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

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Abstract

Cloninger's dimensional psychobiological model of personality accounts for both normal and abnormal variation in 2 major personality components: temperament and character. Here, we examined the psychometric properties of the Turkish version of the Temperament and Character Inventory (TCI) in a healthy Turkish population, obtaining normative data for the Turkish TCI. The study was conducted in healthy volunteers at both Karadeniz Technical University School of Medicine and Atatürk University School of Medicine (n = 683). The Turkish sample had significantly lower mean scores on Novelty Seeking and Reward Dependence and higher mean scores on Harm Avoidance than the American sample. The Turkish sample had significantly lower scores on Self-Directedness, Cooperativeness, and Self-Transcendence. Self-Directedness and Harm Avoidance, Cooperativeness and Reward Dependence, and Cooperativeness and Self-Directedness were intercorrelated. The Cronbach coeficients were between 0.60 and 0.85 on temperament dimensions, and between 0.82 and 0.83 on character dimensions. The lowest Cronbach coefficients were found in Reward Dependence (0.60) and Persistence (0.62). A principal axis factor analysis with a 4-factor solution revealed the highest loadings on Novelty Seeking and Harm Avoidance and relatively weaker loadings on Reward Dependence and Persistence. A 3-factor solution for character subscales indicated the highest loadings on Cooperativeness and Self-Transcendence. The factorial structure was consistent with Cloninger's 7-factor model of personality, and test-retest indicated a good stability of scores over time. The reliability and factorial validity of the Turkish version of the TCI are therefore supported.
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1. Introduction

Cloninger's dimensional psychobiological model of personality accounts for both normal and abnormal variation in 2 major personality components: temperament and character [1,2]. Cloninger's model was initially based on a synthesis of information from twin and family studies, studies of longitudinal development, neuropharmacologic and neurobehavioral studies of learning in humans and other animals, and psychometric studies of personality in individuals and in twin pairs [1,2].

Cloninger's concepts of personality elaborates 4 dimensions of temperament—Novelty Seeking (NS), Harm Avoidance (HA), Reward Dependence (RD), and Persistence (P). They are thought to be genetically independent traits and are moderately inheritable and stable throughout life. *Novelty Seeking* is thought to be derived by the behavioral activation system. It reflects the tendency of an individual toward exhilaration in response to novel stimuli and cues. Subjects with high scores on NS show an increased frequency of exploratory behavior, impulsive decision making, quick temper loss, and active frustration avoidance. *Harm Avoidance* is related to the behavioral inhibition system. It reflects the tendency of an individual to inhibit or

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interrupt behaviors. Subjects with high scores on HA are pessimistic, worrying, fatigable, and shy with strangers, and become tense in unfamiliar situations. *Reward Dependence* involves maintaining or continuing behaviors that have been previously associated with reinforcement and is manifested as sensitivity, sentimentality, and dependency on others' approval. Subjects with high RD scores are described as sentimental, socially attached, and dependent on the approval of others. *Persistence* reflects perseverance in behavior despite frustration, fatigue, and lack of reward [2].

Character reflects individual differences in self-concepts about goals and values in relation to experience that is predominantly determined by socialization. Cloninger's model includes 3 dimensions of character: Self-Directedness (SD), Cooperativeness (C), and Self-Transcendence (ST). The 3 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. *Self-Directedness* expresses individual's competence towards autonomy, reliability, and maturity. *Cooperativeness* is related to social skills, such as support, collaboration, and partnership. *Self-Transcendence* denotes aptitude towards spirituality and idealism [2].

In Cloninger's model, neurotransmitters were hypothesized to be associated with behavioral manifestations: (1) dopamine, NS (behavioral activation); (2) serotonin, HA (behavioral inhibition); (3) norepinephrine, RD (behavioral maintenance); and (4) glutamine, P (behavioral perseverance) [1-3]. Cloninger's model may provide insight into human personality at multiple levels, including genetics of personality, neurobiological foundations of behavior, the cognitive emotional structure and development of personality, the behavioral correlates of individual differences in personality dimensions, and the interactions of personality constellations with developmental factors in relation to the vulnerability to psychiatric disorders [4].

