

Turkish Adaptation and Validation of Behavioral Inhibition Questionnaire Parent Form

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ABSTRACT

Background: Behavioral inhibition has been proposed as a temperamental risk factor for the development of childhood anxiety disorders universally; however, there is no validated instrument for, especially, its evaluation in Turkish children. This study aimed to examine reliability and validity of the Turkish version of Behavioral Inhibition Questionnaire parent form for children aged 3-7 years.

Methods: Around 250 mothers or fathers of 3-7 years old children were recruited from non-clinical population to collect responses to the questionnaires. The sample was created by reaching 3 schools at preschool or elementary grade for the purpose of providing the questionnaires filled about the student and/or his/her little sisters and brothers by their parents; questionnaires were sent out to parents and then gathered. Parents were asked to fill sociodemographic data form, Behavioral Inhibition Questionnaire parent form, Children Behavior Questionnaire, and Strengths and Difficulties Questionnaire parent form in order to perform convergent and divergent validity analyses.

Results: As a result of reliability analysis, total Cronbach alpha coefficient for Behavioral Inhibition Questionnaire was determined as 0.92 with strong reliability. The internal consistency coefficients for Behavioral Inhibition Questionnaire subscales also showed strong reliability with alphas ranging between 0.81 and 0.87 except for the performance ($\alpha=0.69$) and physical challenges ($\alpha=0.19$) subscales of which some items were excluded due to item-total correlations and confirmatory factor analysis results. In the validity assessment analyses, confirmatory factor analysis demonstrated that Behavioral Inhibition Questionnaire has a construct validity with 5 factors loaded on the 2-second order main factors and one third-order final factor (root mean square error=0.032, root mean square residual=0.153, Comparative Fit Index=0.978, Goodness of Fit Index=0.915, and Tucker-Lewis Index=0.970). While the strongest correlations with the overall Behavioral Inhibition Questionnaire score were found for 2 main subscales, inhibition to social novelties ($r=0.926$, $P < .001$) and situational novelties ($r=0.928$, $P < .001$), similarly peers ($r=0.848$, $P < .001$) and new situations ($r=0.898$, $P < .001$) subscales, had strong correlations with the overall Behavioral Inhibition Questionnaire score. The weakest correlation with overall Behavioral Inhibition Questionnaire score was observed for physical challenges subscale even though this subscale displayed moderate association ($r = 0.454$, $P < .001$). A good convergent validity was determined accompanied by significant moderate positive correlations with Children Behavior Questionnaire shyness and Strengths and Difficulties Questionnaire internalizing scales. An adequate divergent validity was also demonstrated based on significant positive mild to moderate correlations with Children Behavior Questionnaire impulsivity, Children Behavior Questionnaire smiling/laugh, Strengths and Difficulties Questionnaire prosocial scales, and non-significant correlation with Strengths and Difficulties Questionnaire externalizing scale.

Conclusion: The study demonstrated that the Turkish version of the Behavioral Inhibition Questionnaire parent form is an effective tool with good reliability and validity among 3-7 years old children.

ARTICLE HISTORY

Received: March 31, 2022

Accepted: September 26, 2022

Publication date:

December 30, 2022

INTRODUCTION

Temperament is a set of behavioral tendencies that can be observed from early infancy, largely genetically determined, that affect how an individual interacts with, approaches, and reacts to others.¹ Behavioral inhibition

(BI) is accepted as a basic temperamental trait and is defined as a tendency to show hyperarousal, cowardice, and shyness in the face of unfamiliar or new people, objects, environments, and situations.² Behavioral

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Cite this article as: Kılınc S, Bilgiç A, Görmez V. Turkish adaptation and validation of behavioral inhibition questionnaire parent form. *Psychiatry Clin Psychopharmacol.* 2022;32(4):320-330.



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inhibition as a highly inhibited category can be observed in approximately 10%-15% of childhood.³ It has been shown that BI is one of the strongest risk factors for the development of anxiety disorders, especially social anxiety disorder, and it has been found that the risk of developing any anxiety disorder is 4 times higher in individuals with BI than in those without.^{4,5} On the other hand, the fact that approximately half of the children with BI do not develop an anxiety disorder suggests that this risk may be regulated by various external and internal factors such as parental attitudes and information processing functions of the child.⁶ Therefore, it has been thought that determining the presence of BI in early childhood and applying early interventions are important in terms of preventive mental health.⁷

Behavioral inhibition has classically been evaluated by laboratory procedures. In these procedures, behavioral characteristics such as speaking, smiling, looking, and reaction time were examined by exposing the child to various social (foreign adult or peer) and non-social (black box, robot, new computer game) stimuli. However, these observational methods are very expensive and time-consuming. Furthermore, none of these methods has been accepted as the gold standard and observation protocols vary widely between laboratories.⁸ Assessments based on the use of scales, on the other hand, can be more advantageous because it is easy and inexpensive to implement, allows the use of the same method, the use for population screening, and gives information about the natural state of the child in real life, which extends over a longer period of time, instead of limited observation in the laboratory environment.⁹

Few scales have been developed to assess BI, and the 2 most commonly used scales are the Behavioral Inhibition Scale (BIS) and the Behavioral Inhibition Questionnaire (BIQ).^{10,11} The BIS does not evaluate inhibited behaviors in non-social situations, so it cannot measure BI in all its aspects. On the other hand, BIQ provides a more comprehensive coverage of children's inhibited behavior assessment in a greater range of contexts than the BIS because BIQ can evaluate

the child's BI level not only in the social domains but also in domains outside the social domains.

