Normative data and factorial structure of the Turkish version of the Junior Temperament and Character Inventory-Revised

Samet Kose, Feryal Cam Celikel, Ercan Akin, Cahit Kaya, Birgul Elbozan Cumurcu, Ilker Etikan & C. Robert Cloninger

Published online: 31 Mar 2017.

Submit your article to this journal ⧉

Article views: 830

View related articles ⧉

View Crossmark data ⧉

Taylor & Francis
Taylor & Francis Group

Normative data and factorial structure of the Turkish version of the Junior Temperament and Character Inventory-Revised

Samet Kose [a,b,c], Feryal Cam Celikel[d], Ercan Akin[c], Cahit Kaya[e], Birgul Elbozan Cumurcu[f], Ilker Etikan [g] and C. Robert Cloninger [h]

aDepartment of Psychiatry, University of Texas Medical School at Houston, Houston, TX, USA; bCenter for Neurobehavioral Research on Addictions (CNRA), Houston, TX, USA; cDepartment of Psychology, Hasan Kalyoncu University, Gaziantep, Turkey; dDepartment of Psychology, Isik University, Istanbul, Turkey; eDepartment of Rehabilitation and Disability, Southern University, Baton Rouge, LA, USA; fDepartment of Psychiatry, Turgut Ozal Medical Center, Inonu University, Malatya, Turkey; gDepartment of Biostatistics, Near East University, Nicosia, Turkey; hDepartment of Psychiatry, Washington University School of Medicine, St Louis, MO, USA

ABSTRACT

Objective: Junior Temperament and Character Inventory (J-TCI) was developed by Luby, Svrakic, McCallum, Przybeck, and Cloninger based on Cloninger's biopsychosocial model to assess temperament and character dimensions in children and adolescents.
Methods: The Turkish version of J-TCI-Revised (J-TCI-R) was administered to 1129 elementary and middle-school (male/female, 546/583) students. Internal consistency reliabilities were measured by Cronbach's alpha; test–retest was assessed across one month.
Results: Cronbach's alphas for the subscales of J-TCI-R ranged from 0.60 to 0.75 for temperament and character subscales, which were comparable to US and other populations. The correlations between baseline and one month after administration of J-TCI-R were highly and statistically significant ($r = 0.578$–0.674 for scales and 0.366–0.582 for subscales) ($n = 795$). Factor analysis results using Eigenvalue greater than one rule indicated three out of four factors for temperament scales and one out of two factors for character subscales which were similar to findings from the other countries. When all of the subscales were subjected to factor analysis, four out of six factors were retained. To our knowledge, this is the first study analysing psychometric properties and factorial construct of the J-TCI-R.
Conclusions: The internal reliability coefficients and test–retest indicated a good stability of scores over time and the factorial structure was consistent with Cloninger's model of personality. The reliability and validity of the Turkish version of the TCI is therefore supported.

Introduction

Cloninger's dimensional psychobiological model of personality accounts for both normal and abnormal variation in two major personality components: temperament and character [1,2]. Cloninger's concepts of personality elaborate four dimensions of temperament – Novelty Seeking (NS), Harm Avoidance (HA), Reward Dependence (RD), and Persistence (P). They are genetically distinct traits and are moderately inheritable and stable throughout life [3,4]. *NS* is thought to be heritable tendency to be excitable, impulsive, exploratory, and quick-tempered; *HA* reflects tendency of an individual to be cautious, apprehensive, and overly pessimistic; *RD* reflects maintaining behaviors that have been reinforced previously and being sensitive, sentimental, and dependent on others' approval; and *P* involves to persevere in behavior despite lack of reward and fatigue [2,5,6].

Character reflects individual differences in self-concepts about goals and values in relation to experience which is predominantly determined by socialization.

The distinction between temperament and character is based on differences in the underlying forms of learning and memory. Temperament measures individual differences in procedural learning (habit learning of emotional responses), whereas character measures individual differences in propositional learning of goals and values [2,5,6]. The character dimensions are Self-directedness (SD), Cooperativeness (C), and Self-transcendence (ST). The three dimensions of character mature over time, through learning about self-concepts, and they influence personal and social effectiveness into adulthood. They are believed to be more culturally inherited than the temperament traits. *SD* expresses individual's competence towards autonomy, reliability, and maturity; *C* is related to social skills, such as support, collaboration, and partnership; and *ST* denotes attitude towards spirituality and idealism [2,5,6].