Based on his theory of personality, Cloninger constructed the Temperament and Character Inventory (TCI). The TCI is a self-administered, 240-item true/false questionnaire requiring 20 to 30 minutes to complete. It measures the temperament dimensions of NS and HA by means of 4 subscales, RD by 3 subscales, and P by a single 8-item scale. The character dimensions of SD and C are assessed with 5 subscales, and ST consists of 3 subscales [4].

The TCI has been translated into several languages; normative data and psychometric properties of these versions have been reported (Swedish—Brändström et al, 1998; Dutch—De la Rie et al, 1998, Duijsens et al, 2000; Czech—Kozeny and Höschl, 1999; German—Richter et al, 1999; French—Pelissolo and Lepine, 2000; Japanese—Kijima et al, 2000; Belgian—Hansenne et al, 2001; Italian—Fassiono et al, 2001; Spanish—Gutierrez et al, 2001; Polish—Zakrzewska et al, 2001; Korean—Sung et al, 2002; Chinese—Parker et al, 2003; Australian—Parker et al, 2003) [5-18].

The Turkish version of the TCI has been developed by Samet Kose and Kemal Sayar, and the final version was approved by Cloninger. The objective of the current study was to establish psychometric properties and factorial validity of the Turkish TCI in a healthy Turkish population and obtain normative data for future epidemiologic and clinical studies in Turkish psychiatric patients.

2. Material and methods

2.1. Participants

Healthy volunteers were chosen from 2 universities within Turkey (male, 366; female, 323; mean age, 26.25 ± 10.84 years; range, 18-75 years). Participants were recruited at Karadeniz Technical University (male, 166; female, 183; mean age, 20.75 ± 2.54 years; range, 18-55 years) and Atatürk University (male, 200; female, 140; mean age, 32.15 ± 12.73 years; range, 19-75 years). To estimate test-retest reliability of the Turkish TCI, 103 participants from the original sample completed the questionnaire 1 month after the initial testing. The sociodemographic characteristics of the sample are presented in Table 1.

Table 1
Demographic characteristics of the sample

	n	%
Sex		
Female	320	46.9
Male	363	53.1
Age (y)		
18-25	577	84.5
26-49	85	12.4
50-91	21	3.1
Marital status		
Married	154	22.5
Single	528	77.3
Divorced	1	.1
Education		
Elementary	21	3.1
Middle school	11	1.6
High school	60	8.8
College	591	86.5
Occupation		
Housewife	3	.4
Student	517	75.7
Officer	116	17.0
Worker	20	2.9
Private	24	3.5
Unemployed	2	.3
Retired	1	.1
Residence		
Village	12	1.8
Town	19	2.8
City	652	95.5
Economic status		
Lower	38	5.6
Middle	547	80.1
Upper	98	14.3

The current study was approved by the Ethics Committee of both university hospitals, and written informed consent was obtained from all participants. Participants could read and write Turkish, and were free of psychiatric disorders (major depressive disorder, psychosis, anxiety disorders, autism, mental retardation, history of suicide attempt and of substance abuse). Participants with neurologic disorders (cerebrovascular disorders, convulsions, meningitis, encephalitis), with a history of abnormal computed tomography or magnetic resonance imaging scans, or on psychotrophic medications were excluded.

2.2. Measures

Participants were administered a questionnaire for sociodemographic information. To eliminate socially desirable responders, the Turkish version of the Marlowe-Crowne Social Desirability Scale [19] was used (developed by Samet Kose and Feryal Cam Celikel). Six participants who answered affirmatively to the TCI item 230 ("I have lied a lot on this questionnaire") were also excluded. Participants who had missing answers for any items were also excluded.

Table 2
Temperament and character scales and subscales, mean and SD, and Cronbach α values in Turkish and American samples

