlight the evidence that stress is a relevant psychological dimension that is correlated with other psychological problems in adolescence (Byrne et al., 2007; Jose & Ratcliffe, 2004; Kosmala-Anderson & Wallace; Moksnes et al., 2010; Trianes et al., 2011; Trianes et al., 2009).

Adolescence is a developmental stage with relevant biopsychological changes. The mentioned lack of synchrony between brain and hormonal changes, and the gap or mismatch between cognitive and emotional changes, and self-regulation capabilities, is especially relevant in early and middle-adolescence (Worthman, 2011). Thus, adolescents are more vulnerable to different kind of problems including stress. In addition, adolescents are exposed to different situations and changes that affect their well-being. The adjustment to these changes is frequently associated with psychological problems that affect well-being and adjustment. In this regard, the assessment of the stress response in early stages of the adolescence through valid and reliable instruments,

such as the SSI-SM could be very relevant in order to conduct prophylactic interventions.

Analysis of DIF revealed that six items functioned differentially according to gender. Previous studies using DIF analysis in the SSI-SM have not been found in the literature. Despite these results are preliminary, and future studies must replicate this findings in representative samples of the population, it is worth mentioning that the presence of DIF does not guarantee equity in the measurement process (no real differences in the traits intended to be measured), so that some consideration of ethical and legal aspects is relevant (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999) (e.g., the adequacy of selecting at-risk individuals based on their scores). Likewise, it is advisable to incorporate DIF analysis as a routine practice in statistical analyses in instruments that assess different psychological problems such as stress manifestations (clinical and non-clinical).

Taking into account DIF results, the SSI-SM scores showed a differential pattern by gender. Women presented higher mean scores than men in Physiological, Emotional, and in the Total Difficulties scores, while differences in Behavioural dimension were not found. These results are similar to those found by Escobar et al., (2011) in Spanish teenagers, and also international research in which women displayed higher rates of stress after puberty (Netherton, Goodyer, Tamplin, & Herbert, 2004). However, Lin and Yussof (2013) did not find any influence of gender in the stress response in high school students. According to age the scores were higher in all the dimensions and in the Total Difficulties scores for the oldest group (14-15 years old). Previous research conducted with the SSI-SM found similar results with an increase of stress related to age (Escobar et al., 2011). According to neuroconstructivism theories (Mareschal et al., 2007; Westerann et al., 2007), teenagers at medium and final stages of the adolescence are more aware about their own problems, including stress responses and manifestations, due to the maturation of brain structures. However, results with self-report instruments are not conclusive to this respect (Fonseca-Pedrero, Paino, Lemos Giraldez, & Muñiz, 2011).

The results found in the present study bring to light new evidences of internal structure validity and reliability of the SSI-SM scores. They should be interpreted, however in the light of the following limitations: First of all, the sample characteristics

(convenient sample) preclude the generalization of the results to other populations of interest. Second, given the inherent problems in any type of study based on self-reports, it would have been useful to employ reports from external informants. Finally, it should be borne in mind that this study was of a cross-sectional nature, so that we cannot make cause-effect inferences. For this reason, it is highly recommended to continue to examine metric properties and to analyse these results in forthcoming works.

Future studies should examine the psychometric properties of the SSI-SM in other samples. These properties should also be considered in the context of the analysis of measurement invariance across cultures. Likewise, it would be interesting to determine the predictive capacity (sensitivity and specificity) of the SSI-SM in independent longitudinal studies and to determine its heuristic value in the detection of individuals at risk for psychological problems. Furthermore, it would be interesting to determine the relation between stress levels and other physiological variables. In addition, it is widely recommended to study how stress affects adolescents' adjustment to school and how it affects their performance.

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