Turkish adaptation of the behavioral flexibility scale for children with autism spectrum disorder: cross-cultural adaptation and psychometric evaluation

Birgül Vural, Nermin Gürhan, Bahadır Geniş and Ahmet Özaslan

Abstract

Purpose – *The purpose of this study is to adapt the ''Behavioral Flexibility Scale for Children with Autism Spectrum Disorder'' to Turkish culture and evaluate its psychometric properties.*

Design/methodology/approach – *The Behavioral Inflexibility Scale (BIS), developed by Luc Lecavalier and her colleagues, is used in diagnostic tests for autistic children. The research used a methodological design. Data were collected between March and September 2021. The study included 254 parents of children with autism. Content validity, construct validity and criterion validity were assessed. Reliability was examined using adjusted item-total correlation, Cronbach's coefficient, composite reliability and split-second reliability.*

Findings – *The Turkish version of the ''Behavioral Flexibility Scale for Children with Autism Spectrum Disorder'' was found to have good content and criterion validity. The single-factor structure of the scale was confirmed for the Turkish version as a result of confirmatory factor analysis. The Cronbach alpha coefficient of the scale was determined as 0.97, and the item/total correlation coefficients were found to be between 0.544 and 0.807. In the first factor analysis conducted for BIS, the KMO value was 0.958, and in the BTS test results, it was determined that the scales were suitable for factor analysis ($X2 = 7{,}296.05$; $df = 705$; $p < 0.001$). As a result of the explanatory factor analysis, it was found that the items forming the scale were gathered under a single factor, and the factor loadings varied between 0.564 and 0.822. It was found that the items constituting the scale explained 52% of the variance, and the Pearson correlation coefficient was $r = 0.775$, $p < 0.001$.*

Research limitations/implications – *In this study, there are some limitations that need to be acknowledged. First, the sample that the study is based on was collected from parents from a single city in our country, and therefore, in future studies, it is recommended to use a stratified sampling method to include participants from all regions of the country. Another limitation is that the behavioral flexibility of children and adolescents with autism spectrum disorder (ASD) was assessed only based on the information provided by their parents. This leads to a one-sided evaluation of the results. Therefore, in future studies, it is recommended to include various sources such as special education teachers and attending physicians to assess the behavioral flexibility of children and adolescents with ASD.*

Practical implications – *The Behavioral Flexibility Scale was found to be a valid and reliable tool that can be used in diagnostic testing in children with ASD.*

Social implications – *It is aimed to early identify and intervene in the behavioral problems experienced by autistic children.*

Originality/value – *The Behavioral Flexibility Scale was found to be a valid and reliable tool that can be used in diagnostic testing in children with ASD.*

Keywords *ASD flexibility, Behavioral flexibility, Scale, Validity reliability*

Paper type *Research paper*

Birgül Vural is based at the Pediatric Nursing Department, Faculty of Health Sciences, Tokat Gaziosmanpasa Universitesi, Tokat, Turkey. Nermin Gürhan is based at the Department of Psychiatric Nursing, Faculty of Health Sciences, Tokat Gaziosmanpasa Universitesi, Tokat, Turkey. Bahadır Geniş is based at the Department of Psychiatry, Faculty of Medicine, Kocaeli Universitesi, Kocaeli, Turkey. Ahmet Özaslan is based at the Department of Child and Adolescent Psychiatry, Gazi Universitesi, Ankara, Turkey.

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1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by difficulties in social communication and restricted, repetitive patterns of behavior, interests or activities (Sanchack and Thomas, 2016). The diagnosis of ASD is made based on atypical social behavior before the age of three; interruption of verbal and nonverbal communication; and the presence of highly restricted interests and unusual patterns of repetitive behaviors, such as hand-flapping. As Kanner noted in 1943, most children with ASD exhibit a strong resistance to change, experience distress over minor changes in daily routines and insist on sameness. It has been noted that children with autism and developmental disabilities often insist on sameness and resist change (Rutter, 2004). Insistence on sameness and resistance to change are seen as a lack of behavioral flexibility (Wahlberg and Jordan, 2001). Therefore, many of these children experience significant difficulties in being flexible in their behavior and are unable to cope with unpredictable changes in their environment (Lewis and Bodfish, 1998). Recent studies focusing on the assessment of behavioral flexibility have highlighted the lack of measurement tools for assessing behavioral flexibility in individuals with developmental disabilities. Studies have shown that poor flexibility is evident when there is significant failure in ASD (Yerys *et al.*, 2009). Weak flexibility, although not a universal or fundamental deficiency in autism (Geurts *et al.*, 2009), is one of the most disturbing behaviors and is a component of several other symptoms of autism (Geurts *et al.*, 2009). Flexibility is a complex structure that encompasses a set of interrelated characteristics, behaviors and cognitions (Dajani and Uddin, 2015). Flexibility includes easily and efficiently transitioning between tasks, shifting attention to different features within a paradigm (Hedden and Gabrieli, 2010) and adaptive responses/learning based on rewards and punishments (Votinov *et al.*, 2015).