	Turkish (n = 683)			American (n = 300)		
	M	SD	α	M	SD	α
NS	18.5	5.00	0.74	19.2	6.0	0.78
NS1 (exploratory excitability)	6.3	1.9	0.52	6.3	2.3	0.60
NS2 (impulsiveness)	3.6	1.9	0.61	3.7	2.2	0.62
NS3 (extravagance)	4.6	2.1	0.62	5.0	2.3	0.71
NS4 (disorderliness)	3.9	1.8	0.45	4.3	2.1	0.54
HA	16.8	6.4	0.85	12.6	6.8	0.87
HA1 (anticipatory worry)	5.6	2.3	0.58	3.2	2.4	0.71
HA2 (fear of uncertainty)	4.1	1.9	0.63	3.6	2.0	0.69
HA3 (shyness with strangers)	3.4	2.2	0.71	3.3	2.3	0.76
HA4 (fatigability and asthenia)	3.6	2.3	0.69	2.5	2.2	0.72
RD	14.1	3.2	0.60	15.5	4.4	0.76
RD1 (sentimentality)	6.9	1.9	0.52	7.3	2.1	0.62
RD3 (attachment)	4.5	1.9	0.67	4.7	2.3	0.72
RD4 (dependence)	2.7	1.4	0.42	3.5	1.6	0.57
P	4.8	1.9	0.62	5.6	1.9	0.65
SD	29.1	6.2	0.83	30.7	7.5	0.86
SD1 (responsibility)	5.1	1.9	0.54	5.8	2.0	0.70
SD2 (purposefulness)	6.0	1.6	0.53	5.5	1.8	0.58
SD3 (resourcefulness)	3.4	1.3	0.51	4.0	1.2	0.57
SD4 (self-acceptance)	5.7	2.6	0.72	6.4	2.8	0.75
SD5 (congruent second nature)	8.9	2.0	0.61	9.0	2.5	0.75
C	29.4	5.9	0.82	32.3	7.2	0.89
C1 (social acceptance)	6.3	1.7	0.63	6.7	1.5	0.64
C2 (empathy)	4.3	1.5	0.49	5.3	1.4	0.47
C3 (helpfulness)	4.8	1.4	0.61	6.3	1.6	0.63
C4 (compassion)	7.1	2.7	0.76	7.6	2.8	0.86
C5 (integrated conscience)	6.9	1.4	0.44	6.5	2.0	0.65
ST	18.6	5.4	0.82	19.2	6.3	0.84
ST1 (self-forgetfulness)	5.9	2.2	0.70	5.9	2.7	0.73
ST2 (transpersonal identity)	4.9	2.1	0.69	4.6	2.4	0.72
ST3 (spiritual acceptance)	7.8	2.8	0.59	8.7	2.9	0.74

2.2.1. The Turkish version of the TCI

The TCI has been translated into Turkish by Samet Kose and reverse-translated into English by Kemal Sayar 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 Brislin's established guidelines [20], the final version of the Turkish TCI was verified and approved by Cloninger.

The TCI evaluates 7 higher-order personality traits: 4 temperament and 3 higher-order character traits. Each of the 7 temperament and character traits is multifaceted, consisting of several lower-order components. Tables 2, 6, and 7 summarize these traits.

2.3. Statistical analysis

The TCI raw scores, mean, and standard deviation were calculated by using the Windows-based Turkish TCI Program (Version 1.0, Kose and Basgok, 2003). All statistical analyses were performed with the SPSS for Windows 12.0 (SPSS Inc, Chicago, IL). A comparison of TCI scores between the Turkish sample and Cloninger's original sample was performed with a 1-sample *t* test. Correlation analyses between the TCI scales and subscales were performed using Pearson correlation coefficients. The internal consistency of the Turkish TCI scales and subscales was estimated using Cronbach α coefficients.

Based on the theoretical structure, 3 sets of exploratory factorial analyses were performed: combined model of temperament and character subscales, temperament subscales only, and character subscales only. Principal factor analyses with Oblimin and Varimax rotations were used.

3. Results

The sociodemographic characteristics of our sample are presented in Table 1. The mean and standard deviation for the temperament and character scales are presented in Table 2.

3.1. Comparison of Turkish TCI scores and US sample scores

Regarding the temperament dimension, the Turkish sample had significantly lower mean scores on NS, NS3, NS4, RD, RD1, RD3, and RD4 than the American sample ($P < .001$). The HA, HA1, HA2, and HA4 mean scores were significantly higher in the Turkish sample than the American sample ($P < .001$). Regarding character dimension, the Turkish sample had significantly lower mean scores on SD, SD1, SD3, SD4, C, C1, C2, C3, C4, C5, ST, and ST3 than the American sample ($P < .001$). The SD2 and ST2 subscale mean scores were significantly higher in the Turkish sample than the American sample ($P < .001$).