The original version of the scale, which was developed for preschool children, has 2 forms: parent and teacher forms. The BIQ parent form was originally developed and tested by Bishop and her colleagues in an Australian sample of 3- to 5-year-old children.¹¹ The total Cronbach's alpha value of the scale was 0.95 and the Cronbach's alpha values in the subscales, except for the inhibition to physical challenges subscale ($\alpha=0.72$), were above 0.80, showing a good level of internal consistency. After the first study, in a study conducted in the Netherlands in the age group of 3-15, the total Cronbach alpha coefficient of the scale was found to be 0.96 and it was shown to be valid and reliable with Cronbach alpha values varying between 0.67 and 0.96 according to age groups and subscales.¹² In another study conducted on preschool children in the United States, all other subscales and total Cronbach alpha values of the BIQ parent form, except physical challenges ($\alpha=0.74$), were found to be above 0.80.¹³ In a recent study, Mernick and his colleagues reported that the BIQ was adequately valid and reliable, with Cronbach alpha coefficients over 0.80 for all subscales, with a total Cronbach alpha coefficient of 0.94 for the Israeli population in the 4-15 age group.¹⁴

In the original BI scale development study, confirmatory factor analysis findings showed that the scale could measure BI over 30 items with 6 separate sub-factors (adults, peers, new situations, preschool/separation, performance, and physical challenges) and the combined total value of these factors strongly supported that it could represent and measure BI adequately.¹¹ Apart from this, it was found that 6 subscales combined in total over 3 main subscales as situational novelties, social novelties, and inhibition to activities involving physical challenge and other factor models in which all items were combined directly in total without a subscale were also acceptable. Subsequent studies, similar to the original study, reported that factorization from 6 subscales to the total was the best possible factor model, and a single model that combined over 3 main factors or directly distributed the items as a whole in the scale total was also acceptable.¹²⁻¹⁴

There has been no psychometric instrument in Turkish so far that specifically evaluates the BI as a temperamental trait. The aim of this study is to examine the validity and reliability of the BIQ parent form in a community sample of preschool-aged children in Turkey using a translation and cultural adaptation of the BIQ into Turkish.

MATERIAL AND METHODS

Participants

The study sample consisted of caregivers who completed the scales for their children attending the primary school

MAIN POINTS

- Substantial evidence indicate that there is a relationship between behavioral inhibition as a temperamental trait in early childhood and internalising psychopathologies later. This process can be prevented if the behavioral inhibition is identified appropriately in early childhood.
- There is a need for an assesment tool that examines behavioral inhibition in Turkish children because there are only assessment tools look into temperament as a main concept in general not as particularly in behavioral inhibition temperamental trait in Turkey.
- Turkish version of Behavioral Inhibition Questionnaire (BIQ) parent form is a reliable and valid measure for evaluating behavioral inhibition in children.

in the 2 different central districts of Konya, the first grade and the kindergartens affiliated with the same school, and if any of their younger siblings. The inclusion criteria were being between the ages of 3 and 7 for children and being at least primary school graduates for their parents. A total of 300 caregivers who met the inclusion criteria and agreed to participate in the study formed the sample of study. A total of 50 participants were excluded from the study because they had more than 10% missing information in the questionnaires or seemed as if they had not completed reliably and the analyses were performed with 250 participants. Regarding factor analysis basis of sample size estimation, recommendations to ensure the sample size ranges from 100 (poor), 200 (fair) and 300 (good) for a factor structure to be measurable in scale adaptation studies as soon as sample size recommendations range from 2 to 20 subjects per item with an absolute minimum of 100-250 subjects.^{15,16}

Procedure

In order to reach the mothers and fathers who volunteered to participate in the study to fill in the scales about the children between the ages of 3 and 7, 3 schools were visited at the primary school level (with the permission of the Ministry of National Education), and the scales were delivered to the parents to be filled in for the student himself/herself or his/her siblings. Parents who signed the informed consent form to participate in the study filled out the scales for their children or younger siblings who were attending school and sent them back to the school. Thereafter, the completed sociodemographic data forms and scales were received from the school principals. Parents filled out the sociodemographic data form, the Child Behavior List short form, and the Strengths and Difficulties Questionnaire parent form, except for the BIQ whose validity-reliability will be made.

Data Collection Tools

Sociodemographic data form: Sociodemographic characteristics such as the child's age, gender, total number of children in the family, family type, education level of the parents, age, and clinical features of the child's medical or psychiatric disease were determined by the sociodemographic data form developed by the researchers.

Behavioral Inhibition Questionnaire Parent Form (BIQ): BIQ was originally developed to evaluate BI in 3- to 5-year-old children based on parental reporting.¹¹ The questionnaire, with also its teacher form which was created by removing 2 items questioning the behavior in foreign houses, was used both in studies evaluating its psychometric properties and in recent studies on BI, and positive results were obtained.^{12,14,17} It is a screening questionnaire consisting of 30 questions. These questions are grouped under 3 main domains: social novelty, situational novelty, and novel

physical activities suggestive of minor risk. Social novelty main scale consists of 14 questions evaluated within the scope of 3 sub-factors: unfamiliar adults (4 questions), peers (6 questions), and performing in front of others (4 questions). Situational novelty main scale consists of 12 questions divided into 2 sub-factors: preschool/separation (4 questions) and unfamiliar situations (8 questions). The main scale of novel physical activities suggestive of minor risk is determined with 4 questions and does not include any sub-factors. The questionnaire is a 7-point Likert-type scale that grades from 1 (never) to 7 (always). Since 16 items are reverse scored, after correcting the scores of these items, the scores of 6 subscales and 3 main scales can be calculated separately by looking at the total BIQ score or the total score of the related items. Total BIQ score ranges from 30 to 210. The total Cronbach's alpha coefficient of the scale was found to be 0.95.¹¹

Children's Behavior Questionnaire (CBQ): The long form of the CBQ, developed by Rothbart and her colleagues (1994), is a 7-point Likert-type scale based on parental reporting, consisting of 195 items, graded from 1 (completely false) to 7 (completely correct).¹⁸ Its short form consists of 94 questions. Child Behavior Questionnaire evaluates 15 temperament characteristics including activity level, anger/frustration, approach/positive anticipation, attention control, discomfort, falling reactivity/soothability, fear, high-intensity pleasure, impulsivity, inhibitory control, low-intensity pleasure, perceptual sensitivity, sadness, smiling and laughter, and shyness. The Turkish validity and reliability of the CBQ short form was performed by Akın-Sarı, İşeri, and their colleagues in 2012. The reliability of the test was found to be 0.78.¹⁹

Strengths and Difficulties Questionnaire (SDQ): There are 2 versions of the parent form, 1 for children aged 2-4 years and 1 for children aged 4-17 years. The version used for children aged 4-17 years was used for 3-4 years old children in the current study because Turkish form of this version could not be obtained. Strengths and Difficulties Questionnaire parent form is a 25-item emotional and behavioral screening questionnaire that assesses parents' perceptions of prosocial and challenging behaviors in their 3- to 16-year-old children.²⁰ It has a 3e-Likert-type rating. Questions are collected in 5 subgroups consisting of emotional problems, behavioral problems, hyper activity-attention-deficit problems, peer problems, and prosocial behaviors. The calculation made by excluding the positive social behaviors subscale, which constitutes the "strengths" part of the questionnaire, reflects the total difficulties score and varies between 0 and 40. The Turkish validity and reliability of the scale was performed by Güvenir and his colleagues.²¹ It has been shown to have an acceptable internal consistency (Cronbach's alpha coefficient 0.73). Turkish adaptation of the scale 2-4 years form was constructed by Dursun and his colleagues.²² In the study, an acceptable internal consistency has been

found (Cronbach's alpha coefficient for total difficulties scale 0.80).

