 DOI: 10.5455/NYS.20190111123743

Validation of the Turkish version of the Thought Control Questionnaire-Insomnia Revised (TCQI-R)

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Date of receipt: 11 January 2018

Date of accept: 29 January 2018

ABSTRACT

Objective: Attempts of thought control as a counterproductive strategy have been thought to be implicated in the formation and perseverance of sleep problems. The current study investigated the psychometric properties of a Turkish version of the Thought Control Questionnaire-Insomnia Revised (TCQI-R), an instrument developed to assess various strategies of thought control during difficult times of sleep.

Method: Forty-five patients with major depressive disorder and four hundred sixty-three individuals from general population participated in the study (N=508; Mean age = 22.96; SD ± 4.82). Approximately half of the sample were female (n=294 57.87%). The TCQI-R, Insomnia Severity Index, and Depression Anxiety Stress Scale -21 (DASS-21) were administered in the study.

Results: Analysis of the current data suggested a three factor latent structure of the instrument: aggressive suppression and worry, behavioral and cognitive distraction, and reappraisal. The TCQI-R revealed considerable internal consistency and temporal stability. All three types of thought control strategies specific to insomnia were found to be significantly associated with sleep disturbances as well as measures of depression and anxiety. Mediation latent structural equation model showed that pre-sleep thought management strategies significantly predicted severity of insomnia and indirectly cause significant increase in insomnia symptoms through exacerbation of negative emotional states (depression, anxiety and stress).

Conclusion: We concluded in light of present results that the Turkish version of the TCQI-R has sound and promising features for research addressing implication of thought control strategies in sleep disturbances.

Keywords: Sleep problems, depression, anxiety, stress, factor analysis, reliability

ÖZ

Düşünce Kontrol Ölçeği – İnsomnia Gözden Geçirilmiş (DKÖ-İGG) Türkçe Formun Geçerliği

Amaç: Olumsuz bir strateji olarak düşünceyi kontrol etme çabalarının uyku problemlerinin ortaya çıkmasında ve süreğenliğinde rol oynadığı düşünülmektedir. Bu araştırmada uyku problemleri yaşandığı zamanlarda kullanılan çeşitli stratejilerin değerlendirilmesinde kullanılmak üzere geliştirilmiş olan Düşünce Kontrol Ölçeği – İnsomnia Gözden Geçirilmiş (DKÖ-İGG) Türkçe Formun psikometrik özellikleri araştırılmıştır.

Yöntem: Araştırmaya 45 majör depresyon hastası ve 463 normal toplum örnekleminden birey katılmıştır (N=508; Yaş ortalaması = 22.96; SS ± 4.82). Katılımcıların yaklaşık yarısı kadındır (n=294 %57.87). Katılımcılara DKÖ-İGG, Uykusuzluk Şiddeti Envanteri (UŞE) ve Depresyon Anksiyete Stres Ölçeği-21 (DASS-21) uygulanmıştır.

Bulgular: Analizler üç faktörlü bir yapıya işaret etmiştir: agresif baskılama ve endişe, davranışsal ve bilişsel dikkat dağıtma, tekrar değerlendirme. DKÖ-İGG için yüksek iç tutarlılık ve kararlılık değerleri elde edilmiştir. İnsomnia özelinde üç düşünce yönetme stratejisi de uyku problemleriyle olduğu kadar anksiyete ve depresyonla ilişkili bulunmuştur. Aracı gizil yapısal eşitlik modeli uyku öncesi düşünce yönetme stratejilerinin insomnia şiddetini doğrudan ve negatif duygulanımında (depresyon, anksiyete ve stres) artışa yol açarak insomnia şiddetini dolaylı olarak yordamıştır.

Sonuç: Elde edilen sonuçlar ışığında Türkçe DKÖ-İGG'nin düşünce kontrol stratejilerinin uyku problemleriyle ilişkilerini ele alan araştırmalarda kullanılabilecek güçlü psikometrik özelliklere sahip bir ölçme aracı olduğu gözlenmiştir.

Anahtar sözcükler: Uyku problemleri, depresyon, anksiyete, stres, faktör analizi, güvenilirlik

INTRODUCTION

Insomnia is characterized by difficulties initiating, maintaining sleep or non-restorative sleep accompanied by severe impairment in daytime functioning and mood regulation.[1-3] Insomnia is prevalent in general population, with between 4-22% of people reporting chronic insomnia.[4-6] Insomnia can be temporary but it may evolve into a chronic condition that two-thirds of insomniacs still present episodes one year later and the same was true for almost half of the cases 3 years after.[7,8]

