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Turkish Validation of the Rapid Interactive Screening Test for Autism in Toddlers

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Abstract

This study aims to investigate the validation of the Rapid Interactive Screening Test for Autism in Toddlers (RITA-T) in Turkish toddlers between 18 and 36 months of age. Children aged 18–36 months were referred to the department of child psychiatry for concerns of autism spectrum disorder, language disorder, developmental delay, and typically developing children were enrolled. A total of 81 toddlers participating in the study received clinical interviews according to the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.) and the Childhood Autism Rating Scale. They received the translated RIT-T from reliably trained and blinded providers. Parents completed the Modified Checklist for Autism in Toddlers form. A cut-off score was calculated based on the sensitivity, specificity, positive, and negative predictive values of the RITA-T total score that best differentiates autism spectrum disorder diagnosis. For all participants, the RITA-T total score correlated with the Modified Checklist for Autism in Toddlers ($r = 0.715$) and the Childhood Autism Rating Scale total score ($r = 0.825$). Using a cut-off score of $\geqslant 17$, the RITA-T had a sensitivity of .90 and a specificity of .927 for identifying autism spectrum disorder risk. The area under the curve was .977. Our findings demonstrate that the RITA-T is effective in Turkish toddlers for the early identification of autism spectrum disorder, early intervention settings, and allowing access to treatment.

Lay abstract

It is important to diagnose autism spectrum disorder at an early age and to start an early intervention program without delay. In this study, we aimed to validate the Rapid Interactive Screening Test for Autism in Toddlers (RITA-T) in a group of Turkish children and found that the RITA-T which has been shown to be a valid and reliable screening test for 18- to 36-month-old children in studies conducted in different countries, is also valid in Turkish children. Similar to previous studies, our results showed that the RITA-T has good sensitivity and specificity in distinguishing children with autism spectrum disorder. We think that our study will contribute to the timely initiation of early intervention programs for many children with autism by enabling a valid test to be used in screening programs.

Keywords

autism spectrum disorder, early identification, RITA-T, screening test, toddler

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Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by persistent deficits in social communication and interaction, limited interests, and repetitive movements (American Psychiatric Association, 2013). ASD causes serious disability in the functionality of both affected individuals and families, and negatively affects independent living skills, academic, social, and professional success. According to the latest Centers for Disease Control and Prevention (CDC) report, the prevalence in the United States is about one in 44 children (Maenner et al., 2021). The American Academy of Pediatrics recommends universal standardized screening for ASD at 18 and 24 months of age in the primary care setting (Hyman et al., 2020). The average age at diagnosis of autism is around 60 months (van 't Hof et al., 2021), but it is known that ASD can be reliably detected as early as 18 months of age and symptoms can be observed as early as 6–12 months (Neimy et al., 2017). There is a consensus about the importance of early diagnosis and intervention in ASD (Kodak & Bergmann, 2020). Early interventions can improve prognosis, and delay in diagnosis and intervention reduces the effectiveness of intervention (Johnson & Myers, 2007). Evaluation and screening studies of children at risk have a crucial place in the early diagnosis of ASD and appropriate referral.

The CDC report underscores the need for enhanced diagnostic tools to meet the needs of all children (Maenner et al., 2021). Currently, there are many questionnaires, observational checklists, and parent-interview formats available worldwide for Level 1 and 2 screening of ASD (Petrocchi et al., 2020). Globally, each country develops and implements health policies and ASD screening programs. Many factors in low- and middle-income countries lead to difficulties in implementing ASD screening processes (Choueiri, Garrison, & Tokatli, 2022).

In Türkiye, in the framework of the "ASD screening and follow-up program" by the Ministry of Health, children at risk of ASD are referred to a specialist according to the five-question survey adapted from the Modified Checklist for Autism in Toddlers (M-CHAT) by primary care physicians (Dursun et al., 2022). The lack of an adequate scale or test that can be used as a Level 2 screening leads to delays in the diagnosis of children at risk of ASD and thus makes it difficult to access early treatment. We believe the adaptation of a Level 2 screening tool to our culture will help to overcome these delays and improve outcomes for both children and families.