Procedure of Translation

The developer of the questionnaire, Susan Hilary Spence, was contacted and the necessary permissions were obtained from her for the translation into Turkish and its validity and reliability. The original form of the questionnaire was translated into Turkish by one of the authors. The clarity of the created form and its suitability for our language were evaluated by an expert in Turkish language and literature and necessary corrections were made. The Turkish questionnaire was translated back into English by the researcher, a child psychiatrist who was fluent in English and did not know the original items of the questionnaire. Then, possible differences between the original English version of the questionnaire and the English version translated from Turkish were evaluated by other researcher, who had medical education in English and worked in England for a very long time, and feedback was received from him. After the researchers decided that the questionnaire was similar and understandable to the original form, it was made ready for preliminary evaluation by consensus. The prepared form was first given to 10 mothers with children aged 3-7 years who applied to the polyclinic to examine what they understood for each question. Since there were no questions that were deemed to be incomprehensible, the questionnaire was then given its final form and made ready for research.

Ethical Committee Approval

Prior to the implementation of the research, approval was obtained by the Ethics Committee of Necmettin Erbakan University, Meram Faculty of Medicine, Non-Pharmaceutical and Medical Device Researches, with the decision dated March 1, 2019 and numbered 2019/1743.

Statistical Analysis

The data obtained from the study were analyzed using the Statistical Package for the Social Sciences 24-AMOS (Analysis of Moment Structures) package program (IBM SPSS Corp., Armonk, NY, USA). Data are presented as frequencies with percentages, mean \pm standard deviation, and median (min-max values). All variables were evaluated with the Kolmogorov-Smirnov and Shapiro-Wilk test to determine whether their distributions were normal. The analysis of the variables conforming to the normal distribution was done with the independent samples *t* test, and the analysis of the variables not conforming to the normal distribution was done with the Mann-Whitney *U* test. For the reliability of the scale, Cronbach's alpha coefficients were used by performing internal consistency analysis. The factor structure of the scale was examined by confirmatory factor analysis to investigate its compatibility with the 6 related factor models in its original form. Various indices were

examined to evaluate the goodness-of-fit of this model: Chi-square analysis (χ^2), the root mean square error (RMSEA), the Comparative Fit Index (CFI), the degrees of freedom (df), the Satorra Bentler Fit Index (χ^2/df), the Tucker-Lewis Index (TLI), the Goodness of Fit Index (GFI), the root mean square residual (RMR), and the Normalized Fit Index (NFI). Correlation analyses were performed to assess convergent and discriminant validity. In correlation analysis, Pearson correlation coefficient was used for parametric data and Spearman correlation coefficient was used for non-parametric data. In the analyses, the significance value was accepted as $P < .05$ at the 95% CI.

RESULTS

Socio-Demographic Characteristics

The age range of 250 children included in the study was 3-7 and the mean age was 5.53 ± 1.18 . 52.8% of the children ($n=132$) were boys and 47.2% were girls ($n=118$). 75.6% of the questionnaires were filled by mothers ($n=189$), 21.6% by fathers ($n=54$), and 2.8% by other caregivers ($n=7$). The number of children of 52% of the participating families was 2 ($n=130$), according to order of frequency, remaining families' number of children was 1 (23.2%, $n=58$), 3 (16.4%, $n=41$), 4 (7.2%, $n=18$), and 5 (1.2%, $n=3$). The mean age of the mothers was 33.96 ± 4.91 and the mean age of the fathers was 37.27 ± 5.21 . It was determined that most of the parents who filled out the questionnaire were university (41.6%, $n=208$) and high school (21.2%, $n=106$) graduates. On the other hand, a minor part of the parents was primary school (17.6%, $n=88$), postgraduate (10%, $n=50$), and secondary school (9.6%, $n=48$) graduates. In family structure data, it is seen that 88% of families are nuclear families ($n=220$), 7.2% are extended families ($n=18$), and 4.8% are divorced ($n=12$). It was found that 90.4% ($n=226$) of the children did not have a history of any medical or psychiatric disease, and 9.6% ($n=24$) had at least 1 medical or psychiatric disease.

Gender, Answering Caregiver, and Age-Related Differences in Behavioral Inhibition Questionnaire Scores

Preschool/separation subscale scores were found to be statistically significantly higher in boys [16 (4-28)] compared to girls [13 (4-28)] ($z=-2.160$, $P=.031$). On the other hand, as marginally accepted due to *P* value, in the physically challenging activities subscale, the scores were found to be statistically significantly higher in girls as 12 (4-22) compared to boys as 10 (4-21) ($z=-1.957$, $P=.050$). No statistically significant difference was found in the comparison of BIQ total score and other subscale scores by gender (for new situations subscale and total *t* test and for all of the remaining subscales Mann-Whitney *U* test $P > .05$). No statistically significant difference was found in the comparison of all subscales and total score according to

Table 1. Medians (Min-Max Values) and Means ± Standard Deviations of the BIQ Scales by Gender

	Girls (n=118)	Boys (n=132)	t/z	P
	Medians (Min-Max)/Means ± SD	Medians (Min-Max)/Means ± SD		
BIQ adults	17 (4-28)	15 (4-28)	-1.252 ^a	.211
BIQ peers	20 (6-39)	19 (6-40)	-0.295 ^a	.768
BIQ performance	11 (4-25)	12 (4-25)	-1.913 ^a	.056
BIO preschool/separation	13 (4-28)	16 (4-28)	-2.160 ^a	.031
BIQ new situations	25.83 ± 9.17	25.34 ± 8.91	0.610 ^b	.421
BIQ physical challenges	12 (4-22)	10 (4-21)	-1.957 ^a	.050
BIQ social novelties	48 (14-86)	47 (14-85)	-0.118 ^a	.906
BIQ situational novelties	52 (16-93)	51 (16-88)	-0.405 ^a	.686
Total BIQ	84.88 ± 27.4	85.59 ± 25.48	0.494 ^b	.212

^a Mann-Whitney U test; ^bIndependent t test.
SD, standard deviation; BIQ, Behavioral Inhibition Questionnaire.