Individuals with sleep disturbances are more likely to attribute antecedents of their complaints to increased pre-sleep cognitive activity rather than somatic arousal.[9] People more prone to insomnia may rely on counterproductive strategies such as an intense engagement in worrying to avoid imaginative involvement the cognitive process of which evokes higher levels of physiological arousal, thereby exacerbating sleep problems.[10] Various models have been developed to conceive of predisposing, precipitating, and perpetuating cognitive processes for insomnia, including pathological worry, rumination, dysfunctional beliefs about sleep, selective attention and metal and behavioral management strategies to fall asleep.[11-17] These activities of cognitive processing are objectified as considerable cortical activity at bedtime.[18] Previous data have consistently provided support for robust associations between cognitive load and sleep onset difficulties.[19-22]

In an attempt to assess thought control strategies in psychiatric disorders, Wells and Davies[23] developed the Thought Control Questionnaire (TCQ), including 30 mental control strategies. In a replication study including a clinical sample, factor analytic investigation of the instrument revealed a six-factor latent structure; namely, behavioral distraction, cognitive distraction, social control, worry, punishment and reappraisal.[24] In order to facilitate to understand the potential role of thought control strategies in sleep disturbances, Harvey[25] modified a new version of the TCQ adapted to assess sleep-related strategies in insomnia. In an attempt to more reliably assess sleep related thought control strategies, the Thought Control Questionnaire-Insomnia Revised (TCQI-R) consisting of 35 different though management strategies when people are trying to fall asleep tapped into six dimensions of aggressive suppression, cognitive distraction/suppression, behavioral distraction/suppression, social avoidance, worry, and reappraisal.[25,26] The six-factor latent structure of thought management strategies relevant to pre-sleep cognitions as indexed by the French version of the TCQI-R in insomnia was replicated in a sample of 298 nonclinical adults. These two psychometric studies provided adequate to excellent internal reliability (Cronbach's alpha coefficients are presented for Ree[26] and Schmidt[27] respectively): 0.79-0.74 for aggressive suppression, 0.66-0.75 for behavioral distraction, 0.64-0.69 for cognitive distraction, 0.76-0.82 for reappraisal, 0.69-0.75 for social avoidance, and 0.78-0.66 for worry. In a more recent investigation on the Italian version by Sella,[28] seven thought management strategies were discarded from the TCQI-R and a five-factor latent structure was extracted through factor analytic analyses.

The association between thought control strategies specific to sleep and insomnia overlaps with etiological accounts for on the role of cognitive hyper-arousal[29] and emotional reactivity.[30] Research on one of the basic assertions of cognitive models of insomnia that excessive mental activity at bedtime is an important risk factor for falling asleep has provided substantial evidence for the pivotal role of counterproductive sleep-related thought control strategies in insomnia. In keeping with cognitive model of insomnia, Gellis and Park[31] identified that aggressive suppression was a significant predictor of insomnia severity, but cognitive distraction was inversely associated, after controlling for demographics (age, gender and race), anxiety, depression, pain and sleep hygiene. In a community dwelling study Schmidt[32] showed that urgency and lack of perseverance facets of the impulsivity exerted significant influence on insomnia in which the relationships were mediated by aggressive suppression and worry. In a similar vein, using a nine-item modified and shortened version of the TCQI-R that yields three facets of maladaptive pre-sleep thought management strategies, all three facets of thought control strategies (self-attacking, suppression and worry) were significantly associated with the frequency of regrets and insomnia severity; on the other hand severity of depression was linked to self-attacking and worry in a sample of elder nonclinical adults.

The current study was set out to investigate psychometric properties of the Turkish version of the TCQI-R among nonclinical individuals and patients with major depression. Given the high prevalence rates of clinical insomnia in community populations as well as in major depression, it was expected to detect significant associations between thought management strategies and insomnia in a mixed sample with sleep features ranging from good sleep to clinical insomnia.

METHOD

Participants and procedure

The study included 45 patients with major depressive disorder (MDD) consequently admitted to the psychiatry clinics of Kahramanmaraş Sütçü Imam University Training and Education Hospital. Outpatients were diagnosed based on the fifth revision of the Diagnostic and Statistical Manual of Mental Disorders.[33] Four hundred sixty-three nonclinical participants were volunteers who were recruited from various faculties of Van Yüzüncü Yıl University. The research was announced in the classes and volunteers completed the battery set in a silent classroom. No criterion was used for inclusion or exclusion of the participants. Clinical and nonclinical participants were involved within the study after being informed about study purposes and protocol and providing written informed consent. Table 1 shows the demographical information of participants.

Instruments

Thought Control Questionnaire-Insomnia Revised (TCQI-R)

The TCQI-R was developed to assess the use of different mental control strategies during the pre-sleep period.[25,26] Subjects are asked to rate a generic question "How often does thinking too much keep you awake?" on an 11-point Likert type scale (0 = Never to 10 = Every night) and 35 items each rated on a four-point Likert type scale (1 = almost never to 4 = almost always). The original factor structure of the instrument yields six mental control strategies that people may use when being kept awake at night: aggressive suppression, behavioral distraction, cognitive distraction, reappraisal, social avoidance and worry.