Flexibility is defined as the ability to adapt thoughts or actions in response to situational changes. Martin and Rubin (1995), Martin and Anderson (1998) and Martin, Anderson and Thweatt (1998) have defined it in more detail as "the individual's awareness of available options and alternatives suitable for each situation, willingness to be flexible and the feeling of competence in being able to adapt to the situation and be flexible." Flexibility has both cognitive and behavioral components. The concept of cognitive flexibility was first defined by Spiro and Jeng (1990) as "the ability of the individual to spontaneously restructure their knowledge to respond appropriately to changing situations." Several studies associate these limited and repetitive behaviors and interests with executive dysfunction and most clearly with the domain of cognitive flexibility (Lopez *et al.*, 2005). Behavioral inflexibility or insistence on sameness has been reported in various psychiatric conditions and in developmental disorders (Prior and Macmillan, 1973); these tendencies have most frequently been associated with autism. However, despite the continuing importance of insistence, there has been little work in the literature to determine and describe the specific daily situations (such as activity, play and interactions) in which individuals exhibit these tendencies in the definition and diagnosis of autism (American Psychiatric Association, 1994). Thus, very little research has been conducted on the assessment of behavioral flexibility in individuals with autism and other developmental disabilities (Green *et al.*, 2007).

The lack of behavioral flexibility is one of the fundamental characteristics of ASD. Individuals with autism may insist on sameness or resist change, often evidenced by their clear inadequacies in coping with and adapting to minor changes in their environment or daily routine (Lewis and Bodfish, 1998). Wahlberg and Jordan (2001) suggested that these coping and adaptation inadequacies reflect a lack of behavioral flexibility (Green *et al.*, 2007). However, the knowledge base on the nature and scope of behavioral flexibility in individuals with ASD, especially situations in which children with ASD exhibit a lack of behavioral flexibility, is insufficient (Geurts *et al.*, 2009).

To assess behavioral flexibility, the Behavioral Flexibility Rating Scale (BFRS) and the Revised BFRS (BFRS-R) have been developed by Green *et al.* (2006a, 2006b, 2007) and

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Pituch *et al.* (2007). Green *et al.* (2006a, 2006b) developed the factor structure of the BFRS by administering it to individuals with autism, Asperger's syndrome and Down syndrome, with the aim of identifying specific situations in which individuals with developmental disabilities insist on sameness (Pituch *et al.*, 2007). Didden *et al.*, (2008) conducted a study on individuals with unspecified intellectual disabilities and Angelman syndrome. However, the studies on this topic are limited, and more research is needed to evaluate behavioral flexibility in individuals with developmental disabilities.

Didden *et al.* (2008) conducted a study with individuals who have non-specific intellectual disability and Angelman syndrome. The results of these studies showed that individuals with ASD and Asperger's syndrome experienced significantly more problems with behavioral flexibility compared to individuals with Down syndrome and Angelman syndrome (Peters-Scheffer *et al.*, 2013). The studies concluded that behavioral and cognitive flexibility are prominent features of neuropsychiatric disorders such as obsessive compulsive disorder (OCD), attention deficit hyperactivity disorder (ADHD), depression and anxiety disorder (Geurts *et al.*, 2009). In this study, it is aimed to adapt the "Behavioral Inflexibility Scale (BIS)" into Turkish and evaluate its validity and reliability, developed by Luc Lecavalier, James Bodfish, Clare Harrop, Allison Whitten, Desiree Jones, Jill Pritchett, Richard Faldowski and Brian Boyd in 2020.