Filling a need in this field, the Rapid Interactive Screening Test for Autism in Toddlers (RITA-T) offers a low-cost, rapid administration and language-independent testing opportunity (Choueiri & Wagner, 2015). RITA-T is validated for 18 to 36 months of age as a Level 2 screening measure (Choueiri et al., 2021; Choueiri & Wagner, 2015). It was designed to reveal ASD symptoms in an interactive testing environment. In addition to the United States, validation studies have been carried out in Canada (Lemay et al., 2020) and Lebanon (Yassin et al., 2020). RITA-T examines areas such as joint attention, social awareness, human agency, and cognition; administration and scoring process for participants can be accomplished within 20 min. Previous studies with the RITA-T (Choueiri et al., 2021; Choueiri, Garrison, Tokatli, et al., 2022; Choueiri & Wagner, 2015; Lemay et al., 2020; Yassin et al., 2020) have identified high sensitivity and specificity with the right cut-off score values and it is a valid and reliable test to identify toddlers at risk. This study aims to investigate the cross-cultural validation of the psychometric properties of RITA-T as a Level 2 screening test in Turkish toddlers between 18 and 36 months of age.

Methods

Participants

The study took place at Istanbul University-Cerrahpaşa, Cerrahpaşa Medical Faculty and Başakşehir Çam and Sakura City Hospital Child and Adolescent Outpatient Clinic between August 2021 and August 2022. Children aged 18 to 36 months were included in the study. Children with severe neurological diseases, and auditory or visual deficits were excluded from the study (Figure 1). Written informed consent was obtained from parents for application. The research team was reliably trained for the RITA-T by Dr. Roula Choueiri.

Procedure

Patients referred to the child and adolescent psychiatry outpatient clinic were evaluated by a child and adolescent psychiatrist. During the diagnostic process, the family was first interviewed and the premorbid status of the patient, developmental history, and current behavioral and social difficulties were evaluated. Afterward, the child was evaluated with a psychiatric examination, behavioral observation, and Childhood Autism Rating Scale (CARS). Further tests (blood, auditory or visual, otolaryngologist's evaluation, etc.) were ordered when necessary. Clinical diagnosis was made based on *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5) criteria. Children diagnosed with language disorder (LD), developmental delay (DD), and ASD were referred to the research group. The RITA-T was administered, and parents completed the M-CHAT form. The RITA-T administrators were blind to the diagnosis. Children with no identifiable psychopathology were classified as the typically developing (TD) group ($n = 14$). The ASD group consisted of 40 children diagnosed with ASD. The LD/DD group consisted of 27 children in total, including 25

