

Adolescent/Adult Sensory Profile for Spanish Population: A Pilot Study of Internal Reliability and Discriminant Validity

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ABSTRACT

Sensory issues impact participation and are frequent in people with schizophrenia. To provide clinicians in Spain with reliable and valid tools to assess sensory integration in adult mental health, we analyzed the internal reliability and discriminant validity of Adolescent/Adult Sensory Profile (AASP-Spain). Cross-sectional descriptive study that analyzed internal reliability (Cronbach's Alpha; $n = 434$ neurotypical) and discriminant validity ($n = 18$ schizophrenia; $n = 54$ neurotypical). Cronbach's Alpha for AASP categories ranged from 0.69 to 0.73. Individuals with schizophrenia had higher scores (more problems) than controls in the three categories. The AASP-Spain offers promising internal reliability and discriminant validity.

KEYWORDS

Occupational therapy; schizophrenia; self-regulation; sensation

Introduction

Problems in Sensory Integration (SI) and the functional alterations derived from such problems have been widely studied since Dr. Ayres developed the theory of SI in the 1960s (Ayres, 1963). Ayres' research (Ayres, 1989), carried out over several decades, and posteriorly confirmed in multiple studies (Mailloux et al., 2011; Mulligan, 1998; van Jaarsveld, 2014), showed consistent patterns of function and dysfunction in sensory integration: somatodyspraxia; visuodyspraxia; vestibular, postural, bilateral integration, and sequencing deficits; sensory over-responsiveness (currently referred to as issues in sensory reactivity).

Studies have shown the existence of numerous risk factors and clinical diagnoses related to sensory integration issues which sometimes lead to mental health problems (Bar-Shalita & Cermak, 2016), such as anxiety, depression (Conelea et al., Citation2014; Engel-Yeger & Dunn, 2011), or stress (Gerstenberg, 2012), as well as problems in occupational, academic and social performance, in both pediatric and adult populations (Crozier et al., 2016; Gourley et al., 2013; Kinnealey et al., 1995; Oliver, 1990). Several studies have identified problems in sensory reactivity in individuals with bipolar disorder or schizophrenia disorder (Brown et al., 2002; Brown & Dunn, 2002; Engel-Yeger et al., 2016; Smucny et al., 2013). Sensory reactivity disorders may manifest as hyper-reactivity or hypo-reactivity (Bundy & Lane, 2019). Hyper-reactivity is also referred to with terms, such as hyper-responsivity, sensory sensitivity, over-responsive, over-reactivity, or low threshold and is characterized by discomfort with sensation and a desire to escape or avoid sensation (Schaaf & Lane, 2015). Under-responsiveness, under-reactivity, poor registration, or high threshold are synonymous with hypo-reactivity, characterized by diminished awareness or lack of reaction to sensation (Schaaf & Lane, 2015).

To assess sensory integration problems, culturally adapted assessment tools and psychometric data on the cultural adaptation are needed (Ramada-Rodilla et al., 2013). If the reliability and validity findings of the cultural adaptation are similar to those found in the original studies, the adapted evaluation tool is considered to have adequate measurement characteristics and to be equivalent to the original version (Muñiz, 1996). Reliability is the degree to which an instrument is capable of measuring without error (AERA et al., 1999; Ramada-Rodilla et al., 2013). Depending on the characteristics of the instrument, its reliability can be evaluated in several ways: (1) internal reliability; (2)

test-retest reliability; and (3) rater-reliability. Cronbach's Alpha is an accepted measure of internal reliability; it represents the degree of interrelation and coherence of the items of a test, with values ranging from 0 (absence of homogeneity) to 1 (maximum homogeneity) (Cronbach, 1951; Cronbach & Meehl, 1955). The test-retest reliability analysis refers to the repeatability capacity of the instrument to measure the same thing at two different moments in the same population (Carvajal et al., 2011). The rater-reliability confidence analysis refers to the degree of agreement that is reached between two or more evaluators in the examination of the same subjects using the same instrument (Ramada-Rodilla et al., 2013). Validity refers to the ability of an instrument to measure the trait or feature for which it was designed (AERA et al., 1999). One of the ways to establish validity is by examining discriminant validity, by obtaining statistically significant differences between a group with typical development and another with a clinical diagnosis known to differ in the trait being measured (Ramada-Rodilla et al., 2013).