2. Method

2.1 Aim

To adapt the "Behavioral Inflexibility Scale (BIS)" to Turkish culture and evaluate its psychometric properties.

2.2 Design

This is a methodological design research conducted to examine the psychometric properties of the Turkish form of the BIS developed by Lecavalier *et al.* (2020).

2.3 Settings and participants

The universe of the study consisted of parents of children diagnosed with ASD who were receiving special education in schools, special education and rehabilitation institutions affiliated with the National Education Directorate. In the literature, a sample of 190 parents or more is considered sufficient for factor analysis. In total, 254 parents who agreed to participate in the study were collected based on face-to-face self-reporting by giving a questionnaire form [Information Form and Behavioral Flexibility Scale (BIS)] in the institutions where they received education. A pilot study was conducted with 25 parents who had children diagnosed with ASD.

2.4 Data collection

Research data were collected between 01.03.2021 and 01.09.2021 and face-to-face interview method. Information Form ($n = 254$), "Behavioral Inflexibility Scale (BIS)" scale (Appendix) (Lecavalier *et al.*, 2020) questionnaire form was used in children with ASD. The questionnaire form consists of questions about the characteristics of the mother and father (age, education status, economic status, marital status, employment status) and children with ASD (age, education status, gender).

BIS scale (Appendix) (Lecavalier *et al.*, 2020). The scale developed by Lecavalier *et al.* (2020) is a six-point Likert scale measuring 38 items and a single substructure. Items are rated on a six-point rating scale ranging from "Not a problem at all" 0 to "Very serious or Extreme problem" [5]. Cronbach's alpha for the BIS scale is 0.97.

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2.4.1 Socio-demographic information form. For the collection of research data, the Participant Information Form ($n = 254$) and the BIS Appendix (Lecavalier *et al.*, 2020) were used. The Participant Information Form includes questions about the parents' (age, education level, economic status, marital status, employment status) and their child's (age, education level, gender) characteristics related to children with ASD.

2.4.2 Behavioral inflexibility scale (BIS). Lecavalier *et al.* (2020) is a 38-item, six-point Likert scale that measures a single subscale. The items are rated on a six-point rating scale ranging from "No problem at all" 0 to "Very serious or Extreme problem" [5]. The Cronbach's alpha for the BIS scale is 0.97.

2.5 Translation and cultural adaptation of instrument

The translation into Turkish and the cultural adaptation process were carried out on the basis of the guide developed by The Professional Society for Health Economics and Outcomes Research (Wild *et al.*, 2005). Practices performed at each stage in the guide are as follows.

Preparation: The scale was examined by the research team and its suitability to Turkish culture was evaluated, and the necessary permission was obtained from the author for Turkish adaptation.

Forward translation: The translation of the scale from English to Turkish was performed. Three expert translators who were fluent in both languages carried out the translation process independently.

Reconciliation: The original version of the scale and the Turkish translations were examined by the research team who were fluent in both languages. After the examination, a consensus was reached in a single Turkish translation form.

Back-translation: The Turkish translation agreed upon by the research team was translated back into English. The back-translation was carried out independently by three experts who were fluent in both languages and did not know the original scale.

Back-translation review: The research team compared the English translations of the scale and reached to a consensus on a single back-translation.

Harmonization: By comparing the agreed upon back translation with the original version of the scale, it was determined that the items maintained semantic integrity. The Turkish *BIS* was accepted as the Turkish version of the scale, which was back-translated.

Cognitive debriefing: At this stage, the content validity of the scale was examined in accordance with expert opinions, and the comprehensibility of the items was evaluated by the research population with a pilot study.

To assess the content validity of the BIS – Turkish version (BIS-T), opinions were obtained from 11 different experts. All experts had a doctorate degree, spoke Turkish (mother tongue) and English fluently and had knowledge and experience in scale development and cultural adaptation. To assess the content validity of the scale items and the overall scale, the item–content validity index (I-CVI) and scale–content validity index–mean (S-CVI/Ave) were calculated (Polit and Beck, 2017). The experts used a four-point Likert-type scale to assess the scale items (1 = Not relevant, 2 = Somewhat relevant, 3 = Relevant and 4 = Very relevant). The lower limit for I-CVI was determined as 0.78 and for S-CVI/Ave as 0.90 by Polit and Beck (2017). As a result of the analysis, the I-CVI value of all items was calculated as higher than 0.564 and the S-CVI/Ave value was calculated as 0.822. The items forming the scale explained 52% of the variance. The comprehensibility of the BIS-T was evaluated with a pilot study conducted with the target audience of the scale. During the pilot study, the researcher was present while the participants completed the questionnaire

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and noted the participants' opinions about the items. The participants who participated in the pilot study were not included in the research sample.