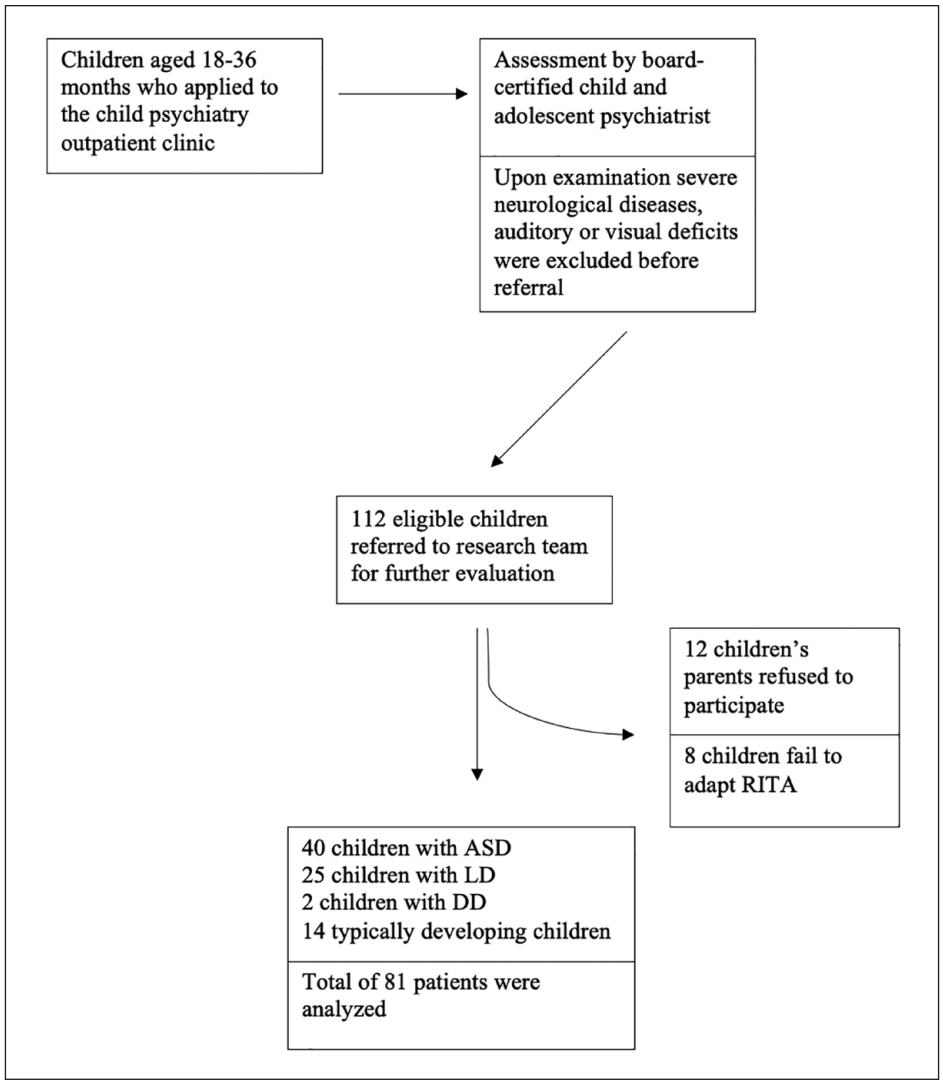

Figure 1. Referral process.
RITA-T: Rapid Interactive Screening Test for Autism in Toddlers; ASD: autism spectrum disorder; LD: language disorder; DD: developmental delay.

children diagnosed with LD and two children diagnosed with DD.

The Declaration of Helsinki was followed as the standard of medical ethics in the study. The study was approved by the ethics committee of Başakşehir Çam and Sakura City Hospital (Approval No: 2021.08.168).

RITA-T

RITA-T is an interactive test administered by a trained and certified clinician to toddlers aged 18–36 months. It consists of nine activities; each activity has a variant number of items and a score. The total score can vary between 0 and 30 points. Higher scores reflect increased risk for ASD (Choueiri & Wagner, 2015).

As the RITA-T is a test administered by the early childhood provider/healthcare worker and is not self-reported, the translation process was designed based on the principles suggested by Beaton et al. (2000). Before the beginning of the study, permission to use and translate RITA-T was obtained from Dr. Roula Choueiri to conduct a validity and reliability study. First, a researcher who was working as a child and adolescent psychiatrist and has language proficiency and a translator both translated RITA-T from English to Turkish. Then, any discrepancies between the two translation reports were resolved. At the next stage, another translator created a back translation from Turkish to English. Later, the whole research team, translators, and developers of the original test reviewed all reports, reached a consensus, and produced the final version. After the final version was formed, the study was initiated.

The researchers independently scored three randomly selected application videos at the start of the study to assess interrater reliability, as was done in the official

Table 1. Demographic and test score comparisons between groups.