In Spain, three culturally adapted instruments are available to assess sensory reactivity; (1) the Sensory Reactivity Test of the Evaluation in Ayres Sensory Integration (EASI; Gándara-Gafo et al., 2021) for children between 3 and 12 years of age, (2) the Short Sensory Profile (SPP; Beaudry-Bellefeuille & Lane, 2015) for children between 3 and 10 years of age, (3) the AASP (Gándara-Gafo, Santos-del Riego, Viana-Moldes, et al., 2019) for individuals aged 11 years or older. The AASP was designed by Brown and Dunn (2002) to examine sensory reactivity using 60 items related to six sensory factors (taste/smell processing, movement processing, visual processing, tactile processing, activity level, and auditory processing) and four sensory response categories (low registration, sensory seeking, sensory sensitivity, and sensory avoiding) (Dunn, 1997). The AASP has been culturally adapted for Spain (Gándara-Gafo, Santos-del Riego, Viana-Moldes, et al., 2019; culturally adapted version in the Spanish language for individuals residing in Spain) and although it has good test-retest reliability, other psychometric analysis, such as internal reliability or discriminant validity has not been carried out. Therefore, the aim of the present study is to explore the internal reliability of the cultural adaptation for Spain of the AASP as well as the discriminant validity, comparing typically developing individuals with those with schizophrenia. More specifically, we aim to explore the psychometric data of the Spanish version of the AASP

through an analysis of internal reliability and discriminant validity to provide an evaluation tool that allows Spanish occupational therapists to evaluate the differences in sensory reactivity in adolescents and adults, both at the clinical and research level. At the clinical level, the availability of this tool will facilitate the identification of sensory reactivity problems, allowing for an adequate clinical intervention that improves occupational participation and quality of life. At the research level, the previously culturally adapted tool will now be supported with documented psychometric data for the Spanish population, an essential aspect to consider when choosing assessment tools for research purposes.

Methods

A cross-sectional descriptive study was carried out to analyze the internal reliability and the discriminant validity of the culturally adapted Spanish version of the AASP for individuals residing in Spain.

This study was approved by the Clinical Research Ethics Committee of Galicia (the entity responsible for reviewing all human research conducted in Galicia, a region of Northern Spain). Data collection preserved participants' anonymity at all times. All study participants signed the corresponding informed consent form. In the case of minors, their parents or legal guardians signed the consent forms.

Instruments

The AASP (Brown & Dunn, 2002) examines sensory reactivity based on the frequency of the behaviors described in each of the 60 items using a five-point Likert scale. Each item forms part both a sensory factor (processing of taste/smell, movement, visual and tactile processing, level of activity, and hearing) and one of the four quadrants (low registration, sensory seeking, sensory sensitivity, and sensory avoiding) (Dunn, 1997). From this perspective, persons with a low sensory threshold, those whose central nervous system (CNS) is easily activated by sensory stimuli, would tend to have patterns of sensory sensitivity and sensory avoiding. On the other hand, persons with a high sensory threshold, those who require more intense stimuli to activate their CNS, would tend to exhibit patterns of low registration and sensory seeking (Dunn, 1997).

The AASP (Brown & Dunn, 2002) has an internal reliability (Cronbach's Alpha) ranging between 0.66 and 0.82 for each of the categories. Discriminant validity of the AASP was established by comparing three groups of individuals: typical development ($n = 29$), bipolar disorder ($n = 30$), and schizophrenia ($n = 27$). Results showed significant differences and distinct sensory reactivity patterns among the 3 groups (Brown & Dunn, 2002). Furthermore, the AASP has reference values for neurotypical populations ($n = 950$; USA) distributed into three age groups: 11–17, 18–64, and >65 years (Brown & Dunn, 2002).

The cultural adaptation for Spain of the AASP, entitled *Perfil Sensorial del adolescente/adulto* (PSAA; Gándara-Gafo, Santos-del Riego, Viana-Moldes, et al., 2019) included direct and back translation, cognitive interviews to ensure the text was understandable to the Spanish population ($n = 18$), linguistic expert review and test–retest reliability in monolingual ($n = 30$) and bilingual ($n = 30$) samples (Gándara-Gafo, Santos-del Riego, Viana-Moldes, et al., 2019). Reference values were collected using the PSAA with a sample of 787 typically developing individuals (201 adolescents aged from 11 to 17 years; 462 adults aged from 18 to 64 years; 124 older adults aged 65 years or over) (Gándara-Gafo, Santos-del Riego, Viana-Moldes, et al., 2019). Category mean (*SD*) scores were similar to the original sample and ranged from 29.3 (6.6) (low registration) to 49.1 (8.3) (sensory seeking), with statistically significant differences by age group ($p < 0.001$) in all four response categories.