2.6 Data analysis

SPSS 22.0 program was used for statistical analysis in the study. The socio-demographic characteristics of the participants were summarized with descriptive analyses (number, percentage, mean, standard deviation). The reliability of the scale was evaluated by calculating Cronbach's α coefficient, split-half reliability, item total score correlation (Pearson) and composite values for each subscale. As the skewness/kurtosis values of the data belonging to the numerical variables were between (± 2), it was accepted that the data were normally distributed. Pearson correlation test was used to evaluate the relationship between the numerical variables. Explanatory factor analysis (EFA) was used to determine the structural validity. Cronbach's alpha coefficient was calculated for the scale sub-dimensions and the reliability of the whole. Principal component analysis method and quartimax rotation method were used in EFA. The significance level was taken as $p < 0.05$ with statistical analyses. The original single-factor structure of the scale was confirmed with confirmatory factor analysis (CFA). Parameter estimates in CFA were made using the maximum likelihood estimation method. Under CFA, chi-square statistical (CMIN/DF) divided by the degree of freedom, root mean square error of approximation (RMSEA), comparative fit index (CFI), normed fit index (NFI) and Tucker–Lewis index (TLI) fit indices were followed (Hair *et al.*, 2019; Tabachnick and Fidell, 2019).

2.7 Ethical considerations

To evaluate the suitability of the "Behavioral Inflexibility Scale (BIS)" scale developed by Lecavalier *et al.* (2020) for Turkish culture and to conduct a validity and reliability study on parents of children with ASD, a communication was made via e-mail and written permission was obtained. The research was conducted in accordance with the principles of the Declaration of Helsinki, and approval was received from the Tokat Gaziosmanpaşa University Social and Human Sciences Research Ethics Committee before starting the research (dated 10.02.2021 and numbered E-33490967-044-11525). The participants were informed about the purpose of the research, and the purpose for which the results obtained would be used, and their consent was obtained.

3. Results

3.1 Sample

In this study, a total of 254 parents of children with mild, moderate and severe special education needs who received special education in private education and rehabilitation institutions and schools affiliated with the Tokat Provincial Directorate of National Education were included. 24.8% ($n = 63$) of the children in the sample were girls, and the mean age was 11.17 ± 4.50. In total, 35.4% of the mothers had completed primary school education, 32.3% of the fathers had completed primary school education, 84.3% of the mothers were not working and 57.5% of the fathers were working in the private sector. The parents reported that their children were diagnosed with autism at an average age of 3.79 ± 1.88 and started special education at an average age of 3.89 ± 1.90 (Table 1).

3.2 Item analysis

Before conducting the EFA, the item-total correlation and Cronbach's alpha coefficient were examined for all items comprising the scale. The internal consistency of the scale was evaluated using the Cronbach's alpha coefficient based on the results obtained from the factor analysis. The Cronbach's alpha coefficient for the 35 items comprising the scale was

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Table 1 General characteristics of participants ($n = 254$)

	n	*%*
Child's gender		
Female	63	24,8
Male	191	*75,2*
Severity of the disease		
Mild	49	19,3
Moderate	108	*42,5*
Severe	97	38,2
Mother's education		
Illiterate	14	5,5
Only literate	17	6,7
Primary-school graduate	90	*35,4*
Secondary-school graduate	41	16,1
High-school graduate	58	22,8
University graduate	34	13,4
Father's education		
Illiterate	5	2,0
Only literate	9	3,5
Primary-school graduate	82	*32,3*
Secondary-school graduate	35	13,8
High-school graduate	72	28,3
University graduate	51	20,1
Mother occupation		
Unemployed	214	*84,3*
Private sector	25	9,8
Public sector	15	5,9
Father's occupation		
Unemployed	146	*57,5*
Private sector	34	13,4
Public sector	74	29,1
Family income level		
Income less than expenses	88	34,6
Income equal to expenses	159	*62,6*
Income higher than expenses	7	2,8
Family structure		
Nuclear	209	*82,3*
Extended family	32	12,6
Broken family	13	5,1
Region where family lives		
City center	148	*58,3*
District	90	35,4
Town/village	16	6,3
Number of children		
1	40	15,7
2	113	*44,5*
3	73	28,7
4 and above	28	11,0
Age of child (mean ± SD)	11,17	4,50
Age at diagnosis	3,79	1,88
Age at special education	3,89	1,90
Age at mother	38,18	5,89
Age at father	43,98	24,80