										KW/χ^2	*p*
	ASD *n* = 40			LD/DD *n* = 27			TD *n* = 14				
	Median	IQR 25	IQR 75	Median	IQR 25	IQR 75	Median	IQR 25	IQR 75		
Demographics											
Age (month)	27.0	24.5	29.0	31.0	27.0	34.0	29.0	23.0	33.0	7.925	**0.019**
Gender (male), *N* (%)	34	85.0		20	74.1		8	57.1		4.620	0.099
	6	15.0		7	25.9		6	42.9			
Maternal age	32.0	28.0	37.0	34.0	32.0	37.0	32.0	28.0	33.0	3.018	0.221
Paternal age	37.0	32.0	41.0	37.0	35.0	41.0	35.0	33.0	37.0	1.054	0.590
Test Scores											
RITA-T total	21.0	18.0	24.0	11.0	10.0	15.0	12.0	9.0	13.0	55.012	<**0.001**
CARS total	38.5	35.3	43.3	19.5	17.5	22.5	17.0	15.5	18.5	58.959	<**0.001**
M-CHAT total	13.0	8.0	15.0	2.0	1.0	3.0	1,0	.0	2.0	45.177	<**0.001**

ASD: autism spectrum disorder; LD/DD: language disorder and developmental delay; TD: typically developing; RITA-T: Rapid Interactive Screening Test for Autism in Toddlers; CARS; Childhood Autism Rating Scale; M-CHAT; Modified Checklist for Autism in Toddlers.

RITA-T training. The interrater-reliability coefficient was calculated using intraclass correlation analysis (intraclass correlation coefficient (ICC) = 0.997, 95% confidence interval (CI) = 0.996–0.998, $p < 0.001$). To further enhance rater reliability and comprehend potential scoring biases, additional meetings with practitioners were held to watch various application videos under the direction of the study's corresponding author.

CARS

The CARS was developed by Schoppler and Reichler in 1971 (Schopler et al., 1980). It consisted of 15 items and was designed as a behavioral rating scale to differentiate autism. At the same time, it allows determining the severity of autism as mild-moderate and moderate-severe. The validity and reliability analysis of the Turkish version of CARS were examined in 2016 and Cronbach's alpha value of the scale was calculated as .95 (Incekas Gassaloglu et al., 2016).

M-CHAT

M-CHAT consists of 23 "yes" or "no" items. M-CHAT is widely used as a Level 1 screening questionnaire for ASD. A study in Turkish toddlers revealed that the positive predictive value (PPV) of the M-CHAT was 75% and it is a useful tool for screening pervasive developmental disorders in primary care (Kara et al., 2014).

Statistical analysis

Analyses were conducted using the IBM SPSS Version 20 and the Jamovi version 2.2.5 software. Numerical variables were presented as mean ± standard deviation, median (interquartile range = 25–75), and categorical variables as frequency and percentage. A chi-square test was used to compare percentages between the groups. In the normality test (Shapiro-Wilks) performed according to the RITA-T ($p = 0.019$), CARS total ($p < 0.001$), and M-CHAT total ($p < 0.001$) scores, it was observed that the scales did not comply with the normal distribution and the Kruskal–Wallis test was applied. The Spearman correlation coefficient was used to test the linear relationship between the continuous variables. Receiver operating characteristic (ROC) curves were used to determine the utility of RITA-T scores and to determine the cut-off values. The area under the ROC curve (AUC) was used to assess the diagnostic performance. The optimal cut-off point was determined by plotting true positive (sensitivity) against false-positive (1–specificity) rates. Youden's J statistic was used for determining the RITA-T cut-off point on the ROC curve. This cut-off was determined for ASD diagnosis. A p value of <0.05 was considered statistically significant.

Results

A total of 101 children were referred: 12 children's parents refused to participate, and a total of 89 children were enrolled. Of those 89, eight children were excluded because of incomplete administration of RITA-T due to behavioral problems. A total of 81 toddlers continued in the study (Figure 1). Of those, 62 (76.5%) were males and 19 (23.5%) were females. The mean age was 22.22 (4.86) months. The median scores of RITA-T, CARS total, and M-CHAT total items checked in the total sample of individuals were 16.0 (12.0–21.0), 28.0 (18.5–38.5), and 6.0

Table 2. Spearman correlation analysis between age and RITA-T total score.