Table 3
Correlations between temperament and character scales and age

Scale	NS	HA	RD	P	SD	C	ST	Age
NS								
HA	−0.198							
RD	−0.002	0.025						
P	−0.271	−0.094	0.003					
SD	−0.113	**−0.437**	0.073	0.080				
C	−0.087	−0.182	**0.365**	0.072	**0.427**			
ST	0.090	0.038	0.113	0.182	−0.277	0.048		
Age	−0.223	−0.004	0.078	0.135	−0.123	−0.024	0.034	

Coefficients greater than or equal to 0.30 are shown in bold.

3.2. Correlations of age with the TCI scales

Intercorrelations among the 4 temperament dimensions and 3 character dimensions and sex are shown in Table 3. Three intercorrelation coefficients were greater than 0.30: SD with HA ($r = -0.437$, $P < .01$), C with RD ($r = 0.365$, $P < .01$), and C with SD ($r = 0.427$, $P < .01$). All other intercorrelation coefficients showed weak relationships, ranging from −0.002 to −0.271. Age correlated negatively with NS ($r = -0.223$, $P < .01$) and SD ($r = -0.123$, $P < .05$), and positively with RD ($r = 0.078$, $P < .05$) and P ($r = 0.135$, $P < .01$). As age increases, NS and SD scores decreased; and RD and P scores increased.

3.3. Correlations of sex with the TCI scales

Our study sample is well distributed (46.9% female). The mean scores of NS (M = 18.93, $t = 2.11$, $df = 681$, $P < .05$), HA (M = 17.79, $t = 3.99$, $df = 681$, $P < .001$), and RD (M = 14.56, $t = 3.39$, $df = 681$, $P < .01$) were significantly higher in female than male subjects. For character dimension, female subjects had significantly higher mean scores of C than male subjects (M = 29.95, $t = 2.40$, $df = 681$, $P < .05$).

3.4. Internal consistency

The Cronbach α coefficients for the Turkish TCI scales ranged from 0.60 and 0.85 for the temperament scales and from 0.82 and 0.83 for the character scales (Table 2). The lowest α values were observed for the RD (0.60) and the P (0.62) scales.

The Cronbach α coefficients for the Turkish TCI subscales were relatively consistent within each of the scales except for the NS and the C scale. In summary, 16 of the 24 subscales had α values greater than 0.60. Cross-cultural comparison of internal consistency measures is shown in Table 4.

Table 5
Test-retest correlations for the Turkish TCI after 1 month (n = 103)

Temperament scale and subscale	r_{tt}	Character scale and subscale	r_{tt}
NS	0.66	SD	0.73
HA	0.84	CO	0.53
RD	0.56	ST	0.58
PS	0.52	SD1	0.59
NS1	0.60	SD2	0.58
NS2	0.60	SD3	0.56
NS3	0.65	SD4	0.70
NS4	0.45	SD5	0.55
HA1	0.71	C1	0.43
HA2	0.61	C2	0.51
HA3	0.79	C3	0.18
HA4	0.75	C4	0.57
RD1	0.50	C5	0.33
RD3	0.54	ST1	0.44
RD4	0.46	ST2	0.50

r_{tt} indicates test-retest correlation coefficient.

3.5. Test-retest reliability of the Turkish TCI

Test-retest correlations for the Turkish TCI scales and subscales after 1 month are presented in Table 5. At the subscale level, the test-retest correlation coefficients ranged from 0.33 to 0.79. There were no significant differences between the mean scores of the TCI across the 1-month test-retest period.

3.6. Factor structure of the Turkish TCI

An exploratory factor analysis with all temperament and character dimensions was performed to reproduce the original TCI's proposed factor structure and generated a 6-factor model (Table 6). Although dimensions of

Table 4
Cronbach α values for different versions of the TCI

Scale	Sweden (n = 1300) healthy (1998)	Netherlands (n = 148) healthy (1998)	France (n = 602) healthy (2000)	Japan (n = 461)	Spain (n = 416) psychiatric outpatients (2001)	Korea (n = 851) college students (2002)	China* (n = 535) healthy (2003)	Germany (n = 509) healthy (1999)	Turkey (n = 683) healthy (2004)
NS	0.78	0.79	0.75	0.71	0.75	0.78	0.69	0.77	0.74
HA	0.85	0.88	0.87	0.85	0.86	0.85	0.81	0.84	0.85
RD	0.62	0.72	0.68	0.73	0.67	0.68	0.56	0.69	0.60
P	0.56	0.65	0.49	0.64	0.49	0.60	0.79	0.57	0.62
SD	0.81	0.83	0.82	0.83	0.87	0.87	0.81	0.84	0.83
C	0.75	0.81	0.81	0.82	0.83	0.82	0.73	0.84	0.82
ST	0.84	0.88	0.84	0.82	0.85	0.85	0.83	0.78	0.82

* 144-item TCI.