Table 2. Medians (Min-Max Values) and Means ± Standard Deviations of the BIQ Scales by Answering Caregiver

	Mother (n=189)	Father (n=54)	t/z	P
	Medians (Min-Max)/Means ± SD	Medians (Min-Max)/Means ± SD		
BIQ adults	13.49 ± 5.37	14.35 ± 5.39	-1.035 ^b	.669
BIQ peers	18 (6-40)	18 (6-40)	-1.118 ^a	.263
BIQ performance	12 (4-23)	12 (4-23)	-0.308 ^a	.758
BIO preschool/separation	14.5 (4-28)	14.5 (4-28)	-0.114 ^a	.909
BIQ new situations	25.35 ± 9.06	26.01 ± 9.25	-0.469 ^b	.858
BIQ physical challenges	11 (4-21)	11 (4-21)	-0.500 ^a	.617
BIQ social novelties	47 (14-82)	47 (14-82)	-0.014 ^a	.989
BIQ situational novelties	52.5 (17-93)	52.5 (17-93)	-0.114 ^a	.909
Total BIQ	85.02 ± 26.79	85.68 ± 26.31	-0.161 ^b	S.778

^aMann-Whitney U test; ^bIndependent t test.
SD, standard deviation; BIQ, Behavioral Inhibition Questionnaire.

the person who filled out it (mother or father) (for adults, new situations subscales and total t test and all of the remaining subscales Mann-Whitney U test $P > .05$). Gender and answering caregiver differences in BIQ scores analyses and findings are represented in Tables 1 and 2.

In Spearman correlation coefficient, BIQ adults subscale ($r = 0.275, P < .001$), unfamiliar situations subscale ($r=0.183, P=.004$), situational novelty main subscale ($r=0.135, P=.033$), social novelty main subscale ($r=0.140, P=.027$), and scale total scores ($r=0.153, P=.015$) revealed a statistically significant but weak positive correlation between age. No correlation was found between other subscales and age ($P > .05$). Age-related differences in BIQ scores analyses and findings are presented in Table 3.

Reliability

Internal consistency of the BIQ Turkish version was determined by examination of Cronbach’s alpha coefficients, item-total correlation values, and “alpha if item deleted” values. The Cronbach’s alpha value of the total BIQ was 0.92. Cronbach’s alpha coefficients for social novelty (0.87) and situational novelty (0.86), which were created as main subscales in the original form of the scale, were

found to be highly reliable like the total scale. In terms of the Cronbach’s alpha coefficients of the subscales except for performance and physical challenges subscales, a high degree of reliability was found also similar to the total reliability of the BIQ (adults 0.82, peers 0.81, preschool/separation 0.83, and unfamiliar situations 0.82).

Table 3. Correlations of BIQ Scales with Age

	Age	
	r	P
BIQ adults	0.275	<.001
BIQ peers	0.018	.782
BIQ performance	0.071	.263
BIQ preschool/separation	0.029	.647
BIQ new situations	0.183	.004**
BIQ physical challenges	0.097	.126
BIQ social novelties	0.140	.027**
BIQ situational novelties	0.135	.033**
Total BIQ	0.153	.015**

*r: Spearman correlation coefficient for age; **P < .05 (sig.).
BIQ, Behavioral Inhibition Questionnaire.

Table 4. Scale and Item-Level Internal Consistency Values for the Turkish BIQ

Subscale	α	Item Number and Abbreviation	Item-Total Correlation	α If Item Deleted	Factor Loading
Adults	0.82	3. Quiet around new (adult) guests.	0.63	0.78	0.57
		16. Talkative to adult strangers.	0.67	0.76	0.63
		26. Chatting to new (adult) visitors.	0.64	0.78	0.66
		30. Quiet with adult stranger.	0.64	0.77	0.57
Peers	0.81	2. Approaching group of unfamiliar children and play.	0.59	0.77	0.61
		7. Asking other children to play.	0.61	0.77	0.65
		12. Reluctant to approach group of unfamiliar children and join in.	0.58	0.77	0.53
		19. Friendly with children he/she just met.	0.53	0.78	0.63
		8. Shy when first meeting new children.	0.60	0.77	0.65
		20. Watching other children rather than join.	0.48	0.79	0.48
New situations	0.82	1. Hesitant in approaching new situations or activities.	0.46	0.81	0.56
		5. Settles quickly when visiting homes of unknown people.	0.55	0.80	0.67
		14. Independent.	0.49	0.81	0.50
		15. Comfortable in new situations.	0.62	0.79	0.62
		22. Clingy in homes of unknown people.	0.50	0.81	0.58
		23. Happily approaches new situations or activities.	0.57	0.80	0.62
		24. Outgoing.	0.67	0.78	0.68
		25. Nervous or uncomfortable in new situations.	0.51	0.81	0.57
Preschool/separation	0.82	9. Happily separates in new situations.	0.65	0.78	0.51
		11. Happily separates in new situations.	0.69	0.76	0.56
		18. Happily separates in new situations.	0.63	0.79	0.43
		27. Takes many days to adjust to new situations.	0.64	0.79	0.40
Performance	0.69	<i>6. Takes many days to adjust to new situations.</i>			0.23
		10. Happy to perform in front of others.	0.53	-	0.41
		<i>21. Dislikes being center of attention.</i>			0.19
		28. Reluctant to perform in front of others.	0.53	-	0.46
Physical challenges	0.19	<i>4. Cautious in activities involving physical challenge.</i>			0.19
		13. Confident in activities involving physical challenge.	0.11	-	0.30
		<i>17. Confident in activities involving physical challenge.</i>			0.21
		29. Happily explores new play equipment.	0.11	-	0.34

Items highlighted in bold font are reverse items and have been included in the total scale after correction. Since the factor loads of the items in italic form were <0.3 , it was deemed appropriate to remove those from the scale for the Turkish version. Social novelties main subscale scores can be calculated over the total scores of adults, peers, and performance subscales. Situational novelties main subscale scores can be calculated over the total scores of new situations and preschool/separation subscales. Since the factor load is <0.3 , only 2 items (13 and 29) of Physical Challenges subscale can be included, and also the Cronbach's alpha coefficient of this subscale was below the acceptable threshold (0.40) so the existence of this subscale was not supported in the Turkish adaptation study. However, remaining 2 items (13 and 29) are used to calculate the total scale score. As a result, the total score of BIQ-TR is calculated by summing up 26 items.