Participants

Two groups of participants were involved in the study: (1) internal reliability group ($n = 434$); (2) discriminant validity group ($n = 72$). The inclusion criteria for the internal reliability group were: being over 11 years of age, having Spanish nationality, being a resident of Spain, acceptance of the informed consent form, and answering all of the items of the PSAA (Gándara-Gafo, Santos-del Riego, et al., 2019). For the study we used the same exclusion criteria as the original study (Brown & Dunn, 2002): a diagnosis of depression, a chronic disease, such as diabetes, cancer, neurological diseases, or cognitive disabilities, and/or the use of medication that might affect the central nervous system (CNS). The discriminant validity group was divided into two subgroups: individuals with typical development ($n = 54$) and individuals with a clinical diagnosis of schizophrenia

($n = 18$). The inclusion and exclusion criteria were the same as those previously described for the internal reliability group, except for the schizophrenia sub-group which additionally had a clinical diagnosis of schizophrenia as inclusion criteria. Individuals with schizophrenia were referred to the study by their psychiatrist only if they were considered to be in a stable condition, without overt psychotic symptoms.

Procedures

The first phase of this study dealt with internal reliability ($n = 434$) and the second phase dealt with discriminant validity ($n = 72$).

Internal reliability

For the reliability analysis, sample size should not be <100 people (Kline, 1994), however, at least five people should be available for each item of the questionnaire (Muñiz & Fonseca-Pedrero 2008). Considering the recommendation of Muñiz and Fonseca-Pedrero (2008), this study used the calculation of five people for each item of the questionnaire (60 items) seeking to obtain a total of 300 participants to fully respond to the AASP (study inclusion criteria). A total of 434 people participated in this phase of the study. The sample was obtained from among the participants of the PSAA Spanish reference value study (Gándara-Gafo, Santos-del Riego, Viana-Moldes, et al., 2019). To obtain a sample representing all the country, the map of Spain was divided into three geographical areas (North, Center/South, and East) representing all of the main cultural contexts of the Spanish population. To recruit participants, the research team contacted, via telephone or e-mail, with schools, public and private universities, occupational and senior citizen centers, associations, and private companies throughout the three geographical areas. Visits were scheduled to the institutions interested in participating in the study. Each person answered a questionnaire asking for demographic characteristics and health status along with the PSAA.

For the internal reliability analysis, Cronbach's alpha was used (Cronbach, 1951) aiming to obtain values similar or greater than the values obtained in the studies of the original version (0.66–0.82; Brown & Dunn, 2002) within each of the four response categories of items of PSAA (low registration, sensory seeking, sensory sensitivity, and sensory

avoiding). Cronbach's alpha is calculated by taking the score from each scale item and correlating them with the total score for each observation and then comparing that with the variance for all individual item scores.

Discriminant validity

In the second phase, we used the methodology of the original validity studies of the questionnaire (Brown & Dunn, 2002). The discriminant validity analysis was a comparative study ($n = 72$) between people with a clinical diagnosis of schizophrenia ($n = 18$) and people with typical development ($n = 54$) to determine possible differences in sensory reactivity. Participants with a clinical diagnosis of schizophrenia were referred to the study by the psychiatrist of a public outpatient mental health hospital and included individuals that were taking neuroleptic or anti-psychotic drugs prescribed by a psychiatrist. The principal investigator administered the questionnaire to users who volunteered to participate in the study. Neurotypical participants were obtained from the participants taking part in the first phase of this study (internal reliability). They were chosen paired by age (± 3 years) and gender in a ratio of 3:1 with respect to the diagnostic group as recommended by Schlesselman (1982) for this type of analysis.

Data analysis

The equality of distributions between the variables of gender and age for both groups (schizophrenia, typically developing) was confirmed using the Fisher test (categorical variable; gender) and the Student t -test (quantitative variable, age) for independent samples. A comparative analysis was carried out to determine the possible differences in sensory reactivity in each of the sensory response categories (low registration, sensory seeking, sensory sensitivity, and sensory avoiding) between the two groups using the Student t -test or the Mann–Whitney U test, depending on whether the hypothesis of normality (required for the t -test) was verified or not (Rohatgi & Saleh, 2015). Data were analyzed using the *Statistical Package for the Social Sciences*, version 19.0 (SPSS) for internal reliability and discriminant validity.