		RITA-T
Total group Age (month)	r	–0.322
$n=81$	p	0.003
ASD age	r	–0.184
$n=40$	p	0.254
LD/DD age	r	–0.296
$n=27$	p	0.134
TD age	r	–0.047
$n=14$	p	0.873

RITA-T: Rapid Interactive Screening Test for Autism in Toddlers; ASD: autism spectrum disorder; LD/DD: language disorder and developmental delay; TD: typically developing.

(1.0–12.0), respectively. Of the 81 participants, 40 (49.4%) were diagnosed with ASD and 27 (33.4%) had a diagnosis of LD/DD. Age was found to be lower in the ASD group than LD/DD and TD groups. There were no significant statistical maternal/parental age and gender differences between groups. The median scores of RITA-T, CARS, and M-CHAT total items were found to be higher in the ASD group. In this study, power was calculated as .99 in the analysis performed in the G*power program according to the RITA-T mean score values between the ASD and LD/DD groups (two tails, $d=2.966$, $\beta/\alpha=3$) (Mathews, 2010). Demographic and test score comparisons between groups are presented in Table 1.

The 27 items of the final RITA-T test showed high/good internal consistency (Cronbach's $\alpha=0.97$), and good interrater reliability (ICC = 0.997, 95% CI = 0.996–0.998, $p<0.001$).

The spearman correlation analysis of RITA-T total score and age for each group was shown in Table 2.

The Spearman correlation between RITA-T, CARS, and M-CHAT total test scores among all participants and ASD groups is presented in Table 3.

To estimate the best cut-off point for RITA-T in determining predictive ASD diagnosis, sensitivity, specificity, PPV, and negative predictive value (NPV) were calculated. These statistics were calculated for each possible RITA-T score (Table 4). The results of a receiver operator curve analysis showed that a cut-off score of 17 provided the best balance of sensitivity and specificity (Figure 2). Using a cut-off score of ⩾17, the sensitivity was .900, specificity .927, PPV .923, and NPV .90. The area under the curve was .997 (95% CI = 0.919–0.987). In our study, a cut-off score of 17 had the best sensitivity and specificity. A total of three were false positives; four were false negatives (Table 5).

Community involvement statement

Not applicable.

Table 3. Spearman correlation analysis between RITA-T, CARS, and M-CHAT total test scores among all participants and ASD groups.

		All participants		ASD group	
		RITA-T Total	CARS Total	RITA-T Total	CARS Total
M-CHAT	r	0.715	0.860	0.170	0.439
Total	p	<0.001	<0.001	0.335	0.009
RITA-T	r		0.825		0.570
Total	p		<0.001		<0.001

ASD: autism spectrum disorder; RITA-T: Rapid Interactive Screening Test for Autism in Toddlers; CARS; Childhood Autism Rating Scale; M-CHAT; Modified Checklist for Autism in Toddlers.

Discussion

Early diagnosis of ASD is of great importance in terms of starting intensive early intervention (Johnson & Myers, 2007). In Turkey, child psychiatry specialists provide evaluation and diagnosis of ASD. Considering the limited access to child psychiatry specialists, integrating a Level 2 screening to be administered by primary care clinicians should be considered. In this study, we aimed to validate the RITA-T test in a group of Turkish children. Developed in 2015, RITA-T has taken its place in the literature as a valid Level 2 screener (Brewer et al., 2020). Similar to previous studies, our results showed that a RITA-T score ⩾17 has good sensitivity and specificity in distinguishing ASD.