To measure the temperament and character dimensions, Cloninger and his colleagues developed the Temperament and Character Inventory (TCI). The

CONTACT Samet Kose ✉ sametkose@gmail.com 📍 810 Oak Meadow Dr., PO 682656, Franklin, TN 37068, USA

adult version of TCI has been successfully used in a number of studies in which older adolescents were included as subjects [2]. However, these studies potentially have limitations due to the facts that the psychometric properties of the adult TCI have not been validated for children and adolescents, and the language in the adult instruments may not be suitable for evaluating children and adolescents. Moreover, use of the adult versions of the TCI was found to be less reliable in many adolescents younger than 17 years. In response to this matter, Luby et al. [7] developed the junior version of the TCI in order to provide an instrument for evaluating Cloninger's model of personality in children and adolescents. Basic reliability measures of the Junior TCI (J-TCI) was studied using a community "convenience" sample, from the local shopping mall (*n* = 322, 145 boys, 177 girls, with an age range of 9–13 years), with Cronbach's alphas ranging from 0.44 to 0.77. However, the sample size was not large enough to conduct detailed analyzes of psychometric properties. Junior versions of the TCI for children and adolescents are as yet less widely employed [7–17]. Out of these studies, using a representative Korean sample (663 middle-school students, 360 males and 303 females), Lyoo et al. [13] examined the reliability and validity of Junior version of the TCI, with Cronbach's alpha values ranging from 0.48 to 0.80 for the temperament and from 0.64 to 0.68 for the character scales. Factorial analysis revealed three out of four temperament scales and three factors of three character scales. Schmeck et al. [16] also reported Cronbach's alpha values ranging from 0.48 to 0.81 on the J-TCI.

In light of these considerations, we developed a Turkish version of the J-TCI-Revised (J-TCI-R) using the same methodology in developing the adult version of the TCI [5,6]. The objective of the present study was to establish psychometric properties and factorial validity of the Turkish J-TCI-R in representative healthy Turkish children and adolescent sample and obtain normative data for future epidemiological and clinical studies in children and adolescents in Turkey.

Material and methods

Study participants

Participants were recruited from co-ed elementary and middle schools (students from 3rd to 7th grades) chosen from a broad range of socioeconomic districts in Tokat, Turkey. Subjects were in the age range of 8-15 in order to represent Turkish population demographically. We enrolled 546 boys and 583 girls. The present study was approved by the Ethics Committee of Gaziosmanpasa University's Ethics Committee. The study was explained to the participants and written informed consents were obtained from the parents of

Table 1. Sociodemographic characteristics of the sample.

	n	%
Gender		
Male	546	48.4
Female	583	51.6
Age (years)		
8	3	0.3
9	162	14.3
10	189	16.7
11	242	21.4
12	274	24.3
13	225	19.9
14	28	2.5
15	6	0.5
Education of mothers		
Less than elementary school	76	6.5
Elementary	552	47
Middle school	171	14.6
High school	256	21.8
College	96	8.2
Education of fathers		
Less than elementary school	13	1.1
Elementary	292	24.9
Middle school	192	16.3
High school	340	28.9
College	311	26.5
Economic status		
Lower	646	55.0
Middle	479	40.8
Upper	41	3.5

all participants. Sociodemographic characteristics of the sample are presented in Table 1.

Participants were able to read and write Turkish, free of psychiatric disorders (major depressive disorder, anxiety disorders, psychotic disorder, autism spectrum disorder, obsessive–compulsive disorder, post-traumatic stress disorder, mental retardation, history of suicide attempt, and substance abuse). Participants with neurological disorders (cerebrovascular disorders, convulsions, meningitis, and encephalitis) or with a history of abnormal CT or MRI scans, or on psychotropic medications were all excluded.

Psychometric measurements

Participants were administered a questionnaire for sociodemographic information. Participants who had missing answers for any items were excluded.

The Turkish version of the J-TCI
The J-TCI-R has been translated into Turkish by Samet Kose, and back-translated into English by Feryal Celikel, who was blinded to the original items. After establishing semantic equivalence of the TCI items, the content equivalence of all items was examined, and no items were excluded as being irrelevant to Turkish culture. Following the Brislin's established guidelines [18] the final version of the Turkish TCI was developed and administered to the participants. This version of J-TCI-R evaluates six higher order personality traits – four temperament and two higher order character traits. Each of the temperament and character traits is multifaceted, consisting of several lower order components. Table 2 summarizes these traits.

Table 2. Temperament and character subscales, total items in subscales, mean SD, and Cronbach's α for total, male, and female participants.