Cronbach's alpha value for the performance subscale was calculated as 0.69 without including the 6th and 21st items which were removed from the scale, since the factor loads remained below 0.3 as a result of factor analysis. In the physical challenges subscale, the Cronbach alpha value

was found to be 0.19 when calculated by excluding the 4th and 17th items from the scale because of the factor loadings below 0.3.

In the correlation analyses, the item-total test correlation coefficients were found to be higher than the 0.30 cut-off

point in all items and the correlation coefficient of the majority of the items was found to be higher than 0.50. Furthermore, all of “alpha if item deleted” values were higher than 0.80. All scale and item level statistics for The Turkish BIQ are presented in Table 4.

Validity

In order to determine the construct validity of the BIQ Turkish Form, confirmatory factor analyses were performed, and the correlations of the subscales were checked with each other. Besides, the correlations with the CBQ shyness and SDQ internalization subscales were examined for concurrent validity; and for the discriminant validity determination, correlations were made with the CBQ impulsivity, smiling and SDQ prosocial behaviors subscales. For the purpose of evaluating the relationship between the BIQ subscales, the correlations of the scales with each other were calculated. No negative correlation was found between any of the subscales of the scale. While the highest correlations with total BIQ were found between main scales social novelty ($r=0.926, P < .001$) and situational novelty ($r=0.928, P < .001$), and also peers ($r=0.848, P < .001$) and unfamiliar situations from subscales. ($r=0.898, P < .001$) showed a very high correlation similarly. Although the lowest correlation with the total was found for physical challenges subscale, this subscale showed a moderate correlation ($r=0.454, P < .001$). While there was a very high correlation between peers ($r=0.814, P < .001$) and adults ($r=0.891, P < .001$), which are the subscales of the main scale of inhibition to social novelties, a high level correlation was shown with its performance subscale ($r=0.637, P < .001$). Although there was a very high correlation between the inhibition to situational novelties main scale and its subscales, unfamiliar situations ($r=0.908, P < .001$), and preschool/separation ($r=0.809, P < .001$), it showed a moderate correlation with physical challenges ($r=0.528, P < .001$).

Correlations with the shyness subscales of the CBQ temperament scale and the internalization subscales of the SDQ scale were examined in order to conduct convergent validity analyses. Except for the very weak positive correlation ($r=0.197, P < .001$) between the CBQ shyness subscale and physical challenges, the correlation with all subscales and the total score was positive and moderate or high. On the other hand, there was a weak, positive, and statistically significant relationship between the SDQ internalization scale, which is not a temperament scale, and all the scales, except for the performance ($r=0.154, P < .05$) subscale, and so findings regarding the convergent validity of the BIQ Turkish Form were obtained.

For the discriminant validity analysis, which is another component of validity, the correlations with the CBQ impulsivity, smile-laughter subscales, and the SDQ prosocial behavior subscales were investigated. Statistically significant and negative correlations were shown between the CBQ impulsivity subscale and all scales. Although there was no statistically significant relationship between the CBQ smile-laughter scale and the preschool/separation subscale ($r=-0.112, P > .05$), statistically significant and negative correlations were found with all other scales. Statistically significant and moderately negative correlations were found between the SDQ prosocial behaviors and total scale ($r=-.253, P < .001$), social novelty main subscale ($r=-0.251, P < .001$), situational novelty main subscale ($r=-0.209, P=.001$), and the peers subscale ($r=-0.256, P < .001$). Discriminant validity can be shown with negative and statistically significant correlations, as well as with correlations that are weak or not statistically significant compared to convergent validity correlations. The total of the scale with all sub-factors and superfactors did not show a statistically significant relationship with the SDQ externalization subscale; for all of the sub-factors, correlations were negative except for performance, preschool, and situational novelties scales ($P > .05$).

Table 5. Convergent and Discriminant Validity Correlation Analyses

Subscales of BIQ-TR	CBQ Shyness	SDQ Internalization	CBQ Impulsivity	CBQ Smiling	SDQ Prosocial	SDQ Externalization
Adults	0.59***	0.29***	-0.30***	-0.27***	-0.14*	-0.05
Peers	0.63***	0.30***	-0.37***	-0.25***	-0.25***	-0.11
New Situations	0.62***	0.42***	-0.46***	-0.31***	-0.18**	-0.02
Preschool	0.36***	0.22***	-0.24***	-0.11	-0.15*	0.06
Performance	0.39***	0.15*	-0.17**	-0.22***	-0.18**	0.06
Physical Challenges	0.19***	0.27***	-0.24***	-0.24***	-0.17**	-0.04
Social Novelties Total	0.69***	0.33***	-0.38***	-0.31***	-0.25***	-0.06
Situational Novelties Total	0.56***	0.40***	-0.42***	-0.27***	-0.20***	0.02
Total	0.67***	0.39***	-0.43***	-0.31***	-0.18***	-0.02

* $P < .05$; ** $P < .01$; *** $P < .001$.

CBQ, Child Behavior Questionnaire; SDQ, Strengths and Difficulties Questionnaire.

Results of convergent and discriminant validity correlation analyses are presented in Table 5.