The introductory question and the 35 items of the English version of the TCQI-R were translated into Turkish by two academicians. The discrepancies between two translations were analyzed, and amendments were made to reach a consensus on the final form of the Turkish TCQI-R.

Insomnia Severity Index (ISI)

The ISI was developed to assess sleep impairment.[34] The ISI consists of seven items each is rated on a five point Likert scale ranging from 0 to 4. Total ISI scores range from 0 to 28, with greater scores indicative of insomnia severity. The ISI assesses the five dimensions of insomnia: difficult falling and staying asleep and waking up too early, dissatisfaction with sleep pattern, impairment noticeable to others,

distress about sleep, and impairment in daily functioning. Scores on the instrument greater than 14 indicate clinical insomnia. The Turkish version had good psychometric properties with a Cronbach's alpha of $\alpha = 0.79$.[35]

Depression Anxiety Stress Scale 21 (DASS-21)

The DASS-21 is a self-report questionnaire designed to measure negative emotional states over the past week in three categories: depression, anxiety and stress.[36] The instrument contains 21 items, seven items for each dimension, each item is rated on a four-point Likert type scale (0 – did not apply to me all to 3 applied to me very much or most of the time). Higher scores indicate more severe emotional distress. The Turkish version of the questionnaire was demonstrated to have good psychometric properties with excellent internal reliability (Depression $\alpha = 0.89$, Anxiety $\alpha = 0.87$, and Stress $\alpha = 0.90$).[37]

Study ethics

The study was conducted in accordance with the Declaration of Helsinki; study procedures were reviewed and approved by the Clinical Ethics and Research Committee of Van Yüzüncü Yıl University, Faculty of Medicine. Clinical individuals were invited to participate in the clinical trial following diagnosis of major depressive disorder at Psychiatry Clinics of School of Medicine, Kahramanmaraş Sütçü Imam University. The study was announced in various majors of the Van Yüzüncü Yıl University, nonclinical volunteers completed the test battery package in a silent room in their own faculty. All volunteered participants provided a written consent form that they had fully informed of the purposes and procedures of the study. They were not compensated for their participation.

Data analysis

We started with computing descriptive statistics for the sample characteristics. Differences in gender and group (nonclinical vs major depression) between insomniacs and good sleepers were evaluated using $\chi 2$ statistics. Student t-test was performed to compare age between these two groups.

Using structural equation modeling approach, we evaluated latent factor structure of the Turkish version of the TCQI-R. Using LISREL 8.71,[38] confirmatory factor analysis was conducted to test original 6-factor structure and a newly proposed 3-factor structure extracted through exploratory factor analysis. We used the $\chi 2$ goodness of fit statistic, root mean square of approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis Index (TLI) and standardized root mean square residual (SRMR) to examine model fit of structural equation models. Sample size and increased number of parameters generally cause inflated $\chi 2$ values in the structural equation models that the acceptable ranges for the model fit indexes were as follows: RMSEA < 0.08, CFI and TLI ≥ 0.90, and SRMR < 0.10.[39]

We used polychoric correlation matrix, which is strongly recommended when the univariate distributions of ordinal variables are asymmetric or with excess of kurtosis, in exploratory and confirmatory factor analytic investigations of the instrument.[40] Dimensionality of the TCQI-R on the current data was carried out using Horn's parallel analysis based on minimum rank analysis[41,42] and robust unweighted least squares with promin rotation which is suggested for small samples and in case multivariate normality is violated.[43-46] We utilized FACTOR (Version 10.8.04) developed by Lorenzo-Seva and Ferrando,[47] Lorenzo-Seva and Ferrando[48] to carry out parallel analysis and exploratory factor analysis.

Item statistics were computed to examine reliability and validity of the TCQI-R. Standardized Cronbach's alpha and Donald's omega were used to investigate internal reliability.[49,50] Three-week temporal stability of the instrument was assessed by computing intraclass correlation coefficients in a sample of 45 participants.[51]

Analysis of covariance (ANCOVA) was performed to compare scale scores on the TCQI-R between insomniacs and good sleepers after controlling for age, gender and group effects. Zero-order and partial correlations between scores on the psychological instruments were computed. Three multiple regression analyses were performed. Subscales of the TCQI-R were separately regressed onto the ISI total, and three subscales of the DASS-21 (depression, anxiety, and stress) after controlling for age, gender and group effects in each model.

Finally, we specified a mediation latent structural model to explore the multivariate relationship between sleep-related thought control strategies and insomnia mediated by mood changes after adjusting for age, gender and group. We used Satorra-Bentler correction in evaluating the goodness of model fit.[52] The statistical significance threshold was set at $p < 0.05$ in the analyses.