Table 6
Factor structure of the Turkish TCI

Scale	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
	SD	C	ST	NS	HA	RD
Eigenvalue	4.362	2.693	2.349	1.886	1.171	1.107
Variation (%)	17.4	10.8	9.4	7.5	4.7	4.4
NS1 (exploratory excitability)	0.298	0.120	0.174	0.274	−0.439	0.455
NS2 (impulsiveness)	−0.204	−0.245	0.055	**0.664**	0.034	−0.173
NS3 (extravagance)	−0.047	0.097	−0.033	**0.658**	−0.150	0.188
NS4 (disorderliness)	−0.127	−0.348	0.178	**0.599**	−0.237	0.009
HA1 (anticipatory worry)	**−0.400**	−0.092	0.105	−0.193	**0.536**	−0.074
HA2 (fear of uncertainty)	−0.201	0.004	−0.029	−0.212	**0.767**	−0.144
HA3 (shyness with strangers	−0.193	−0.256	0.002	0.064	**0.708**	−0.356
HA4 (fatigability and asthenia)	**−0.513**	−0.172	0.164	0.091	**0.578**	−0.114
RD1 (sentimentality)	−0.137	0.251	**0.510**	−0.264	0.216	0.340
RD3 (attachment)	0.075	0.036	−0.079	0.074	−0.173	**0.765**
RD4 (dependence)	0.152	0.211	−0.080	0.043	**0.476**	0.357
P	0.194	−0.036	0.320	**−0.612**	−0.172	−0.031
SD1 (responsibility)	**0.610**	0.367	**−0.414**	−0.043	−0.276	0.157
SD2 (purposefulness)	**0.707**	0.227	−0.026	−0.261	−0.078	0.192
SD3 (resourcefulness)	**0.722**	0.158	−0.066	0.003	−0.370	0.083
SD4 (self-acceptance)	0.251	**0.581**	**−0.401**	0.037	−0.090	0.070
SD5 (congruent second nature)	**0.666**	0.227	−0.119	−0.200	0.000	0.197
C1 (social acceptance)	0.210	**0.696**	−0.011	0.005	−0.111	0.198
C2 (empathy)	0.288	**0.512**	0.118	0.106	−0.092	**0.452**
C3 (helpfulness)	0.287	**0.429**	−0.086	−0.062	0.062	**0.591**
C4 (compassion)	0.010	**0.750**	0.117	−0.231	0.013	0.252
C5 (integrated conscience)	0.341	**0.621**	0.195	−0.134	0.201	0.063
ST1 (self-forgetfulness)	−0.257	−0.140	**0.703**	0.002	−0.087	−0.163
ST2 (transpersonal identity)	−0.115	0.138	**0.722**	−0.274	−0.123	0.121
ST3 (spiritual acceptance)	0.109	−0.020	**0.686**	0.238	0.093	−0.097

Oblimin rotations with Kaiser normalization were performed. Loadings with absolute value greater than or equal to 0.40 are shown in bold.

temperament and character are assumed to interact throughout life, character dimensions are predominantly determined by socialization [4]. Principal axis factor analyses with Oblimin rotations were performed for the temperament and character subscales separately based on the theoretical structure of the 7-factor model (Table 7).

For the temperament dimensions, NS and HA subscales loaded robustly, whereas RD and P loaded weakly. These 4 factors accounted for 22.34%, 16.03%, 10.70%, and 8.75% of the variance (57.81% cumulatively). The NS1 subscale loaded negatively on factor 1 (HA) and positively on factor 3 (RD). Dependence (RD4) subscale loaded positively on factor 4 (P). Interfactor correlations were −0.111 between factors 1 and 2, −0.139 between factors 1 and 3, −0.051 between factors 1 and 4, −0.023 between factors 2 and 3, −0.077 between factors 2 and 4, and 0.016 between factors 3 and 4.