Previous studies showed that RITA-T scores are not correlated with chronological age (Lemay et al., 2020; Yassin et al., 2020). In our study, there seems to be a negative weak correlation between age and RITA-T total score in whole group analysis. As the children in the ASD group were significantly younger than the LD/DD and TD groups, correlation analysis was performed in the ASD group instead of the whole group. Thus, there was no correlation between age and RITA-T total score in children with the ASD group. It is thought that this finding compared with other studies may be due to the fact that the study sample was clinic-based rather than community-based or screening program–based and that children at risk may have been admitted to the child psychiatry outpatient clinic at an earlier age. In addition, the cross-sectional and naturalistic design of the study may have led to these results.

Cultural differences in the populations and the methodological differences of the scales and semi-structured assessments used for distinguishing ASD may cause changes in sensitivity and specificity values (Randall et al., 2018). Compared with other studies, Choueiri et al.'s 2015 study (Choueiri & Wagner, 2015) and Lemay's 2020 study (Lemay et al., 2020) set the cut-off to >14, Yassin et al.'s (2020) set the cut-off to >15, and Choueiri et al., 2021 study (Choueiri et al., 2021) and

Table 4. RITA-T sensitivity, specificity, PPV, and NPV ($n = 81$).

Cut point	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Youden's index
11	100	41.46	62.5	100	0.4146
12	100	48.78	65.57	100	0.4878
13	100	53.66	67.8	100	0.5366
14	97.5	68.29	75	96.55	0.6579
15	97.5	78.05	81.25	96.97	0.7555
16	97.5	82.93	84.78	97.14	0.8043
17	90	92.68	92.31	90.48	0.8268
18	85	97.56	97.14	86.96	0.8256
20	70	100	100	77.36	0.7000

ASD: autism spectrum disorder; RITA-T: Rapid Interactive Screening Test for Autism in Toddlers; PPV: positive predictive value; NPV: negative predictive value.

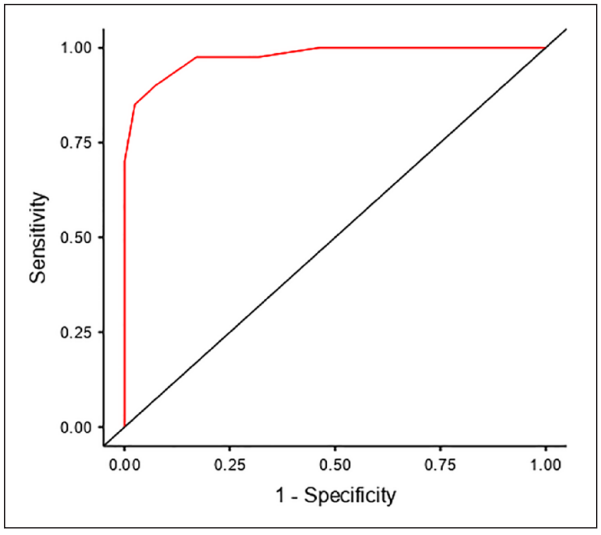

Figure 2. ROC curve for RITA-T cut-off score.
Area under the curve (AUC = 0.997, 95% confidence interval = 0.919–0.987).
ROC: receiver operating characteristic; RITA-T: Rapid Interactive Screening Test for Autism in Toddlers.

lastly, the 2022 review (Choueiri, Garrison, Tokatli, et al., 2022) set the cut-off to >16. In our study, a cut-off score of ⩾17 gave the best results regarding sensitivity and specificity. Although the scores are generally close to each other, the fact that the studies were conducted in different settings and patient groups may help explain the difference. This continues to be consistent with current cut-off scores used in clinical practice that specify a moderate risk range for scores 12 to 16 and a high-risk range for scores more than 16 (Choueiri et al., 2021; www.childrenshospital.org/autismRITA-T).

Considering the RITA-T total scores, it was observed that four children were evaluated as false-negative although they were diagnosed with ASD. It was observed that all of them were included in the early intervention program. Their symptom severity was described as significantly decreased after early intervention programs according to the information obtained from the families. Another three children were evaluated as false-positive by the RITA-T and did not receive the ASD diagnosis. Instead, they presented with behavioral problems such as hyperactivity, attention and focus problems, excessive shyness, and restlessness. Thus, when evaluating the RITA-T total score, the presence of any previous intervention history and behavioral problems that affect compliance with the test should be considered.