Source: Authors' own work

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found to be 0.97, indicating high internal consistency. The item-total correlation coefficients for the scale ranged from 0.544–0.807 (Table 2).

3.3 Construct validity

In the study, CFA was conducted to verify the original single-factor structure of BIS. As a result of CFA, the standardization coefficient values of the items were calculated between 0.56 and 0.82. As a result of the analysis, the fit indices were calculated as Cmin/DF = 3.379, RMSEA = 0.074, GFI = 0.80, NFI = 0.84, TLI = 0.87, CFI = 0.88.

3.4 Criterion validity

In the EFA, the adequacy of the sample was assessed with the Kaiser–Meyer–Olkin (KMO) test, and the suitability of the data for factor analysis was assessed with the Bartlett sphericity (BK) test. In the first factor analysis conducted for the Behavioral Flexibility Scale (BIS), the KMO value was 0.988. This analysis showed that the sample size was sufficient. In the BK test results, it was determined that the scales were suitable for factor analysis ($X^2 = 7{,}296.05$; df = 705; $p < 0.001$). In this factor analysis, it was determined that the eighth item formed a component on its own with a factor loading of 0.587. Therefore, the relevant item was removed and the analysis was repeated. In the new analysis, it was observed that both the third item and the seventh item were included in the first and second factors with close loadings (factor loading difference less than 0.100). Therefore, the relevant items were removed, and the analysis was repeated. In these analyses, both items were removed in order, and the analysis was repeated. In the factor analysis performed after the removal of the third, seventh and eighth items, the KMO value was determined as 0.988. According to the BK test results, the scales were again found to be suitable for factor analysis ($X^2 = 6{,}727.65$; df = 595; $p < 0.001$). As a result of the EFA, it was found that the items forming the scale were gathered under a single factor and the factor loadings varied between 0.564 and 0.822. The items forming the scale explained 52% of the variance (Table 3). In scales consisting of a single dimension, it is reported that the variance is above 40% as sufficient.

Table 2 Correlation coefficients obtained from the internal consistency analysis of Behavioral Flexibility Scale

Item no.	*Item-total score correlation coefficient*	*Cronbach's alpha value after item deletion*	*Item no.*	*Item-total score correlation coefficient*	*Cronbach's alpha value after item deletion*
23	0.807	0.971	9	0.704	0.971
20	0.801	0.971	38	0.702	0.971
25	0.797	0.971	27	0.678	0.971
36	0.789	0.971	14	0.681	0.971
33	0.775	0.971	21	0.674	0.972
26	0.770	0.971	28	0.663	0.972
31	0.762	0.971	16	0.663	0.972
30	0.763	0.971	17	0.657	0.972
34	0.762	0.971	1	0.654	0.972
32	0.754	0.971	15	0.642	0.972
24	0.754	0.971	11	0.630	0.972
22	0.756	0.971	4	0.623	0.972
37	0.744	0.971	29	0.586	0.972
6	0.727	0.971	10	0.590	0.972
2	0.724	0.971	12	0.565	0.972
18	0.716	0.971	5	0.559	0.972
35	0.711	0.971	13	0.544	0.972
19	0.709	0.971			

Note: Cronbach's alpha (α)
Source: Authors' own work

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Table 3 Behavioral Flexibility Scale exploratory factor analysis