RESULTS

Sample Characteristics

MDD patients and nonclinical participants were matched for their Insomnia Severity Index scores. Relying on the cutoff score on the ISI, the sample was split into two groups as insomniac (≥ 15) and good sleepers (< 15). Gender ($\chi 2(1) = 0.458$ $p = 0.498$) and group (clinical vs nonclinical) ($\chi 2(1) = 0.520$ $p = 0.471$) differences between insomniacs and good sleepers were not significant. We used student t-test with the assumption of variances not equal due to the Levene's test for equality of variances was significant ($F = 4.865$, $p = 0.028$). T-test showed that good sleepers participated in the study were older than insomniac respondents ($t(292.37) = 2.234$, $p = 0.026$).

Table 1. Socio-demographic characteristics

			Overall sample		Good sleepers		Insomniacs		
			n=508		n =384		n = 124		
Group	Control	n, %	463	91.14%	348	90.63%	115	92.74%	$\chi 2(1) = 0.520$ $p = 0.471$
	Major Depression	n, %	45	8.86%	36	9.38%	9	7.26%	
Sex	Female	n, %	294	57.87%	219	57.03%	75	60.48%	$\chi 2(1) = 0.458$ $p = 0.498$
	Male	n, %	214	42.13%	165	42.97%	49	39.52%	
Age [§]		Mean, SD	22.96	4.82	23.19	5.12	22.26	3.64	$t(292.37) = 2.234$, $p = 0.026$

Note. [§] Levene's test for equality of variances was significant ($F = 4.865$, $p = 0.028$).

Confirmatory and exploratory factor analyses

In order to explore the latent factor structure of the TCQI-R on the collected data, we began with performing a six-factor CFA with correlated latent variables. The six-factor CFA model suggested a less acceptable fit to the collected data than expected according to the guidelines.[39]: Satorra-Bentler Scaled $\chi 2$ ($df = 545$ $n = 508$) = 2050.00 $p < 0.01$; an RMSEA of 0.07 (90% Confidence Interval = 0.070 - 0.077); a CFI of 0.90; a TLI of 0.89 and an SRMR of 0.10. Next, using Horn's

parallel analysis based on minimum rank analysis[41,42] we identified that three eigenvalues were greater than simulated eigenvalues when 95% percentile was considered indicative of that a three-factor model represents the optimal latent factor structure for current data. In keeping with the parallel analysis, we carried out a robust EFA with promin rotation using polychoric correlation matrix to extract a three factor structure. Bartlett's $\chi 2$ statistic of test of sphericity was significant ($\chi 2$ (595) = 4628.3 p < 0.001) and Kaiser-Meyer-Olkin test of sampling adequacy was good (KMO=0.86), all of which were indicative of meeting prerequisites for multivariate analysis. Three factors explained 39% of original variance. As EFA factor loadings for the three-factor latent structure can be seen in Table 2, except for four items (9, 33, 5, and 7), all items loaded strongly on the predicted factors (30 ≥). Finally, the three-factor measurement model was subjected to a CFA with the estimation method of unweighted least squares. The model fit indices suggested an acceptable fit and lent support to the three-factor structure of the TCQI-R: Satorra-Bentler Scaled $\chi 2$ (df = 557 n= 508) = 1890.74 p < 0.01; an RMSEA of 0.07 (90% Confidence Interval = 0.070 - 0.077); a CFI of 0.90; a TLI of 0.90 and an SRMR of 0.09. The three latent variables were strongly intercorrelated that aggressive suppression and worry subscale revealed high shared variance with behavioral and cognitive distraction (r = 0.53 p < 0.001) and reappraisal (r = 0.67 p < 0.001). Correlation between behavioral and cognitive distraction and reappraisal was also significant (r = 0.52 p < 0.001). All items statistically significantly loaded on the respective factors in the CFA analysis. EFA and CFA loadings are presented in Table 2.