	Total ($n = 1129$)				Male ($n = 546$)		Female ($n = 583$)	
	Total items in subscale	Mean	SD	α	Mean	SD	Mean	SD
NS1 (Exploratory Excitability)	6	5.06	2.37	0.23	4.95	2.41	5.16	2.33
NS2 (Impulsiveness)	6	2.65	2.17	0.33	2.68	2.13	2.62	2.21
NS3 (Extravagance)	6	2.07	2.05	0.35	1.98	2.00	2.15	2.08
NS4 (Disorderliness)	6	3.11	2.09	0.33	3.10	2.12	3.12	2.06
HA1 (Anticipatory worry)	6	3.95	2.29	0.29	3.73	2.35	4.16	2.21
HA2 (Fear of uncertainty)	4	3.30	1.99	0.25	2.99	1.91	3.58	2.02
HA3 (Shyness with strangers)	5	3.13	1.65	0.08	3.03	1.59	3.22	1.71
HA4 (Fatigability and asthenia)	6	5.04	2.54	0.40	4.83	2.56	5.24	2.52
RD1 (Sentimentality)	4	4.90	2.04	0.40	4.82	2.05	4.97	2.04
RD2 (Openness)	4	2.95	2.01	0.29	3.01	2.04	2.89	1.98
RD3 (Attachment)	6	7.08	2.33	0.35	6.98	2.33	7.17	2.32
RD4 (Dependence)	5	5.87	2.11	0.21	5.81	2.13	5.93	2.10
PS1 (Eagerness)	4	3.73	2.13	0.32	3.50	2.07	3.95	2.15
PS2 (Working Hard)	5	5.36	2.52	0.50	5.20	2.55	5.52	2.49
PS3 (Ambitiousness)	4	4.54	1.47	0.17	4.52	1.45	4.57	1.48
PS4 (Perfectionism)	5	5.33	2.20	0.24	5.16	2.17	5.48	2.21
SD1 (Responsibility)	7	9.10	3.39	0.51	8.91	3.79	9.26	2.97
SD2 (Purposefulness)	6	6.66	2.84	0.50	6.46	2.86	6.84	2.81
SD3 (Resourcefulness)	6	6.95	2.89	0.54	6.69	2.94	7.19	2.82
SD4 (Self-Acceptance)	5	5.94	2.39	0.51	5.80	2.33	6.07	2.43
C1 (Social Acceptance)	6	5.89	2.67	0.42	5.65	2.66	6.12	2.67
C2 (Empathy)	5	6.46	2.48	0.55	6.02	2.51	6.87	2.38
C3 (Helpfulness)	4	6.30	1.75	0.49	6.27	1.77	6.32	1.73
C4 (Compassion)	4	5.29	2.07	0.50	5.05	2.14	5.51	1.98

Statistical analysis

The J-TCI-R raw scores, means, and standard deviations were calculated by using the Windows-Based Turkish J-TCI-R Program (Version 1.0. Kose and Basgok, 2008). All statistical analysis were performed with the SPSS Version 16 for Windows (SPSS Inc, Chicago, IL). Correlation analysis between the J-TCI-R scales and subscales were performed using Pearson's correlation coefficients. The internal consistency of the Turkish J-TCI-R scales and subscales was estimated using Cronbach's alpha coefficients. Based on the theoretical structure, three sets of exploratory factorial analyzes were performed: combined model of temperament and character scales, temperament scales only, and character scales only. Principal factor analyzes with Oblique rotations were used in the factor analyzes.

Results

Sociodemographic characteristics of our sample were presented in Table 1. The mean and standard deviation and Cronbach's alpha scores for the temperament and character scales and subscales were presented in Tables 2 and 3, respectively.

Correlations of age with the TCI scales

Inter-correlations among the four temperament dimensions and two character dimensions and age are shown in Table 4. All of the correlation coefficients between character and temperament subscales were significant at $p < .05$ level except the correlation between SD and HA. For the temperament scales, the correlation coefficients between RD and P ($r = 0.52$, $p < .01$) and RD and SD ($r = 0.57$, $p < .01$) were higher than the correlations between the other subscales ($r < 0.27$, $p < .01$). In terms of correlation coefficients between temperament and character scales, the correlation coefficients between P and SD ($r = 0.68$, $p < .01$), P and C ($r = 0.64$, $p < .01$), and between RD and C ($r = 0.67$, $p < .05$) were higher than the correlation coefficients between other subscales. Age was found to be positively correlated with NS ($r = 0.19$, $p < .01$), and negatively correlated with RD ($r = -0.06$, $p < .05$) and C ($r = -0.06$, $p < .05$). As age increased, NS scores increased, and RD and C scores decreased.

Correlations of gender with the TCI scales

Our study sample is well distributed by gender (51.6% female participants). The results indicated that the

Table 3. Temperament and character scales, total items in scales, mean SD, and Cronbach's α for total, male, and female participants.

Scale	Total items scale	Total ($n = 1129$)			Male ($n = 546$)			Female ($n = 583$)		
		Mean	SD	α	Mean	SD	α	Mean	SD	α
NS	24	12.90	5.78.	0.60	12.72	5.68	0.59	13.06	5.87	0.62
HA	21	15.44	5.78	0.61	14.61	5.62	0.57	16.21	5.83	0.62
RD	19	20.82	5.67	0.60	20.64	5.73	0.61	20.98	5.61	0.60
PS	18	18.98	5.90	0.66	18.39	5.90	0.66	19.53	5.86	0.66
SD	24	28.66	8.86	0.79	27.88	9.19	0.78	29.38	8.48	0.79
C	19	23.95	6.71	0.75	23.02	6.93	0.76	24.83	6.38	0.74

Note: NS, Novelty Seeking; HA, Harm Avoidance; RD, Reward Dependence; P, Persistence; SD, Self-Directedness; and C, Cooperativeness.