No.	Item	Mean ± sd	Factor loadings
23	My child has trouble tolerating changes in the daily routine	2.58 ± 1.45	0.822
20	My child needs things to remain the same	2.16 ± 1.60	0.817
25	My family avoids trying new things because my child tends to react negatively	2.29 ± 1.58	0.813
36	My child insists that the order of events or activities stay the same	2.31 ± 1.58	0.807
33	My child prefers to stick with one topic or activity even when it is clear that others are not interested	2.25 ± 1.53	0.795
26	My child is bothered by changes in plans	2.32 ± 1.52	0.789
31	My child has rigid or routine ways that he engages in play or leisure activities	2.14 ± 1.59	0.782
30	My child wants to complete specific routines or rituals	2.57 ± 1.55	0.782
34	My family has to maintain a consistent routine because that is what my child requires	2.44 ± 1.54	0.781
32	My child gets upset by changes that seem minor to others	2.22 ± 1.60	0.775
24	My child has to keep things in the same place	2.26 ± 1.69	0.773
22	My child prefers to do things the same way even if we show him an easier way to do something	2.69 ± 1.43	0.772
37	My child dislikes when things are unpredictable	2.29 ± 1.50	0.765
6	My child dislikes changes to his surroundings	2.40 ± 1.54	0.745
2	My child takes a long time to get comfortable in new situations	2.70 ± 1.32	0.742
18	My family needs extra time to get things done because my child must do things in a specific order	2.44 ± 1.64	0.735
35	My child seems to have a very particular way of doing most things	2.16 ± 1.49	0.733
19	My child insists that certain items or objects are available to him	2.61 ± 1.52	0.729
9	My child can be hard to redirect from things he is doing	2.67 ± 1.34	0.723
38	My child has trouble tolerating new experiences	2.61 ± 1.47	0.721
27	My child has trouble leaving play or leisure activities before he is able to finish them	2.33 ± 1.56	0.699
14	My family changes the way we do things to avoid disrupting my child's routine	2.46 ± 1.41	0.699
21	My child is reluctant to try new things	2.55 ± 1.58	0.695
28	My child insists that other people play in a certain way	1.96 ± 1.57	0.686
16	My child insists we use specific routes when we go places	2.11 ± 1.74	0.686
17	My child becomes upset if you interrupt what he is doing	2.40 ± 1.44	0.678
1	My child resists having to change the way he usually does things	2.70 ± 1.34	0.674
15	My child reacts negatively when unexpected things happen	2.91 ± 1.37	0.662
11	My child dislikes changes in the appearance of others who are around him	1.78 ± 1.59	0.650
4	My family must instruct others how to interact with my child because he is so rigid	2.68 ± 1.34	0.643
29	My child insists on wearing certain items of clothing	1.88 ± 1.67	0.613
10	My family limits community outings because my child is rigid	2.34 ± 1.53	0.610
12	My child is "rule-driven" or "rule-bound"	2.51 ± 1.49	0.587
5	My child insists on eating certain foods at mealtimes	2.51 ± 1.64	0.580
13	My child has difficulty interacting with peers because he insists that the interaction go a certain way	3.09 ± 1.44	0.564
Eigenvalue		18.218	
Variance explanation rates %		52.052	
Items removed from the scale			
8	My child has difficulty transitioning between activities*		
3	My child gets suck on particular activities or topics**		
7	My child has trouble coming up with new ways of doing things even when the situation calls for it***		

Source: Authors' own work

3.5 Reliability analysis

Within the scope of reliability assessments, Cronbach's α coefficient of BIS-T was calculated as 0.97. Total item correlation coefficients of the scale were calculated between 0.544 and 0.807. To determine the reliability of the scale, BIS-T test–retest reliability and Cronbach's alpha internal consistency coefficients were examined. As a result of the test–retest application of the scale with 84 parents after 15 days, the Pearson correlation coefficient was found to be $r = 0.775$, $p < 0.001$. It was observed that there was a highly significant positive relationship between both CDEQ scores (Table 4).