For the character dimensions, C and ST factors showed robust loading. Except for the self-acceptance (SD4) subscale of ST, other subscales loaded consistently. The SD4 subscale loaded positively on factor 1 (C) and negatively on factor 3 (ST). The SD1 subscale loaded negatively on ST. These 3 factors accounted for 25.50%, 15.31%, and 9.96% of the variance (50.76% cumulatively). Interfactor correlations were −0.042 between factors 1 and 2, −0.153 between factors 2 and 3, and 0.332 between factors 1 and 3.

An exploratory factor analysis with Varimax rotations was also performed and yielded similar results.

4. Discussion

This study provides normative data for the Turkish TCI and confirms its stability and reliability. Data also show differences between means and standard deviations for the higher- and lower-order dimensions of the TCI between the Turkish sample and American sample. The NS and RD scores of the Turkish sample were lower compared with those of the US sample. The Turkish sample had higher scores on HA compared with the US sample. For the character dimensions, SD, C, and ST scores were lower compared with the US sample. These results are similar to Swedish, Dutch, and French normative samples, which provides a rationale for developing other TCI versions. Differences especially on character dimensions can be explained by different definitions of character concepts in different cultures. Demographic compositions may also contribute to differences in mean scores. Similarly, Brändström et al [5] showed that ST scores were significantly lower than the US sample. De la Rie [6] et al showed that NS and SD scores were higher and that P and ST scores were lower compared with the US sample. Kijima et al [11] reported

Table 7
Factor structure of the temperament and character dimensions of the Turkish TCI

A. Temperament dimensions

Scale	Factor 1	Factor 2	Factor 3	Factor 4
Eigenvalue	2.681	1.923	1.283	1.050
Variation (%)	22.34	16.03	10.70	8.75
NS1 (exploratory excitability)	**−0.497**	0.258	**0.558**	0.052
NS2 (impulsiveness)	0.096	**0.724**	−0.173	−0.036
NS3 (extravagance)	−0.164	**0.651**	0.229	−0.181
NS4 (disorderliness)	−0.122	**0.697**	0.023	0.192
HA1 (anticipatory worry)	**0.692**	−0.118	0.074	0.092
HA2 (fear of uncertainty)	**0.764**	−0.213	−0.144	−0.156
HA3 (shyness with strangers	**0.682**	0.020	−0.396	−0.186
HA4 (fatigability and asthenia)	**0.711**	0.171	−0.077	−0.105
RD1 (sentimentality)	0.324	−0.232	**0.633**	0.111
RD3 (attachment)	−0.274	0.139	**0.619**	−0.275
RD4 (dependence)	0.151	−0.181	0.126	**−0.791**
P	−0.042	**−0.535**	0.235	**0.574**

B. Character dimensions

Scale	Factor 1	Factor 2	Factor 3
Eigenvalue	3.314	1.991	1.295
Variation (%)	25.50	15.31	9.96
SD1 (responsibility)	0.352	**−0.435**	**0.667**
SD2 (purposefulness)	0.302	−0.034	**0.733**
SD3 (resourcefulness)	0.172	−0.079	**0.761**
SD4 (self-acceptance)	**0.519**	**−0.434**	0.269
SD5 (congruent second nature)	0.271	−0.121	**0.711**
C1 (social acceptance)	**0.685**	−0.058	0.252
C2 (empathy)	**0.595**	0.051	0.288
C3 (helpfulness)	**0.565**	−0.145	0.294
C4 (compassion)	**0.758**	0.054	0.044
C5 (integrated conscience)	**0.617**	0.136	0.290
ST1 (self-forgetfulness)	−0.121	**0.739**	−0.268
ST2 (transpersonal identity)	0.195	**0.755**	−0.060
ST3 (spiritual acceptance)	−0.013	**0.704**	0.012

Oblimin rotations with Kaiser normalization were performed. Loadings with absolute value greater than or equal to 0.40 are shown in bold.

that Japanese volunteers had higher HA and lower RD, SD, and C scores compared with the US sample. Why the Turkish sample had lower scores on empathy (C2), helpfulness (C3), and spiritual acceptance (ST3) is unclear because the Turkish are known to be more collectivistic than individualistic.