Table 4. Correlations between temperament and characters scales and age (*n* = 1129).

Scale	NS	HA	RD	PS	SD	C	Age
NS							
HA	0.27**						
RD	0.14**	0.25**					
PS	0.14**	0.10**	**0.52****				
SD	0.10**	0.04	**0.57****	**0.68****			
C	0.07*	0.19**	**0.67****	**0.64****	**0.67***		
Age	0.19**	−0.04	−0.06*	−0.02	−0.02	−0.06*	

Notes: NS, Novelty Seeking; HA, Harm Avoidance; RD, Reward Dependence; P, Persistence; SD, Self-Directedness; and C, Cooperativeness. Coefficients greater than or equal to 0.40 are shown in bold.
*p < .05.
**p < .01.

female participants had significantly higher mean scores of NS (*M* = 13.06, SD = 5.87) and RD (*M* = 20.98, SD = 5.61) than the males (*M* = 12.72, SD = 5.68, *t* = −0.966, df = 1127, *p* < .33, *d* = 0.05; *M* = 20.64, SD = 5.73, *t* = −1.011, df = 1127, *p* < .31, *d* = 0.05) with very small effect sizes. They also had significantly higher mean scores of HA (*M* = 16.21, SD = 5.83), and P (*M* = 19.53, SD = 5.86) compared to the male participants (*M* = 14.61, SD = 5.62, *t* = −4.704, df = 1127, *p* < .01, *d* = 0.27; *M* = 18.39, SD = 5.90, *t* = −3.258, df = 1127, *p* < .01, *d* = 0.19) with a medium and a small effect sizes. As for the character dimensions, female participants had significantly higher mean scores of SD (*M* = 29.38, SD = 8.48) and C (*M* = 24.83 SD = 6.38) than males with a small and a medium effect sizes (*M* = 27.88, SD = 9.19, *t* = −2.852, df = 1127, *p* < .01, *d* = 0.16; *M* = 23.02, SD = 6.93, *t* = −4.588, df = 1127, *p* < .01, *d* = 0.27).

Internal consistency

The Cronbach's alpha coefficients for the Turkish J-TCI-R scales ranged from 0.60 and 0.66 for the temperament scales, and from 0.75 and 0.79 for the character scales (Table 2). The lowest alpha values were observed for the RD (0.60) and the NS (0.60) scales.

The Cronbach's alpha coefficients for the Turkish J-TCI-R subscales were relatively consistent within each of the scales except for the HA and the PS scales. Although the character and temperament subscales had fewer items than the higher order scales, 11 of the 24 subscales had alpha values above 0.40. The alpha coefficients of Turkish J-TCI-R were comparable to other cultures. Cross-cultural comparison of internal consistency measures for six countries were shown in Table 5.

Test–retest reliability of the Turkish J-TCI-R

There was a period of one month between test and retest administrations and 841 adolescents participated in the retest procedure. Participants who had more than five missing answers in baseline J-TCI or repeat J-TCI forms (*n* = 45) were excluded. The remaining 796 participants were included in data analysis. All the scales and subscales of J-TCI-R were positively and significantly correlated with retest scores. The test–retest correlation coefficients for NS, HA, RD, P, SD, and C were found to be 0.600, 0.578, 0.582, 0.639, 0.715, and 0.674, respectively. At the subscale level, the test–retest correlation coefficients were statistically significant and ranged from 0.366 to 0.582. All correlation coefficients for J-TCI-R were found to be statistically significant at *p* < .01 level. Results of correlation coefficients between test and retest scores of all scales and subscales were presented in Table 6 in detail.

Factor structure of the Turkish TCI

Factor analysis of the temperament subscales

Factor structure of the temperament scales was explored with an exploratory factor analysis using a condition of Eigenvalues greater than 1 rule for retaining factors. The results indicated that a four-factor solution did not provide a strong fit. On the other hand, a three-factor solution showed a better factor orientation. The result of the three factors structure of temperament scales was shown in Table 7. For the temperament dimensions, three subscales of RD and all of the P subscales loaded on factor 1. All of the HA subscales loaded on factor 2 and all of the NS subscales loaded on factor 3. These three factors accounted for 21.93%, 12.35%, and 9.11% of the variance (43.40%

Table 5. Cronbach's alpha values for different versions of J-TCI.

Scale	US (*n* = 322) elementary and early age adolescents	France (*n* = 452) secondary school students	Portugal (*n* = 801) adolescents	Norway (*n* = 1193) high school students	South Korea (*n* = 663) middle-school students	Turkey (*n* = 1129) elementary and early age adolescents
NS	0.77	0.52	0.76	0.79	0.64	0.60
HA	0.83	0.74	0.67	0.85	0.80	0.61
RD	0.62	0.31	0.57	0.79	0.59	0.60
P	0.50	0.62	0.66	0.80	0.48	0.66
SD	0.75	0.67	0.76	0.84	0.68	0.79
C	0.78	0.70	0.82	0.81	0.64	0.75

Note: NS, Novelty Seeking; HA, Harm Avoidance; RD, Reward Dependence; P, Persistence; SD, Self-Directedness; and C, Cooperativeness.