Results

Internal reliability

Characteristics of the sample for internal reliability analysis are shown in Table 1. Internal reliability ranged from 0.69 to 0.73 for each of the four categories of items (Table 2).

Discriminant validity

Characteristics of the sample for the discriminant validity analysis are shown in Table 1. As expected, given the selection process (groups matched by age and gender), the equality of distribution was confirmed and did not show differences in distribution according to gender (p -value test Fisher = 1) or age (p -value of Student's t -test = 0.62). Due to the small sample size of the diagnostic group ($n = 18$), a specific analysis for age and gender was not carried out.

The hypothesis of normality was verified for all categories and therefore the Student t -test was used for the discriminant validity analysis. The means (SD) obtained by response categories were as follows: 27.17 (7.07; low registration), 34.35 (7.26; sensation avoiding), 35.22 (8.28; sensory sensitivity), and 47.19 (8.41; sensory seeking) for the sample with typical development (Table 2). For the group with schizophrenia the means (SD) were as follows: 36.11 (9.72; low registration), 40.61 (12.00; sensation avoiding), 43.78 (8.52; sensory sensitivity), and 45.17 (9.39; sensory seeking) (Table 2). The results obtained by comparing the responses from both groups showed significant differences in three of the four response categories: low registration ($p < 0.001$), sensory sensitivity ($p > 0.001$), and sensation avoiding ($p 0.049$). Individuals diagnosed with schizophrenia obtained higher scores (more sensory reactivity problems) than those that were neurotypical (Table 2).

Discussion

This is the first study in Spain to explore the psychometric characteristics of a questionnaire designed to analyze sensory reactivity in adolescents and adults with a psychiatric diagnosis. This pilot study revealed adequate internal reliability and

discriminant validity of the PSAA, the Spanish cultural adaptation (for Spain) of the AASP.

The internal reliability analysis carried out in this study shows appropriate Cronbach's alpha, in three of the four response categories (ranging from 0.69 to 0.73), results very similar to those obtained in the original AASP study (Brown & Dunn, 2002) and in others carried out with cultural adaptations of this questionnaire in China (Chung, 2006) and Israel (Engel-Yeger, 2012). It is generally accepted that values exceeding 0.7 offer adequate internal reliability. In the sensation-seeking category, the result (0.69) is very close to the established limit, similar to other studies carried out with this tool, including the original study (Brown & Dunn, 2002). This issue has not prevented the AASP from being widely accepted both in clinical practice and in research and supports the use of the PSAA, the Spanish version of the questionnaire.

The discriminant validity analysis used in this study was carried out among neurotypical individuals and those diagnosed with schizophrenia. These two groups have been shown to differ in sensory reactivity (Brown et al., 2002; Brown & Dunn, 2002) and our Spanish adaptation of the instrument should also differentiate between them. As such, in our study, sensory reactivity patterns in individuals diagnosed with schizophrenia differed significantly from those found in people with typical development. The results obtained indicate that people with schizophrenia have higher scores (more sensory reactivity problems) in three of the four response categories: low registration, sensory sensitivity, and sensation avoiding. The results of this study partially confirm the data obtained in the original study carried out with individuals from the United States to compare the same groups. The original study found significant differences in the low registration, avoidance of sensory stimuli, and sensory-seeking categories, with higher scores in the group diagnosed with schizophrenia. In contrast, our study identified sensory sensitivity behaviors in people with schizophrenia and did not detect behaviors linked to seeking sensory stimuli. Similarly, to the original study, we also found patterns of low registration and avoidance of sensory stimuli in people with this diagnosis.

This study, therefore, supports some of the findings of the original study (Brown & Dunn, 2002) and supports other research results (Dickey et al., 2010; Smucny et al., 2013) that show that people with schizophrenia have higher scores in the sensory sensitivity and sensation avoiding categories.

The validity analysis, designed to guarantee that the questionnaire represents the aspects relevant to the characteristics evaluated, confirms that the PSAA detects differences between the sensory reactivity of neurotypical people and people with schizophrenia. This analysis supports the use of the PSAA as an instrument that can be applied both in clinical practice and in research.

Although the discriminant validity sample was small, this study was able to detect significant differences in three of the four response categories established by Dunn (1997) between people with typical development and people with a diagnosis of schizophrenia and should detect differences with other diagnostic groups. Discriminant validity analysis with a larger sample and with other diagnostic groups could be a line of research to pursue using the Spanish version of the AASP to further support its discriminative validity.