Confirmatory Factor Analysis and Fit Index Models

A confirmatory factor analysis was carried out to test the fit of the hypothesized previous models of the BIQ as described for the original validation study.¹¹ We followed the same CFA procedures and examined 4 models: (a) single factor (model 1), (b) 3 correlated factors (model 2), (c) 6 correlated factors (model 3), and (d) 6 correlated factors loading onto 1 higher order factor (model 4) as well as 6 correlated factors loading onto 2 main sub-factors and by these 2 factors, items that go to 1 main factor model (model 5) were also examined peculiar to our study. On the other hand, since the Cronbach's alpha value of the physical challenges subscale was far below the acceptable level, this subscale was removed, but since the factor loadings of the 2 items of this subscale were above 0.3, the remaining items 13 and 29 in the scale were continued to be used in the main scale. Therefore, finally, a model (model 6) was established, in which 5 sub-factors (first-order factor) loading onto 2 main sub-factors (second-order factor) went to the main factor at the end (third-order factor). Model fit was evaluated by a range of Goodness of Fit Indexes. It has been recommended that using one of the relative fit indices like TLI close to 0.95 or higher in combination with 1 of the 2 Absolute Fit Indices either RMSEA or sRMR above around .08 or .06 respectively is enough to determine a good fit.²³ In our study, we primarily showed regard to the CFI and the RMSEA, which are the most frequently reported fit indexes and among the measures least affected by sample size. Only fit indices below the acceptable cut-off values were the sRMR but it has also been reported below the cut-off values in previous BIQ validation studies except for BIQ scale development study. Our CFA results are presented in Table 6.

In the original study, the model with 6 sub-factors and all sub-factors going to a higher-level main factor (model 4) showed high fit index values.¹¹ In our study, unlike the model with the best fit in the original study, it was found that the 5 related sub-factors that did not include

physical challenges subscale, which was not supported by factor analyses and reliability analysis, went to 2 higher level sub-main factors and that these 2 sub-main factors were loaded onto the highest level in which 1 super-factor (Model 6) displayed strongest fit measurements than both previous 4 factor models and model 5 peculiar to our study with the best fit indices ($\chi^2/df=1.25$; RMSEA=0.032; RMR=0.153; CFI=0.978; GFI=0.915; TLI=0.970). Although three correlated factors, six correlated factors, and six correlated factors loading onto one higher order factor models supported by increasing fit values, respectively, in the current literature; because of low internal consistency coefficient of physical challenges subscale ($\alpha=0.19$), even the fit index values were acceptable, they could not be supported in our study.¹¹⁻¹⁴ Despite the fact that it is the model with lowest fit indices accepted by previous studies, the single model (model 1) in which all items are included in the scale as a single factor, and there is no separation into separate sub or main factors, was determined as a second model supported by good fit indices in factorization of BIQ Turkish version ($\chi^2/df=1.371$; RMSEA=0.039; RMR=0.149; CFI=0.968; GFI=0.911; TLI=0.956).

DISCUSSION

To date, many studies in the international literature have investigated the structure of BI, especially its neurobiological underpinnings, how it progresses, its relationship with psychopathology, internal and external factors affecting this relationship, and intervention programs to prevent the progression to psychopathology. Nevertheless, perhaps the most important and first step in deepening our knowledge of this basic temperamental structure is to determine the BI by evaluating it appropriately and validly. As far as we know, there is no study examining specifically BI in children in our country. One of the most important reasons for this is the absence of a measurement tool that has been translated into Turkish and whose validity and reliability have been tested. Behavioral inhibition needs to be studied in different cultures and countries, as cultural factors can affect both the way BI is expressed and parents'

Table 6. Model Fit Indices From CFA for the Turkish BIQ

Models of CFA	χ^2	df	χ^2/df	RMSEA	CFI	RMR	GFI	TLI	NFI
Model 1: single factor	323.636	236	1.371	0.039	0.968	0.149	0.911	0.956	0.895
Model 2: 3 subfactors	324.674	237	1.370	0.039	0.968	0.154	0.910	0.956	0.894
Model 3: 6 subfactors	301.945	236	1.279	0.033	0.976	0.147	0.914	0.967	0.902
Model 4: 6 subfactors (first order), 1 main factor (second order)	320.541	245	1.308	0.033	0.976	0.147	0.914	0.967	0.896
Model 5: 6 subfactors (first order), 2 main subfactors (second order), 1 main factor (third order)	319.046	244	1.308	0.035	0.973	0.152	0.910	0.964	0.896
Model 6: 5 subfactors (first order), 2 main subfactors (second order), 1 main factor (third order)	304.974	244	1.250	0.032	0.978	0.153	0.915	0.970	0.901

approaches to inhibited children. In this study, the BIQ parent form, which is one of the few unique tools used to evaluate BI in the international literature, has been translated into Turkish, and it has been shown to have good validity and reliability in a population sample of 3- to 7-year-old children. Although there are differences in factor distribution, results confirming the reliability and validity findings of previous studies were obtained in our study. The differences in factor distribution are that either the single total factor model in which the BI features represented by all items are evaluated over a single total or the model with 5 sub-factors, in which the inhibition to physical challenges subscale is not included in, load onto 2 main sub-factors, social and situational novelties, and then in total, supported the use of 5 subscales-2 main scale-1 total factor model specific to our culture in our society.

The total Cronbach's alpha coefficient of the Turkish version of the BIQ parent form was found to be highly reliable at 0.92. In our study, it was shown that not only the internal consistency of the total scale but also the majority of the subscales were very highly or highly reliable (with an alpha value range from 0.69 to 0.87). Only physical challenges subscale ($\alpha=0.19$, not reliable) did not show internal consistency. It has been reported that the internal consistency of physical challenges was also low in previous studies and showed atypical features.^{12,14} Considering that 2 items in this subscale had to be removed from the scale due to the factor loadings below 0.3, and only 2 items remained in the subscale, it can be expected that the alpha coefficient remains below 0.40. The item-total correlation analysis, which is another method used in internal consistency assessment, has found that removing the items 4 and 17 from physical challenges scale and the 6th and 21st items from the performance subscale increased the reliability. Furthermore, since the factor loadings of these items were below 0.30 in the confirmatory factor analysis, it was thought that it would be appropriate to remove the 4th, 6th, 17th, and 21st items from the scale. Although it varies according to the number of samples, in a validity-reliability study conducted with around 300 participants, it was suggested that a factor loading of at least 0.30 should be required, and items below 0.30 could be discarded by considering other validity findings.²⁴ As it is known, the low number of items falling into the sub-dimensions reduces the internal consistency coefficients. Therefore, containing only 2 items can be seen as a sufficient explanation of the relatively low internal consistency ($\alpha=0.697$) for the performance subscale, even if it is not sufficient for physical challenges subscale.