Table 6. Test–retest correlations (baseline and one month) for temperament and character scales and subscales ($n = 795$).

Temperament		Character	
Scale and subscale	Correlation coefficients	Scale and subscale	Correlation coefficients
NS	0.600**	SD	0.715**
HA	0.578**	C	0.674**
RD	0.582**		
PS	0.639**		
NS1	0.396**	SD1	0.582**
NS2	0.408**	SD2	0.565**
NS3	0.518**	SD3	0.546**
NS4	0.441**	SD4	0.523**
HA1	0.393**	C1	0.550**
HA2	0.436**	C2	0. 527**
HA3	0.353**	C3	0. 451**
HA4	0.480**	C4	0.485**
RD1	0.557**		
RD2	0.446**		
RD3	0.459**		
RD4	0.366**		
PS1	0.411**		
PS2	0.542**		
PS3	0.399**		
PS4	0.479**		

$**p < .01.$

cumulatively). Interfactor correlations were 0.40 between Factors 1 and 2, 0.18 between Factors 1 and 3, and 0.37 between Factors 2 and 3.

Factor analysis of the character subscales

Factor structure of the character subscales was explored with an exploratory factor analysis using a condition of Eigenvalues greater than 1 rule for retaining factors. The results indicated that one-factor solution provided a good fit explaining 48% of the variance. However, to inspect if character scales would differ, another exploratory factor analysis with the two-factor solution was conducted. The two-factor solution explained 57.99% of the variance. The results indicated that SD2, SD3, and SD4 loaded on the first factor and C1, C2, and C4 loaded on the second factor. Both SD1 and C2 did not load on their respective factors. The

interfactor correlations were 0.75 between Factors 1 and 2. The result of the one and two factors structure of character subscales was shown in Tables 8 and 9.

Factor analysis of all temperament and character subscales in one solution

An exploratory factor analysis with all temperament and character dimensions was performed to reproduce the original J-TCI's proposed six factorial structure. However, the results generated a four-factor model. Factor loadings of the factor structure were shown in Table 10. A preset six-factor solution was performed with all temperament and character subscales. The factor structure did not provide strong results. More information about the results is available upon request.

Discussion

The present study provided normative data and studied reliability and validity of the Turkish J-TCI-R with 1129 Turkish children and adolescents. The results indicated three temperament factors and two character factors were similar to Lyoo et al. [13] and Vangerbg

Table 7. Factor structure of temperament subscales in four-factor solution.

Subscale	Factor 1(RD, PS)	Factor 2 (HA)	Factor 3 (NS)
Eigenvalues	3.51	1.97	1.45
Variation (%)	21.93	12.35	9.11
NS1	**0.30**		**0.39**
NS2			**0.51**
NS3			**0.54**
NS4			**0.61**
HA1		**0.57**	
HA2		**0.59**	
HA3		**0.60**	
HA4		**0.30**	
RD1	**0.40**	**0.30**	
RD2	**0.31**		
RD3	**0.66**		
RD4		**0.33**	
PS1	**0.50**		
PS2	**0.73**		
PS3	**0.52**		
PS4	**0.50**		

Notes: Only factor loadings with absolute value of ≥30 are shown, except within subscales. Oblique rotations with principal factor analysis estimation were performed. Loadings with absolute value greater than or equal to 0.40 are shown in bold.

Table 8. Factor structure of character subscales in one-factor solution.

Eigenvalues	3.86
Variation (%)	48.25
Subscale	Factor 1(SD,C)
SD1	**0.61**
SD2	**0.66**
SD3	**0.72**
SD4	**0.64**
C1	**0.59**
C2	**0.60**
C3	**0.59**
C4	**0.68**

Notes: Only factor loadings with an absolute value of ≥30 are shown, except within subscales. Loadings with an absolute value greater than or equal to 0.40 are shown in bold. NS, Novelty Seeking; HA, Harm Avoidance; RD, Reward Dependence; P, Persistence; SD, Self-Directedness; and C, Cooperativeness.

Table 9. Factor structure of character subscales in two-factor solution.

Subscale	Factor 1(C)	Factor 2 (SD)
Eigenvalues	3.86	0.78
Variation (%)	48.25	9.74
SD1		
SD2	**0.75**	
SD3	**0.71**	
SD4	**0.44**	
C1		**0.49**
C2	**0.37**	
C3		**0.36**
C4		**0.82**

Notes: Only factor loadings with an absolute value of ≥30 are shown, except within subscales. Oblique rotations with principal axis factoring were performed. Loadings with an absolute value greater than or equal to 0.40 are shown in bold.

Table 10. Factor structure of temperament and character subscales in four-factor solution.