4. Discussion

In this study, the validity and reliability of the Behavioral Flexibility Scale in children in Turkish society was examined with data obtained from parents of children diagnosed with ASD between the ages of 6–18. It is thought that the fact that BIS only assesses behavioral flexibility will contribute to a more selective interpretation of the effect of interventions

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Table 4 Correlation coefficients related to the test–retest reliability of the Behavioral Flexibility Scale

	Mean	*SS*	r	p
The total score of the BIS in the initial administration	60.94	43.14	0.775	<0.001
Recurring BIS total score	64.11	40.67		

Source: Authors' own work

applied to children with ASD on the behavioral flexibility dimension. There has not been a specific scale developed for use in the follow-up of ASD in our country for years. Instead, the Behavioral Flexibility Scale (BIS) has been widely used in children with ASD to examine symptoms and evaluate improvement in response to different interventions (Bölte *et al.*, 2019). Although the BIS scale shows general stability over time, it was primarily designed as a diagnostic tool. However, it is suggested that it is not sensitive enough for the severity of specific symptoms and longitudinal assessments (Fuentes *et al.*, 2012). The ASD Treatment/Therapy Evaluation Form (ODER) form, which has a Turkish version, is widely used in many countries in the evaluation of various interventions in children with ASD. However, although ODER provides a comprehensive screening with its speech/language/communication, social, perception and health/physical/behavior sub-dimensions (Brentani *et al.*, 2013), its validity and reliability study has not yet been conducted in our country. However, it cannot assess behavioral flexibility in as much detail as BIS. Therefore, it is anticipated that the Turkish version of the BIS scale will contribute to the monitoring and clinical evaluation of the effectiveness of interventions aimed at behavioral flexibility in children with ASD in our country.

4.1 Validity of Behavioral Inflexibility Scale – Turkish version

4.1.1 Content validity. The adaptation of BIS to Turkish culture was carried out in accordance with internationally accepted standards developed by ISPOR (Wild *et al.*, 2005). The I-CVI and S-CVI/Ave values calculated using expert evaluations regarding the translation of BIS into Turkish were found to be high (Polit *et al.*, 2007). In addition, in the pilot study, participants did not indicate any serious problems with the comprehensibility of the scale items. These results support that the translation process was successful, and that BIS-T has sufficient content validity.

4.1.2 Construct validity. The single-factor structure of the original form of BIS was confirmed in the Turkish adaptation. In the CFA, the factor loading values of all items were calculated above 0.56 (Hair *et al.*, 2019). The scale developers calculated the CMIN/DF, RMSEA, CFI, NFI, TLI fit index values of the original form within acceptable limits. Similar to the original scale, in the current study, while the CMIN/DF and RMSEA values were calculated within acceptable limits, only the CFI value was found to be lower (0.88). However, the 0.97 calculated in the original scale was acceptable (Brown, 2015; DeVellis, 2017; Kim and Shin, 2022).

4.1.3 Criterion validity. İn the study, it was determined that the general BIS-T score of the groups with high perceived academic success levels was also statistically significantly higher within the scope of criterion validity.

4.2 Reliability of Behavioral Inflexibility Scale – Turkish version

Cronbach's α coefficient of BIS-T was calculated as 0.90, and Cronbach's α coefficients of all subscales were calculated as higher than 0.70. In addition, the corrected item-total correlation values of all items were found to be higher than 0.50 (Field, 2018; Tabachnick and Fidell, 2019). Similar to this study, the Cronbach α value of the original scale was determined to be 0.97, and the values of the subscales were higher than 0.80; the item-total

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correlation coefficients showed a normal distribution ($r = 0.92$). These results support the high internal consistency of the BIS-T.

5. Limitations

In this study, there are some limitations that need to be acknowledged. First, the sample that the study is based on was collected from parents from a single city in our country, and therefore, in future studies, it is recommended to use a stratified sampling method to include participants from all regions of the country. Another limitation is that the behavioral flexibility of children and adolescents with ASD was assessed only based on the information provided by their parents. This leads to a one-sided evaluation of the results. Therefore, in future studies, it is recommended to include various sources such as special education teachers and attending physicians to assess the behavioral flexibility of children and adolescents with ASD. ASD is often comorbid with other psychiatric disorders that affect behavioral flexibility, such as ADHD, intellectual disability and OCD. In this study, comorbidities were not clinically evaluated, and this limitation should be taken into consideration in a clinical sample where psychiatric disorders are diagnosed through structured or semi-structured diagnostic interviews.