The present study confirms that some of the Turkish TCI scales are correlated among themselves. The SD scale negatively correlated with HA. This relationship may imply that the anxious subjects have more difficulties in choosing goals and personal values and that they do not accept themselves [2,4]. The C scale correlated with RD and SD, indicating a connectedness and an interpersonal relationship. Other TCI scales showed weaker correlations among themselves, and similar correlations were reported in previous studies [2,5,10,12]. We also report that NS was significantly and negatively varied with age, similar to reports in previous studies, perhaps because of diminishing interest in novel stimuli to accompany increased age and maturity [2,9,11]. Moreover, SD scores negatively correlated with age; this atypical negative correlation between age and SD might be due to a sampling bias with fewer participants older than 50 years. The NS scores were reported to decrease 1 point for every 10 years of life [21].

The sex differences we found were similar to those of Cloninger et al [2]. De La Rie et al [6] reported higher HA, C, and ST scores in Dutch women compared with men. Pelissolo and Lepine [10] reported higher HA, RD, and ST scores and lower SD scores in French women compared with men. Turkish women had higher mean scores on the temperament dimensions of NS, HA, and RD and character dimension of C compared with Turkish men. Higher RD scores in women are found probably in all cultures. Buss proposed [22] that women's brains have evolved earlier than men's brains, perhaps rendering more effective caretaking and parenting. Increased RD would eventually improve women's effective parenting.

Cronbach α coefficients of the Turkish TCI are similar to Cloninger's original TCI. They are high for main scales (≥0.75) except for P (0.62). Persistence is actually a subscale corresponding to RD2 in the very first versions of the Tridimensional Personality Questionnaire (TPQ), with a limited number of items [1]. The current study also

confirmed that the Turkish TCI has good test-retest reliability; and we observed similar correlations across a 1-month interval, indicating stability of the measures over time. Temperament is genetically determined and can be defined in terms of individual differences in percept-based habits and skills, whereas character can be defined in terms of individual differences in concept-based goals and values and conscious expectations [4]. The psychobiological model assumes an interaction between temperament and character scales. These interactions elicit secondary emotions and are essential in the development of personality [23].

An exploratory factor analysis extracted a 6-factor model rather than a pattern consistent with the 7-factor model of the TCI, similar to TCI studies in other cultures. Oblimin rotation is the standard method when one wishes a nonorthogonal solution, that is, one in which the factors are allowed to be correlated. Oblimin factor rotation was preferred given the modest empirical correlations among the dimensions (Table 3). Principal axis factor analysis with Oblimin rotations for the temperament and character subscales separately confirmed the high stability of the 7-factor model developed by Cloninger. The portions of the variance explained by these factor solutions, 57.81% for temperament and 50.76% for character dimensions, were satisfactory compared with other versions of the TCI (58.9% and 48% for Brändström and colleagues, 61.8% and 53% for Richter et al, 53% and 53% for Pelissolo and Lepine, 60.3% and 57.3% for Gutierrez et al, 53% and 54% for Hansenne et al, 61.2% and 56.1% for Sung et al, and 54.5% and 55.2% for Parker and colleagues).

Varimax rotation is an orthogonal rotation of the factor axes to maximize the variance of the squared loadings of a factor on all the variables in a factor matrix, which has the effect of differentiating the original variables by extracted factor. Therefore, an exploratory factor analysis with Varimax rotations extracted a factorial pattern that was mainly in agreement with Cloninger's model's predictions for temperament and character subscales. These results coincide with previous studies with different TCI versions [2,5,9,10,12,14,16,17].

One limitation of the present study is that our sample is mainly composed of healthy participants who were recruited from 2 university hospitals; they are younger than 26 years (84.5%), with college education (86.5), and of middle-upper economic status (94.4%). The representativity of the sample might be discussed. Another limitation of the present study is that the eigenvalues-greater-than-unity criterion was used as the valid criterion for deciding the number of factors to retain in factor analysis. Other recommended citeria such as Velicer's Minimum Average Partial (MAP) or the parallel test were not used.

In conclusion, the Turkish TCI was psychometrically sound with internal consistency, test-retest reliability, concurrent validity, and factorial structure. Our data suggest that, although the temperament and character dimensions overlap, their nature (inherited dispositions vs learned strategies and self-concept) suggested the need for a 7-factor model for conceptual and practical reasons. Thus, Cloninger's TCI will be useful for future studies in different countries to help better understand psychopathology and normalcy and to examine the biological, social, and psychologic differences among people from different cultures.

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