Subscale	Factor 1 (SD, C, PS)	Factor2 (HA)	Factor 3 (NS)	Factor 4 (RD, C)
Eigenvalues	6.46	2.35	1.58	1.01
Variation (%)	26.92	9.08	6.59	4.22
NS1	0.15	0.01	**0.38**	0.17
NS2	0.04	0.06	**0.53**	−0.17
NS3	−0.14	−0.05	**0.49**	0.06
NS4	−0.05	0.11	**0.56**	0.07
HA1	0.02	**0.56**	0.18	−0.06
HA2	0.07	**0.58**	−0.14	−0.08
HA3	0.05	**0.32**	0.07	−0.01
HA4	0.14	**0.58**	0.09	0.15
RD1	0.23	0.22	−0.08	**0.30**
RD2	0.27	0.05	−0.09	0.04
RD3	**0.33**	−0.13	−0.01	**0.45**
RD4	0.02	0.24	0.01	**0.38**
PS1	**0.67**	0.05	0.07	−0.22
PS2	**0.71**	−0.04	−0.08	−0.00
PS3	0.24	−0.00	0.19	0.36
PS4	**0.36**	0.04	−0.17	0.15
SD1	**0.62**	−0.02	−0.12	0.03
SD2	**0.72**	−0.04	0.13	−0.05
SD3	**0.68**	−0.11	0.21	0.09
SD4	**0.58**	0.00	0.07	0.07
C1	**0.53**	0.18	−0.11	0.04
C2	0.24	−0.00	0.05	**0.48**
C3	0.19	−0.05	−0.06	**0.56**
C4	**0.47**	0.07	−0.26	0.23

Notes: Oblique rotations with principal axis factoring were performed. Loadings with absolute value greater than or equal to 0.30 are shown in bold.

et al. [12] findings with samples of Korean and Norwegian children. The scales and subscales had good internal consistency and test–retest reliability over one month. The findings provide interesting information about the psychometrics of personality assessment in younger children. Overall, the psycho-biological model of personality was partially supported by our results despite the limitations of self-reports by children younger than age 14.

All of the J-TCI-R scales revealed acceptable levels of internal consistencies which were similar to the levels found in the original J-TCI-R validation study [7]. The range of internal consistency coefficients for the subscales was relatively low comparing to Kose et al.'s [5,6] normative adult sample. This might be due to the fact that adolescence is a developmental

period where high level of emotional and developmental changes is expected, which might reflect as larger variances in personality dimensions. The present study also reports sufficient test–retest reliability of the Turkish J-TCI. The correlation between scores across a one-month interval was statistically significant at both scale and subscale levels.

In the present study, when exploratory factor analysis was conducted separately on temperament and character scales, three temperament and two characters factors were successfully extracted. When all of the temperament and character subscales were subjected to an exploratory factor analysis with an original fixed six-factor solution, the results did not successfully extract a six-factor solution. The similar results were observed in studies of J-TCI in a Korean sample and adult TCI studies with Turkish and American samples [5–7,13]. These findings suggest an alternative hypothesis: temperament and character traits may be less fully developed in younger than in older children.

Previous J-TCI validation studies with Norwegian and Korean samples extracted three and four-factor solutions for temperament scales and three-factor solutions for character scales [12,13]. Those studies, however, rather than extracting a six or seven-factor solution for all the subscales, reported separate factor analysis for temperament and character subscales due to non-linear relations between temperament and character that invalidate the assumptions of linear factor analysis [13]. In Cloninger's original TCI validation, and the Dutch validation of TCI, a seven-factor solution from combined the temperament and character scales were extracted. However, the seven-factor solution was not extracted in a study with older people in the US [19]. Kose et al. [5] reported the factorial structure of adult TCI in a Turkish sample and they were able to extract a six-factor solution. The discrepancy between the studies might be due to social, cultural, and environmental differences or due to the internal weakness of the scales and methodological issues such as the limitations of linear factor analysis.

Significant correlations observed between the scales were ranging from 0.07 to 0.67. The correlations above 0.40 (shown boldface in the table) indicate the J-TCI-R scales does not have similar level of independence as adult TCI [7]. Consistent with personality development theories, the results imply that these character traits may not be as well differentiated and independent from each other as they are in adulthood [6].

In terms of gender differences, females had significantly higher mean scores of NS, HA, RD, P, SD, and C than males with higher effect sizes detected for the HA and C scales. The findings were consistent with previous findings reported by Kose et al. [5,6] in an adult Turkish sample indicating females had higher scores in RD, HA, NS, and C and were consistent with J-TCI in a Korean and a US sample indicating

Table 11. *T*-test results comparing children under 12 years old and above on temperament and character scales and subscales.