Table 2. Item factor loadings for exploratory and confirmatory factor analyses

	Factor 1		Factor 2		Factor 3	
	θ	λ	θ	λ	θ	λ
Item 1	-0.271		0.130		**0.536**	**0.35**
Item 2	-0.247		0.136		**0.604**	**0.43**
Item 3	-0.317		0.418		**0.437**	**0.45**
Item 4	-0.354		0.141		**0.616**	**0.38**
Item 5	0.155		**0.233**	**0.47**	0.167	
Item 6	0.291		0.043		**0.297**	**0.54**
Item 7	0.140		**0.273**	**0.33**	-0.023	
Item 8	-0.166		**0.578**	**0.41**	0.067	
Item 9	**0.271**	**0.48**	0.182		0.120	
Item 10	0.258		-0.272		**0.496**	**0.44**
Item 11	**0.606**	**0.56**	0.014		-0.038	
Item 12	**0.747**	**0.53**	-0.035		-0.199	
Item 13	**0.662**	**0.55**	-0.245		0.121	
Item 14	0.163		-0.126		**0.324**	**0.33**
Item 15	0.182		**0.396**	**0.60**	0.131	
Item 16	0.169		-0.100		**0.614**	**0.62**
Item 17	**0.580**	**0.73**	-0.055		0.253	
Item 18	**0.336**	**0.38**	0.181		-0.112	
Item 19	**0.674**	**0.58**	0.165		-0.239	
Item 20	0.039		0.195		**0.352**	**0.53**
Item 21	-0.143		**0.736**	**0.48**	-0.012	
Item 22	**0.488**	**0.51**	0.346		-0.248	
Item 23	0.032		**0.708**	**0.48**	-0.165	
Item 24	0.188		0.027		**0.405**	**0.55**
Item 25	0.187		**0.478**	**0.61**	0.043	
Item 26	0.077		0.212		**0.414**	**0.63**
Item 27	**0.501**	**0.59**	-0.030		0.169	
Item 28	**0.675**	**0.52**	-0.118		-0.053	
Item 29	0.337		0.028		**0.389**	**0.65**
Item 30	**0.509**	**0.61**	0.055		0.111	
Item 31	0.243		**0.503**	**0.64**	0.004	
Item 32	0.137		**0.450**	**0.66**	0.178	
Item 33	**0.274**	**0.52**	0.224		0.139	
Item 34	0.029		**0.348**	**0.52**	0.235	
Item 35	0.130		**0.344**	**0.59**	0.212	

Note. θ = Exploratory factor analysis item loadings; λ = Confirmatory factor analysis standardized item loadings; Estimated parameters loaded onto the respective factors were boldfaced; Factor 1 = Aggressive suppression and worry; Factor 2 = Behavioral and cognitive distraction; Factor 3 = Reappraisal.

Scale reliabilities and item statistics

Using standardized Cronbach's alpha and Donald's omega coefficients, we evaluated internal reliability of the Turkish TCQI-R. The internal consistency of the instrument was excellent as follows (the respective standardized Cronbach's alpha and Donald's omega appear in parentheses): TCQI-R global (α = 0.89, ω = 0.89), aggressive suppression and worry (α = 0.84, ω = 0.84), behavioral and cognitive distraction (α = 0.81, ω = 0.81), and reappraisal (α = 0.80, ω = 0.80). Temporal stability of the Turkish TCQI-R was assessed using intraclass correlation coefficients between two applications within a 3-week interval among 45 respondents. The intraclass correlation coefficients showed acceptable to good test retest reliability for Turkish TCQI-R as follows: TCQI-R global (intraclass r = 0.79), aggressive suppression and worry (intraclass r = 0.73), behavioral and cognitive distraction (intraclass r = 0.75), and reappraisal (intraclass r = 0.74). Item discrimination indices, as evaluated by computing corrected item-total correlation coefficients, for the instrument ranged from acceptable to excellent. Scale reliabilities and descriptive item statistics are indicated in Table 3.

Comparison between the TCQI-R scores of good sleepers and clinical insomniacs

To explore the TCQI-R dimensions that discriminated statistically significantly between good sleepers and insomniacs, we performed four ANCOVAs with insomnia levels indexed by the ISI as independent variable and the three TCQI-R subscale scores as dependent variable after adjustment for age, gender, and group (general population vs major depressive disorder). The ANCOVAs indicated that ISI-defined good sleepers and clinical insomniacs differed significantly on the TCQI-R total, F (1, 503) = 11.114, p = 0.001, $\eta 2$ = 0.022 (M = 75.12, s.d.= 14.44 [good sleepers] M = 80.38, s.d. = 13.41 [clinical insomnia]) and aggressive suppression and worry subscale F (1, 503) = 24.394, p < 0.001, $\eta 2$ = 0.046 (M = 22.71, s.d.= 6.11 [good sleepers] M = 25.89, s.d. = 5.92 [clinical insomnia]).

Zero-order and partial correlation coefficients between scale scores

To investigate the construct validity of the Turkish TCQI-R, we performed Pearson product-moment correlation coefficients of the TCQI-R subscale scores with the ISI and DASS-21 subscale scores. We also computed partial correlation coefficients within scores on psychological variables. Univariate correlation analyses indicated that three factors of the TCQI-R reflected mild to moderate associations with insomnia, depression, anxiety and stress. As the sample was organized by groups (general population vs major depression), the ISI was moderately associated with the TCQI-R total (r = 0.27 p < 0.01) and aggressive suppression and worry subscale (r = 0.30 p < 0.01) and was slightly associated with behavioral and cognitive

distraction (r = 0.16 p < 0.01) and reappraisal (r = 0.16 p < 0.01). Patients with major depression reported more robust correlation coefficients of the ISI scores with the TCQI-R (r = 0.43 p < 0.01), aggressive suppression and worry (r = 0.37 p < 0.01) and reappraisal (r = 0.46 p < 0.01), but its relationship with behavioral and cognitive distraction was not significant (r = 0.25 p = 0.10).