The main limitation of this study was the use of a relatively small convenience sample ($n = 18$) for the discriminant validity phase. Also, only persons with one particular diagnosis (schizophrenia) were included in the study of discriminant validity. Further research using this tool should be carried out in other groups of patients with other clinical diagnoses known to affect sensory reactivity to help in better understanding its applicability in clinical practice.

Another limitation was that all the schizophrenia samples belonged to the same area of Spain (A Coruña, Galicia, Spain). Furthermore, we did not collect information regarding the severity of symptoms or comorbidities.

Although this study analyzes the discriminant validity of the cultural adaptation to the Spanish population of the AASP, it should be noted that future lines of research can be opened for other types of analysis to support construct validity, such as convergent or factorial validity. In relation to convergent validity, the absence of other assessment tools designed to measure sensory reactivity in adolescents and adults, adapted to the Spanish population, makes this analysis difficult to carry out. However, if new assessment tools were available in the future for the evaluation of sensory reactivity in adolescents and adults in Spain, this could open this line of research. Furthermore, factorial validity analysis through a factor analysis could also be contemplated. Although this type of validity is an essential criterion in the development of new assessment tools which is not usually documented in relation to cultural adaptations, future research could focus on a factorial validity analysis in the Spanish population with the AASP.

Conclusion

Data obtained in the internal consistency and validity analysis provides initial support for the PSAA as a useful and valid instrument for use in the Spanish population. Although further studies with larger sample sizes are needed, occupational therapists and other professionals may consider using this instrument for the purposes for which it was originally designed, in both clinical and research environments.

Acknowledgments

Thanks are due to the Consultancy Unit of Technical-Scientific Services at the University of Oviedo, especially Tania Iglesias, for her methodological advice. We would also like to thank the Maritime Hospital of Oza (A Coruña, Galicia, Spain), especially the occupational therapist Carmen García Pinto for her hard work and cooperation, and all the people who cooperated with this research. Research carried out by the Integra Saúde Unit (University of A Coruña, Galicia, Spain).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Key messages

This study provides Spanish occupational therapists with an assessment tool for sensory reactivity issues in adolescents and adults that supports both evidence-based practice and research in the area of sensory integration with this population.

A Spanish version of this well-known assessment tool in the area of sensory reactivity in adults and adolescents paves the way for international studies and a more detailed understanding of patterns of sensory reactivity dysfunction and cultural differences.

Funding

The author(s) reported there is no funding associated with the work featured in this article.

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Table 1. Sample that Participated in Internal Reliability ($n = 434$) and Discriminant Validity ($n = 72$)

Variable		Reliability	Validity	
		Sample ($n = 434$)	Sample with typical development ($n = 54$)	Sample with schizophrenia ($n = 18$)
Gender	Female	244 (56.2)	18 (33.3)	6 (33.3)
	Male	190 (43.8)	36 (67.7)	12 (67.7)
Age [Average SD)]	Female	38 (25)	42 (11)	43.50 (10)
	Male	33 (21)	37 (11)	37 (11)
Age group	11–17 years	110 (25.3)	3 (5.55)	1 (5.55)
	18–64 years	220 (50.7)	51 (94.45)	17 (94.45)
	>65 years	104 (24.0)	0	0
Geographic zone	North	174 (40.1)	54 (100)	18 (100)
	Centre/South	156 (35.9)		
	East	104 (24.0)		
Education level	High school	213 (49.1)		
	Superior technician	161 (37.1)		
	University	60 (13.9)		
Employment status	Student	223 (51.4)		
	Paid worker	85 (19.6)		
	Other situation	126 (29.0)		

Results expressed in number (percentage).

Table 2. Internal Reliability (Neurotypical) and Discriminant Validity (Schizophrenia Disorder and Neurotypical) by Response Categories

Categories/population	Internal reliability Cronbach alpha (<i>n</i> = 434)	Discriminant validity			
		Average	SD	Range	p-Value
Low registration	0.72				
Typical development		27.17	7.07	16–45	<0.001
Schizophrenia		36.11	9.72	18–48	
Sensation seeking	0.69				
Typical development		47.19	8.41	16–71	0.394
Schizophrenia		45.17	9.39	25–58	
Sensory sensitivity	0.73				
Typical development		35.22	8.28	18–55	<0.001
Schizophrenia		43.78	8.52	29–61	
Sensation avoiding	0.71				
Typical development		34.35	7.26	22–62	0.049
Schizophrenia		40.61	12.00	22–67	

SD: standard deviation.