	9–11 years old (n = 593)		12–14 years old (n = 527)				
	Mean	SD	Mean	SD	t	P	Cohen's d
NS1 (Exploratory Excitability)	4.97	2.37	5.18	2.37	−1.48	0.139	
NS2 (Impulsiveness)	2.43	2.11	2.89	2.22	−3.66	0.000**	
NS3 (Extravagance)	1.76	1.94	2.41	2.11	−5.36	0.000**	
NS4 (Disorderliness)	2.82	2.03	3.44	2.13	−5.04	0.000**	
NS	11.98	5.49	13.94	5.97	−5.72	0.000**	−0.34[b]
HA1 (Anticipatory worry)	3.83	2.31	4.09	2.27	−1.93	0.053*	
HA2 (Fear of uncertainty)	3.67	1.95	2.88	1.96	6.75	0.000**	
HA3 (Shyness with strangers	3.05	1.61	3.24	1.72	−1.86	0.063	
HA4 (Fatigability and asthenia)	5.24	2.64	4.84	2.42	2.62	0.009**	
HA	15.79	5.79	15.06	5.77	2.13	0.034*	0.13[a]
RD1 (Sentimentality)	5.03	2.07	4.76	2.02	2.22	0.027*	
RD2 (Openness)	3.17	2.05	2.73	1.94	3.67	0.000**	
RD3 (Attachment)	7.12	2.42	7.07	2.24	0.36	0.722	
RD4 (Dependence)	5.95	2.22	5.79	1.99	1.30	0.193	
RD	21.28	5.94	20.35	5.35	2.73	0.006**	0.16[a]
P1 (Eagerness)	3.92	2.15	3.54	2.10	2.97	0.003**	
P2 (Working Hard)	5.66	2.54	5.05	2.48	4.03	0.000**	
P3 (Ambitiousness)	4.51	1.52	4.59	1.42	−0.98	0.326	
P4 (Perfectionism)	5.35	2.25	5.33	2.15	0.14	0.885	
P	19.44	5.97	18.52	5.81	2.59	0.010**	0.16[a]
SD1 (Responsibility)	9.48	3.05	8.67	3.70	3.99	0.000**	
SD2 (Purposefulness)	6.66	2.96	6.66	2.72	−0.13	0.895	
SD3 (Resourcefulness)	6.86	3.02	7.07	2.75	−1.22	0.221	
SD4 (Self-Acceptance)	6.18	2.33	5.69	2.42	3.47	0.001**	
Self-Directedness	29.19	8.98	28.13	8.69	2.01	0.045*	0.12[a]
C1 (Social Acceptance)	6.30	2.72	5.45	2.56	5.36	0.000**	
C2 (Empathy)	6.39	2.48	6.56	2.49	−1.15	0.251	
C3 (Helpfulness)	6.36	1.74	6.26	1.72	0.92	0.356	
C4 (Compassion)	5.47	2.05	5.11	2.08	2.94	0.003**	
C	24.53	6.74	23.39	6.62	2.85	0.004**	0.17[a]

[a]Small effect size.
[b]Medium effect size.
*p < .05.
**p < .01.

females had higher scores of RD and C than males. It was argued that women's brain evolved much earlier than men's in order to provide effective caretaking and parenting to their offspring [5]. In addition to that, higher scores on HA and C was evaluated to be consistent with expected female personality characteristics in more traditional societies (e.g. Turkish society).

Luby et al.'s study [7] reported that older participants had higher NS scores and lower HA scores. In this present study, older participants had higher NS, which was consistent with the findings of Luby et al.'s study [7]. The positive correlation between age and NS is consistent with child development literature indicating that as children grow up, they tend to individuate from family and have greater tendency to explore and perform risky behaviors. Our findings that age was found to be positively correlated with NS provides a further signal about early puberty effect on NS. It was also interesting to note that RD and PS did not separate well in our sample and that SD and C overlapped so much. Self-report, especially in younger children, is challenging as shown by the lack of discrimination and weaker reliability than in older children and adults. *T*-test results comparing children under 12 years old and above on temperament and character scales and subscales revealed that these two different age groups have different personality profiles

in terms of all scale scores and most subscale scores (Table 11). Cloninger's adolescent version of the TCI-3 is known to be working well down to age 12–13 and we might speculate that the J-TCI-R overlaps with the TCI-3 for this age group. However, younger children (9- to 11-year-old) may require parent report for good discrimination. We might also speculate that elementary students before puberty are so regimented by the authority that they do not distinguish RD and PS well or SD and C well (reflecting latency phase). Our findings in a large sample from both age groups provide further insight on the developmental perspective of younger children and early adolescents.

The results reported in this study should be considered in light of certain limitations. First, this study included elementary and middle-school students from 3rd grade to 7th grade. Future studies could extend this study by focusing on examining psychometric properties of the scale for the entire childhood population and examine changes in temperament and character from childhood to adolescence and then to adulthood. Second, since the results are from children and adolescents in Turkey, the results may not easily be generalizable to other culturally diverse ethnic populations. The studies exploring Cloninger's J-TCI in in different cultures will shed light on normalcy and psychopathology among people from different cultures. Lastly, Eigenvalues greater than one rule

was used to retain factors in factor analysis. This study did not include other suggested analysis such as Velicer's Minimum Age Partial and parallel test.