6. Conclusion

This study presents a valid and reliable Turkish version of the BIS. The results of the exploratory factor analysis confirm the one-dimensionality of the scale. These findings support the results of Lecavalier *et al.* (2020) indicating the one-dimensionality of the BIS (1). The Turkish version of the BIS is suitable for clinical and research purposes in children and adolescents aged 6–18 years with ASD. However, further research with larger and more diverse samples is needed to confirm the scale's capacity. The simplicity and practicality of the BIS make it a useful tool both in academic literature and in clinical practice. Nonetheless, longitudinal studies are needed to assess the relationship of the BIS with other tools currently used to evaluate the treatment process in children and adolescents with ASD in our country and to assess the effectiveness of behavioral flexibility interventions.

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Appendix

ASD Behavioral Inflexibility Scale (BIS)

Today's Date: __ __ /__ __ / __ __ __ __ Child's Initials: __ __ __ Your Initials: __ __ __ Child's Gender: Female

Male Child's Date of Birth: __ __ / __ __ / __ __ __ __ Relationship to the Child:

• Instructions:

• The items on this scale refer to your child's behaviors. Some of the items describe things your child may do. Other items describe things that you or members of your family may do because of your child's behavior. • Please read each item and then choose the score that best describes how much of a problem the behavior is for you

• Make your ratings based on observations and interactions with your child OVER THE LAST MONTH.

• Be sure to read and score all 38 items listed. Use the definitions in the box below to score each item.

0 = Not at all a problem 1 = Very mild problem 2 = Mild problem 3 = Moderate problem 4 = Severe problem 5 = Very severe or extreme problem

No.	Öğe	Scale					
1	My child resists having to change the way he usually does things	0	1	2	3	4	5
2	My child takes a long time to get comfortable in new situations	0	1	2	3	4	5
3	My family must instruct others how to interact with my child because he is so rigid	0	1	2	3	4	5
4	My child insists on eating certain foods at mealtimes	0	1	2	3	4	5
5	My child dislikes changes to his surroundings	0	1	2	3	4	5
6	My child can be hard to redirect from things he is doing	0	1	2	3	4	5
7	My family limits community outings because my child is rigid	0	1	2	3	4	5
8	My child dislikes changes in the appearance of others who are around him	0	1	2	3	4	5
9	My child is "rule-driven" or "rule-bound"	0	1	2	3	4	5
10	My child has difficulty interacting with peers because he insists that the interaction go a certain way	0	1	2	3	4	5
11	My family changes the way we do things to avoid disrupting my child's routine	0	1	2	3	4	5
12	My child reacts negatively when unexpected things happen	0	1	2	3	4	5
13	My child insists we use specific routes when we go places						
14	My child becomes upset if you interrupt what he is doing	0	1	2	3	4	5
15	My family needs extra time to get things done because my child must do things in a specific order	0	1	2	3	4	5
16	My child insists that certain items or objects are available to him	0	1	2	3	4	5
17	My child needs things to remain the same	0	1	2	3	4	5
18	My child is reluctant to try new things	0	1	2	3	4	5
19	My child prefers to do things the same way even if we show him an easier way to do something	0	1	2	3	4	5
20	My child has trouble tolerating changes in the daily routine	0	1	2	3	4	5

(*continued*)

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21	My child has to keep things in the same place	0	1	2	3	4	5
22	My family avoids trying new things because my child tends to react negatively	0	1	2	3	4	5
23	My child is bothered by changes in plans	0	1	2	3	4	5
24	My child has trouble leaving play or leisure activities before he is able to finish them	0	1	2	3	4	5
25	My child insists that other people play in a certain way	0	1	2	3	4	5
26	My child insists on wearing certain items of clothing	0	1	2	3	4	5
27	My child wants to complete specific routines or rituals	0	1	2	3	4	5
28	My child has rigid or routine ways that he engages in play or leisure activities	0	1	2	3	4	5
29	My child gets upset by changes that seem minor to others	0	1	2	3	4	5
30	My child prefers to stick with one topic or activity even when it is clear that others are not interested	0	1	2	3	4	5
31	My family has to maintain a consistent routine because that is what my child requires	0	1	2	3	4	5
32	My child seems to have a very particular way of doing most things	0	1	2	3	4	5
33	My child insists that the order of events or activities stay the same	0	1	2	3	4	5
34	My child dislikes when things are unpredictable	0	1	2	3	4	5
35	My child has trouble tolerating new experiences	0	1	2	3	4	5

Source: Author's own work

Corresponding author

Birgül Vural can be contacted at: birgul.vural@gop.edu.tr

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