As can be seen in Figure 1, significant direct influence of pre-sleep thought control strategies on severity of insomnia (β = 0.20 p < 0.01) was found after controlling for demographic variables (age, gender and group). More importantly, sleep-related cognitive strategies were indirectly associated with deterioration of insomnia symptoms through exacerbation of negative emotional states (β = 0.17 p < 0.01).

Table 3. Descriptive statistics for the psychometric instruments

	α	ω	Intra r	Rjt	Inter-item r	Mean	SD	Item mean (range)	Item SD (range)	Scores Range
Thought Control Questionnaire-Insomnia Revised	0.89	0.89	0.79	0.24-0.51	-0.10-0.63	76.40	14.36	1.63-2.60	0.87-1.07	35-140
Aggressive suppression and worry	0.84	0.84	0.73	0.30-0.57	0.02-0.41	23.48	6.21	1.63-2.42	0.87-1.03	12-48
Behavioral and cognitive distraction	0.81	0.81	0.75	0.25-0.51	0.09-0.46	24.50	5.84	2.03-2.36	0.92-1.07	11-44
Reappraisal	0.80	0.80	0.74	0.26-0.51	0.01-0.63	28.42	6.14	2.23-2.60	0.91-1.01	12-48
Insomnia Severity Index	0.70		-	0.22-0.52	0.01-0.49	11.40	4.62	1.28-2.36	0.92-1.30	0-28
Depression Anxiety Stress Scale – 21										
Depression	0.87		-	0.54-0.68	0.39-0.60	8.58	5.36	1.00-1.54	0.96-1.13	0-21
Anxiety	0.86		-	0.49-0.67	0.35-0.59	7.36	5.10	0.82-1.23	0.93-1.03	0-21
Stress	0.87		-	0.55-0.71	0.38-0.69	8.93	5.32	1.15-1.35	0.93-1.06	0-21

Note. N = 508; α= Standardized Cronbach's alpha; ω = Donald's omega; Inra r = Test re-test intra-correlation coefficients between two applications with 3-week interval among 45 participants; Rjt= Corrected item-total correlation coefficients (range); Inter-item r= Spearman inter-item correlation coefficients (range); SD= Standard deviation

As for partial correlations between scale scores, only aggressive suppression and worry subscale scores were significantly associated with the ISI total (r = 0.10 p = 0.032) and depression subscale of the DASS-21 (r = 0.15 p = 0.001). Correlation coefficients are presented in Table 4.

Table 4. Zero-order and partial correlations of the TCQI-R with scores on psychological instruments

	Insomnia Severity Index	Depression	Anxiety	Stress
Aggressive suppression and worry	0.31** / **0.10***	0.46** / **0.15****	0.45** / **0.08**	0.42** / **0.02**
Behavioral and cognitive distraction	0.17** / **0.03**	0.16** / **0.00**	0.17** / **0.03**	0.13** / **-0.07**
Reappraisal	0.20** / **0.06**	0.20** / **-0.03**	0.22** / **0.01**	0.20** / **0.04**

Note. *: p < 0.05, **: p < 0.01; Partial correlation coefficients indicated on the right side are boldfaced.

Mediation latent structural equation model

To determine the multivariate associations between latent variables of thought management strategies in the bedtime as indexed by three factors of the TCQI-R, negative emotional states as measured by three subscales of the DASS-21 and insomnia as indicated by seven items of the ISI, we performed a mediation latent structural equation model. Thought management strategies during the pre-sleep period as exogenous variable directly predicted unique variance of insomnia latent variable as endogenous variable in the structural model. An indirect effect of thought control strategies through negative emotional states on insomnia latent variable was also specified. The multivariate relationships between latent variables were controlled for age, gender and group (general population vs major depressive disorder). A CFA with Satorra-Bentler corrected robust maximum likelihood estimation was carried out. The mediation latent structural model revealed acceptable fit to current data: Satorra-Bentler Scaled χ2 (df=92 n= 508) = 378.51 p < 0.01; an RMSEA of 0.08 (90% Confidence Interval = 0.070 - 0.087); a CFI of 0.92; a TLI of 0.90 and an SRMR of 0.07.

DISCUSSION

The main focus of the present study was to carry out an investigation into a Turkish version of the TCQI-R in a sample comprised of clinical and nonclinical individuals. The most central findings of this investigation may be listed as follows:

i) The six-factor structure of the original English version of the TCQI-R (aggressive suppression, behavioral distraction, cognitive distraction, reappraisal, social avoidance, and worry) could not be replicated with the Turkish TCQI-R.