Previous studies comparing the Autism Diagnostic Observation Scale module 2 (ADOS-2) and RITA-T found a high level of similarity between the two tests in terms of distinguishing ASD (Kong et al., 2021). We found a significant correlation between the RITA-T total scores and the CARS total scores in both the whole group and the ASD group. The AUC value of the ROC analysis performed by comparing the results of the specialist diagnosis according to the DSM-5 criteria with the RITA-T scores was found to be .977. We conclude that the RITA-T, which provides a much faster application and evaluation opportunity compared with both the CARS and the ADOS-2, has an important place in ASD screening and evaluation.

There are several limitations for our study. First, this study has a relatively small sample size. Second, the ASD group was found to be significantly younger than the LD/DD and TD groups. The cross-sectional design of the study sample in a tertiary center where children at risk can apply earlier may have caused this limitation. Although the gold standard DSM-5-based clinical psychiatric interview was conducted while making the diagnosis, the fact that developmental tests suitable for the age group were not applied is another limitation. It may be useful to use it in developmental tests in later validity studies to facilitate the differentiation of overlapping symptoms, especially in the younger age group. Another important limitation is that because the families were reluctant to reapply to the hospital due to the ongoing COVID-19 risk during the study period, we were unable to conduct test–retest analyses of

Table 5. Distribution of new RITA-T cut-off score of individuals with or without ASD.

		LD/DD and TD		ASD		χ^2	*p*
		N	%	*N*	%		
RITA-T (Cut-off ⩾ 17)	Negative	38	92.7	4	10.0	55,443	<0.001
	Positive	3	7.3	36	90.0		

ASD: autism spectrum disorder; LD/DD: language disorder and developmental delay; TD: typically developing; RITA-T: Rapid Interactive Screening Test for Autism in Toddlers.

the RITA-T, which are crucial in the assessment of scale reliability (as mentioned Brewert al., 2020). Given that scale reliability and validity studies are ongoing processes, we think that future studies should take into account the limitations we have mentioned. An important strength of this study is that toddlers were evaluated and diagnosed by a child and adolescent psychiatrist and the RITA-T was administered by providers blinded to diagnosis. Despite limitations, our study is vital in terms of assessing the validity and reliability of RITA-T as a needed Level 2 screening in Türkiye.

Conclusion

This current study aimed to validate the RITA-T and establish a cut-off score for Turkish toddlers. Similar to previous studies, our results demonstrated strong psychometric properties and consistent cut-off scores. We intend to expand the RITA-T to bigger groups and develop new models that will allow for earlier diagnosis, referral, and intervention for children at risk of ASD. We expect that in the future, RITA-T will be used safely as an autism Level 2 screening test in Türkiye.

Authors' note

M.T.K. and M.C.T. planned the design and method of the study. RITA-T application training was provided to the authors by Roula Choueiri. The project for the ethics committee application was prepared by Y.M., M.T.K., and M.C.T. Data collection and psychiatric examinations were conducted by Z.K., Y.M., A.H., and Y.Ç. The RITA-T was administered by N.S., M.S.Y., A.A., T.S., G.B., and E.C.Ö. Analysis and interpretation of the data were done by M.E.G., M.T.K., and M.C.T. The first draft of the article was written by N.S. and M.S.Y., and the revision was made by M.T.K. and M.C.T. Commentaries and critical revisions were made by R.C., M.T.K., and M.C.T. All authors have read, commented, and approved the final version of the article. The whole process was managed by M.T.K. and M.C.T.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the Başakşehir Çam and Sakura City Hospital (Approval No: 2021.08.168).

Consent to participate

Written informed consent was obtained from the parents.

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Data and/or code availability

Available

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