In conclusion, the present study is the first to investigate the psychometric properties of J-TCI-R in a representative sample of children and adolescents in Turkey. Factor structure of temperament and character scales of J-TCI-R is similar to factorial structure observed in the adult population in Turkey [5,6]. Results overall indicate that the Turkish J-TCI-R is a valuable measurement tool to examine personality dimensions in children and adolescents in Turkey. Additionally, our data provide sufficient reliability of the scale and subscales in this specific population where temperament and character traits are still developing. Further research using the J-TCI-R in examining temperament and character of children and adolescents in clinical and other populations is needed. Further research would provide valuable information to the mental health professionals in developing better management and treatment plans in predicting risky behaviors and prognosis.

Disclosure statement

ORCID

Samet Kose 🄳 http://orcid.org/0000-0003-0841-004X
Ilker Etikan 🄳 http://orcid.org/0000-0001-9171-8269
C. Robert Cloninger 🄳 http://orcid.org/0000-0003-3096-4807

References

[1] Cloninger CR. A systematic method for clinical description and classification of personality variants. Arch Gen Psychiatry. 1987;44:573–588.

[2] Cloninger CR, Svrakic DM, Przybeck TR. A psychobiological model of temperament and character. Arch Gen Psychiatry. 1993;50:975–990.

[3] Gillespie NA, Cloninger CR, Heath AC, et al. The genetic and environmental relationship between Cloninger's dimensions of temperament and character. Pers Individ Diff. 2003 Dec 1;35(8):1931–1946.

[4] Josefsson K, Cloninger CR, Hintsanen M, et al. Associations of personality profiles with various aspects of well-being: a population-based study. J Affect Disord. 2011 Sep;133(1–2):265–273.

[5] Kose S. A psychobiological model of temperament and character: TCI. New Symp. 2003;41(2):86–97.

[6] Kose S, Sayar K, Kalelioglu U, et al. Normative data and factorial structure of the Turkish version of the Temperament and Character Inventory. Compr Psychiatry. 2009 Jul–Aug;50(4):361–368.

[7] Luby JL, Svrakic DM, McCallum K, et al. The Junior Temperament and Character Inventory: preliminary validation of a child self-report measure. Psychol Rep. 1999 Jun;84(3 Pt 2):1127–1138.

[8] Andriola E, Donfrancesco R, Zaninotto S, et al. The Junior Temperament and Character Inventory: Italian validation of a questionnaire for the measurement of personality from ages 6 to 16 years. Compr Psychiatry. 2012 Aug;53(6):884–892.

[9] Asch M, Cortese S, Perez Diaz F, et al. Psychometric properties of a French version of the Junior Temperament and Character Inventory. Eur Child Adolesc Psychiatry. 2009 Mar;18(3):144–153.

[10] Constantino JN, Cloninger CR, Clarke AR, et al. Application of the seven-factor model of personality to early childhood. Psychiatry Res. 2002;109(3):229–243.

[11] Chotai J, Jonasson M, Hägglöf B, et al. Adolescent attachment styles and their relation to the temperament and character traits of personality in a general population. Eur Psychiatry. 2005;20(3):251–259.

[12] Vangberg H, Eisemann M, Waterloo K, et al. The Norwegian Junior Temperament and Character Inventory (JTCI): an assessment of its psychometric properties (English). Compr Psychiatry. 2013;54(7):904–910.

[13] Lyoo IK, Han CH, Lee SJ, et al. The reliability and validity of the Junior Temperament and Character Inventory. Compr Psychiatry. 2004;45(2):121–128.

[14] Moreira PA, Oliveira JT, Cloninger KM, et al. The psychometrics and validity of the Junior Temperament and Character Inventory in Portuguese adolescents. Compr Psychiatry. 2012;53(8):1227–1236.

[15] Pitzer M, Esser G, Schmidt MH, et al. Temperament in the developmental course: a longitudinal comparison of New York Longitudinal Study–derived dimensions with the Junior Temperament and Character Inventory. Compr Psychiatry. 2007;48(6):572–582.

[16] Schmeck K, Goth K, Poustka F, et al. Reliability and validity of the Junior Temperament and Character Inventory. Int J Methods Psychiatry Res. 2001;10(4):172–182.

[17] Tillman R, Geller B, Craney JL, et al. Temperament and character factors in a prepubertal and early adolescent bipolar disorder phenotype compared to attention deficit hyperactive and normal controls. J Child Adolesc Psychopharmacol. 2003;13(4):531–543.

[18] Brislin RW. Back-translation for cross cultural research. J Cross Cult Psychol. 1970;1:185–216.

[19] Herbst JH, Zonderman AB, McCrae RR, et al. Do the dimensions of the temperament and character inventory map a simple genetic architecture? Evidence from molecular genetics and factor analysis. Am J Psychiatry. 2000;157(8):1285–1290.