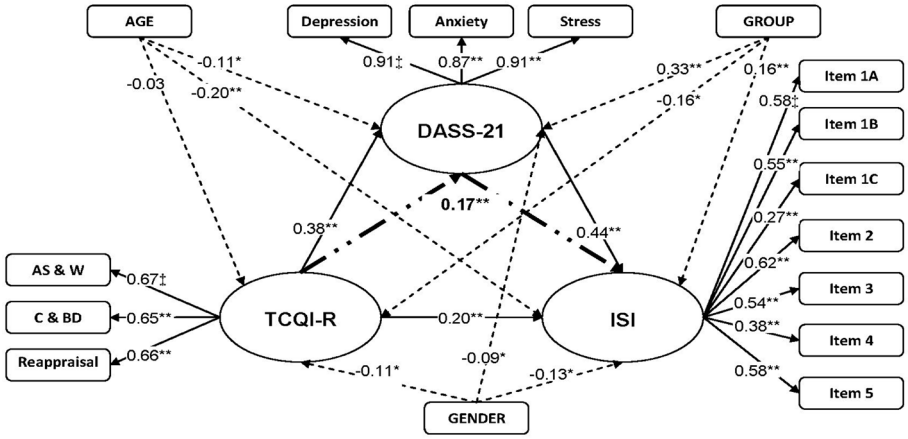
ii) The items of behavioral and cognitive distraction subscales tapped into a unique dimension in the EFA. One of aggressive suppression strategies was also involved within distraction strategies (Item 34). Pre-sleep thought management strategies through items loaded in aggressive suppression and worry factors in the original English version of the TCQI-R were highly related and merged into the same factor in the present data ('aggressive suppression and worry' subscale). Two items of social avoidance subscale (items 18 and 33) were also classified into the aggressive suppression and worry subscale. All items of reappraisal subscale (with an exception of item 32), two items of aggressive suppression subscale (1 and 2), item 3 from cognitive distraction subscale, item 14 from social avoidance subscale, and two items of worry subscale (items 6 and 10) constituted 'reappraisal' subscale. Therefore, a three-factor latent structure proposed for the instrument: (1) Aggressive suppression and worry, (2) Behavioral and cognitive distraction, and (3) Reappraisal.

iii) The three dimensions of pre-sleep thought management strategies at bedtime revealed excellent internal reliability and temporal stability ranging from acceptable to good.

iv) Criterion validity of the instrument was established relying on significant correlation coefficients of three factors of the Turkish TCQI-R with insomnia, with aggressive suppression and worry subscale

being the most powerfully related to sleep problems and depression.

v) The meditational structural equation model identified that thought management strategies utilized during time period prior to sleep were significantly associated with heightened negative emotional states (depression, anxiety and stress) and insomnia severity independent of age, gender, and group (clinical and nonclinical). Participants who have a tendency to engage in any types of cognitive activity in response to intrusive thoughts during sleep period appeared to be at greater risk for the development of affect dysregulation, thereby exacerbating the severity of insomnia symptoms.



***: p < 0.05; ** : p < 0.01**

Figure 1. Latent structural mediation model of relationship between thought control strategies and insomnia mediated by mood after controlling for age, group (nonclinical vs major depression) and gender (female vs male). ‡ denotes fixed parameters in the model. Standardized indirect effect is boldfaced.
TCQI-R = Thought Control Questionnaire Insomnia – Revised; ISI = Insomnia Severity Index; DASS-21 = Depression Anxiety Stress Scale – 21; AS&W = Aggressive Suppression and Worry; C & BD = Cognitive & Behavioral Distraction

Our results concerning with latent structure of the TCQI-R were not in consonant with the previous factor analytical investigations of the instrument. The initial factor analysis by Wells and Davies,[23] conducted on the TCQ identified a six-factor solution which was replicated and supported in the further studies by Ree[26] and Schmidt[27] in the context of insomnia. All factor analytical investigations of the thought control strategies generally clearly fitted a six-factor latent structure with an exception of that Reynolds and Wells[24] suggested a five-factor solution in which behavioral and cognitive distraction strategies were tapped into a unique factor. Current data also did not provided support for differentiation between behavioral and cognitive distraction, partly consistent with the study by Reynolds and Wells.[24]