To examine the relationship between BIQ-TR subscales and factor structures, their correlations with each other were calculated. No negative correlation was found between any of the subscales of the scale. Significant positive correlations were found between all of the factor structures in the BIQ-TR, both with the subscales in which they were

represented and with each other. As can be expected, the highest correlations with the total scale were found between social novelty ($r=0.926$, $P < .001$) and situational novelty ($r=0.928$, $P < .001$), which are the 2 confirmed main subscales of BIQ. Although the lowest correlation with the total was found for the physical challenges, even this subscale showed a moderate correlation ($r=0.454$, $P < .001$). In the only study in which the correlations between the scales were presented in detail, the researchers found correlation findings similar to the findings of our study, and they argued that the weak correlations of only the physical challenges subscale were due to atypical structure of this subscale and they suggested that this sub-factor perhaps should be handled more isolated than others in BI.¹⁴

Convergent validity is another method used to evaluate the validity of a scale. In our study, the correlations between the shyness subscales of the CBQ temperament scale and the internalization subscales of the SDQ scale were examined with a view to determining the convergent validity of the BIQ. Statistically significant and strong positive correlations were found for all scales and the total except the very weak correlation ($r=0.197$, $P < .001$) between the shyness subscale and physical challenges subscale. Moderately positive correlations were found between the SDQ internalization subscale, which is not a temperament scale but a scale giving a point of anxiety, and all scales of BIQ except for the performance subscale ($r=0.154$, $P < .01$). These results were expected when measuring the temperamental phenotype of BI, with its established links to the shyness traits and the features of social anxiety. Similar to the studies in the literature, strong and moderate positive correlations detected with related scales provided evidence that BIQ-TR has good concurrent validity.^{11,13} As for the weak correlation between the physical challenges subscale and the CBQ shyness subscale, while the correlations with the SDQ internalization scale were moderate, it was thought that consistent with the findings pointing to the isolated atypical structure of the physical challenges sub-feature, it was related to the non-social dimension of BI and linked anxiety symptoms in total, not specific.

Another component of defining validity in scale adaptation studies is discriminant validity. In order to determine the discriminant validity in our study, correlations with SDQ prosocial behaviors and externalization subscales, CBQ smile-laughter and impulsivity subscales which are thought to represent different characteristics, not similar to BI, and have been used for this reason in other studies, were investigated. Discriminant validity was not evaluated in the original study of the scale and in another adaptation study, and this was reported among the limitations of both studies.^{11,12} In the current study, by using both types of scales (temperament and externalization) simultaneously, the lack of correlation or the presence of weak-moderate negative correlations was found in discriminant analyses of

the BIQ-TR and CBQ and SDQ subscales scores, similar to the existing studies,^{13,14} demonstrating that it has sufficient discriminant validity. When examining SDQ externalization subscale and CBQ impulsivity subscale independently, neither was significantly associated with the overall BIQ or its component subscales, suggesting the Turkish BIQ has sufficient discriminant validity when compared to a questionnaire that measures emotional ability and restless impulsive or aggressive behaviors. On the other hand for SDQ prosocial subscale and CBQ smile/laughter subscales, there were weak-moderate negative correlations with total BIQ and its subscales so that means as a temperamental trait, behavioral inhibition increases, outgoing temperamental traits, and prosocial behaviors decrease. In this way, it has been proven that BIO-TR has a good power to distinguish BI from other unrelated features. Low surgency or positive emotionality, negative emotionality, and high constraint or effortful control as temperamental traits and Gray's model of the Behavioral Inhibition System and Behavioral Approach System as externalization-related features fall under these unrelated features.^{25,26} In BI, fear is associated with unfamiliar contexts, whereas other temperamental traits are more generalized. Behavioral inhibition overlaps conceptually with also Gray's Behavioral Inhibition System but unlike the Behavioral Inhibition System, signals of non-reward do not elicit BI so BIQ should be discriminated between BI and these aforementioned features.

Confirmatory factor analysis of the Turkish BIQ yielded support for only the single factor model among the factor models as suggested by the developers of the scale and confirmed in subsequent studies. Both the 6 correlated sub-factors leading to a single main factor and the other models showed increasing fit index values by removing 6th and 21st items from the performance subscale and 4th and 17th items from the physical challenges subscale. Therefore, compared to the original scale study and subsequent studies, it was concluded that it would be appropriate not to include these items in the total BIQ for Turkish society. In addition, contrary to other studies, when the 2 items of the physical subscale included in the scale are only included in the total of the scale, that is, when they are distributed within the general factor without being considered as a separate sub-factor, it has been shown that it can be used in scale scoring in our society, supported by the single fit model. The original model put forward by our study is the 5 correlated factors model. The other 5 subscales (adults, peers, new situations, preschool/separation, performance) that do not include physical challenges due to being a subscale of items with very low item-total correlations go to 2 sub-main factors at level 2, inhibition to social novelty and situational novelty, and then they are collected in the highest level main factor. This finding suggests that BI may have specific expressions for some contexts and even cultures so it should be handled differently in those contexts and cultures.²⁷ The single model, in which all the items coexist without decomposition, also fits well. Taking

this finding into account, it also validates the view that this originality does not remain completely separate but is gathered under a single structure, thus forming a part of a separable whole.¹²⁻¹⁴

Our study has some limitations. The first of these is that the test-retest findings were not included in the validity scope of our study. Test-retest reliability was determined in the development study of BIQ and test-retest findings were included and replicated in only one more study with a fractional part of entire sample, considering that this is the adaptation of BIQ not a scale development study, this limitation can be compensated by adequate findings of other aspects of reliability. The second is that since there is no alternative scale directly translated into Turkish that measures BI, the convergent validity analyzes are carried out on a more general temperament scale subscale and the internalization subscale of the SDQ. The third limitation is that because there is no observational method to evaluate the standardized BI translated into Turkish, it was not possible to test the extent of bias in the reports. A fourth limitation is that the age range is limited to only 3-7 years old. A final limitation is that we did not investigate the validity and reliability of the scale in the clinical sample, considering the relationship between BI and psychopathology, although the advantages of the population sample are high in scale validity and reliability studies. Despite all these limitations, our study also has strengths. Our study has added a new one to the limited number of studies of BIQ in the field of validity-reliability by extending the findings to include Turkish society for the first time. It also enriched these findings by providing concurrent convergent and discriminant validity data, as well as providing construct validity of an alternative factor model specific to Turkish society.

In conclusion, our study showed that the Turkish version of BIQ has good validity and reliability for children aged 3-7, with its factor structure specific to our culture. Thus, the basis for future studies on BI in our country is laid, by providing an opportunity to screen this basic temperamental feature in young children easily and reliably. It is thought that the first step is formed for preventive interventions that can be developed to reduce the risk of psychopathology in the future.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Necmettin Erbakan University Meram Faculty of Medicine University (Approval No: 2019/1743).

Informed Consent: Written informed consent was obtained from the parents of participants in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - S.K.; Design - S.K.; Supervision - A.B., V.G.; Funding - S.K.; Materials - S.K.; Data Collection and/or Processing - S.K.; Analysis and/or

Interpretation - A.B.; Literature Review - S.K.; Writing - S.K.; Critical Review - A.B., V.G.

Declaration of Interests: The authors have no conflicts of interest to declare.

Funding: The authors declared that this study has received no financial support.

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APPENDIX

Behavioral Inhibition Questionnaire (Parent Form) Turkish Version

Aşağıdaki ifadeler çocukların farklı durumlarda gösterdikleri davranışları tanımlamaktadır. Her bir ifade, o davranışın çocuğunuzda ne sıklıkta görüldüğüne “neredeysse hiç”, “nadiren”, “ara sıra”, “bazen”, “sıklıkla”, “çok sık”, veya

“neredeysse her zaman” seçeneklerinden birini seçerek karar vermeniz istenmektedir. Örneğin, eğer davranış “neredeysse hiç” görülüyorsa “1” numarayı, “nadiren” görülüyorsa “2” numarayı vs. yuvarlak içerisine alınız. Çocuğunuzun aynı yaşlardaki diğer çocuklar ile karşılaştırarak elinizden geldiğince en uygun kararı vermeye çalışınız.

1 Neredeyse Hiç	2 Nadiren	3 Ara Sıra	4 Bazen	5 Sıklıkla	6 Çok Sık	7 Neredeyse Her Zaman	
1. Yeni bir durum ile karşılaştığında ya da yeni bir aktiviteye katılması söz konusu olduğunda çok tereddütlü yaklaşır.	1	2	3	4	5	6	7
2. Tanımadığı bir çocuk grubunun oyunlarına katılması söz konusu olduğunda güle oynaya onlara yaklaşır.	1	2	3	4	5	6	7
3. Evimize tanımadığı (yetişkin) misafirler geldiğinde onların yanında çok sessizdir.	1	2	3	4	5	6	7
4. Fiziksel zorluk içeren aktivitelerde (örneğin, tırmanma, yüksekten atlama) temkinli davranır.	1	2	3	4	5	6	7
5. İyi tanımadığımız insanların evlerine misafirlğe gittiğimizde çabuk uyum sağlar.	1	2	3	4	5	6	7
6. İlgi odağı olmaktan hoşlanır.	1	2	3	4	5	6	7
7. Diğer çocukları oyun oynamaya davet ederken rahattır.	1	2	3	4	5	6	7
8. Tanımadığı çocuklarla ilk kez buluştuğunda utangaçtır.	1	2	3	4	5	6	7
9. Yeni ortamlara (örneğin, kreş, anaokulu, bakıcı) ilk kez bırakıldığında anne-babasından güle oynaya ayrılır.	1	2	3	4	5	6	7
10. Diğer insanların önünde faaliyette (örneğin, şarkı söylemek, dans etmek) bulunmaktan mutlu olur.	1	2	3	4	5	6	7
11. Yeni ortamlara hızlı bir şekilde uyum sağlar (örneğin, kreş, anaokulu, bakıcı).	1	2	3	4	5	6	7
12. Tanımadığı bir çocuk grubuna katılıp katılamayacağını sormak için onlara yaklaşmakta gönülsüzdür.	1	2	3	4	5	6	7
13. Fiziksel zorluk içeren aktivitelerde (örneğin, tırmanma, yüksekten atlama) kendine güvenir.	1	2	3	4	5	6	7
14. Özgürce davranır.	1	2	3	4	5	6	7
15. Yeni bir durumla karşılaştığında rahat görünür.	1	2	3	4	5	6	7
16. Tanımadığı yetişkinlere karşı çok konuşkandır.	1	2	3	4	5	6	7
17. Yeni oyun araç gereçlerini incelemekte tereddüt eder.	1	2	3	4	5	6	7
18. Yeni bir ortama (örneğin, kreş, anaokulu, bakıcı) ilk kez bırakıldığında rahatsızlık duyar.	1	2	3	4	5	6	7
19. Henüz yeni tanıştığı çocuklara oldukça arkadaşa davranır.	1	2	3	4	5	6	7
20. Oyunlarına katılmaktansa diğer çocukları izlemeyi tercih eder.	1	2	3	4	5	6	7
21. İlgi odağı olmaktan hoşlanmaz.	1	2	3	4	5	6	7
22. İyi tanımadığımız kişilerin evlerine misafirlğe gittiğimizde yanımızdan ayrılmaz.	1	2	3	4	5	6	7
23. Yeni durum veya aktivitelere güle oynaya yaklaşır.	1	2	3	4	5	6	7
24. Dışa dönüktür.	1	2	3	4	5	6	7
25. Yeni durumlarda gergin ya da huzursuz görünür.	1	2	3	4	5	6	7
26. Evimize gelen tanımadığı (yetişkin) misafirlerle keyifle sohbet eder.	1	2	3	4	5	6	7
27. Yeni ortamlara (örneğin, kreş, anaokulu, bakıcı) alışması günlerce sürer.	1	2	3	4	5	6	7
28. Diğer insanların önünde faaliyette (örneğin, şarkı söylemek, dans etmek) bulunmakta isteksizdir.	1	2	3	4	5	6	7
29. Yeni bir oyunun araç gereçlerini keyifle inceler.	1	2	3	4	5	6	7
30. Tanımadığı yetişkinler ile birlikte iken çok sessizdir.	1	2	3	4	5	6	7