A body of investigation identifies that individuals experiencing sleep problems report difficulties relinquishing control strategies when trying to fall asleep.[13] Cognitive accounts of insomnia contend that cognitive load or failure in down regulation of mental arousal[12] is critical in formation and perseverance of sleep problems. In keeping with continuity hypothesis,[53,54] inadequate emotional processing during the day is considered to result in acceleration of negatively toned cognitive activity in the presleep period and negative sleep affect, thereby undermining sleep-wake cycle and fueling the negative affect in the following day.[55-57] Positive distraction strategies are suggested to be a productive alternative to counterproductive repetitive thinking in the context of depressive symptoms.[58] However, researchers pointed out inconclusive relationships of distraction with repetitive thoughts and depressive symptoms.[59] In some studies using distraction informed thought management strategies was instrumental in response to emotional strains and negatively toned repetitive thoughts[60-63] and some studies paradoxically reported significant dose response relationships with adverse emotional states and cognitive activity.[64] In an experimental study of the role of distraction in the context of insomnia, forty one people with insomnia were randomly assigned to one of three groups with the following instructional sets: instructions to distract using imagery, general instructions to distraction and no instructions. Attesting to the hypothesis of the study, in part, evidence was found for the speculation that imagery distraction was significantly associated with shorter sleep onset latency as well as less frequent and distressing cognitive activity, but none of these improvements were true for general distraction.[65] Comparative studies between good sleepers and individuals with insomnia showed controversial results that Schmidt[27] could not find significant associations of insomnia with either cognitive or behavioral distraction, poor sleep quality was negatively correlated with cognitive distraction and the relationship was inverse for the latter among patients with primary insomnia.[24] In the present study, pre-sleep behavioral and cognitive distraction was positively linked to insomnia severity among individuals drawn from general population; whereas, patient with major depression reported unsubstantial associations between distraction strategies and insomnia. It appeared that variations in associations between distraction and insomnia may be a function of distraction type and individual differences in endorsement of negative emotional states.

Reappraisal of cognitive inferences concerning with sleep is one of the central therapeutic techniques of cognitively informed treatment approaches to insomnia.[66,67] However, in a meta-analysis of 114 studies that investigated the relationships between dispositional emotion regulation strategies and psychopathology found that reappraisal was negatively associated with depression, yet relatively a small effect size was identified for this strategy.[68] Intriguingly, primary insomniacs were differentiated from good sleepers on their reappraisal scores[26] and reappraisal was significantly associated with insomnia for the French TCQI-R.[27] Our finding was in line with the previous psychometric examinations of the TCQI that scores on reappraisal subscale positively tied to insomnia severity.

A In an extensive review of literature, Schmidt[57] concluded that dysfunctional forms of cognitive control such as thought suppression, worry, rumination, and imagery control were significantly associated with sleep problems. In an experimental investigation into effects of attempted thought suppression on insomnia, good sleepers and insomniacs were randomly allocated to two groups of instructional sets. Participants in suppression group were instructed to suppress the thought most likely to dominate their presleep cognitive activity and the other group represented the nonsuppression condition. Thought suppressed participants were more likely to appraise their sleep onset latency to be longer and their sleep quality to be poorer relative to participants subjected to nonsupression instructions.[69] To test the hypothesis of paradoxical increase in suppressed thoughts, various

lines of research with experimental design identified that individuals who received a suppression instruction in the presleep period were more likely to experience dream rebound, indicative of that dream content may be influenced by attempted suppression in the pre-sleep period,[70,71] this effect can be enhanced by cognitive load among those of thought supressors,[72] and reversal of target thought frequency was observed at sleep onset.[73] As with the attempts of suppression to fall asleep at bedtime, negatively toned cognitive activity or arousal such as worry result in lengthen sleep onset latency[74,75] and interventions targeting worry in the presleep period were found to be associated with shorten sleep-onset latency.[76,77] In line with the emphasize in the literature, we found that aggressive suppression and worry subscale of the Turkish TCQI-R was the most prominent factor in determining insomnia among clinical and nonclinical samples. Moreover, using a mediation structural equation model we identified that thought control strategies in general significantly contributed to heighted negative emotional states as measured by the DASS-21.[37] Attempts to control thought content during pre-sleep period was significantly associated with insomnia and indirectly predicted severity of insomnia symptoms through causing increase in emotional dysregulation (depression, anxiety, and stress).

Several limitations of the current study are worth to mention. First, the sample included nonclinical individuals and only a relatively small sample of MDD patients. Therefore, these findings may not be generalizable to adults in the community and clinical populations. The potential mechanisms and relationships within the variables of interest may differ in a homogenous sample of severe clinical insomnia. Future studies should replicate the three-factor latent structure of the TCQI-R and their relationships with negative emotional states and insomnia in larger clinical and nonclinical samples. Second, the data are cross-sectional and all identified associations within the variables are correlational that causal interpretations cannot be drawn. Given risk factors for insomnia are proliferate, the current data did not include all potential antecedents of insomnia one or more of which may account for the identified relationships between thought control strategies and insomnia. To uncover the role of pre-sleep thought control strategies in insomnia, longitudinal studies adjusting for additional risk factors for insomnia should be warranted.

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