

Turkish Validation and Adaptation of Children 's Chronotype Questionnaire (CCTQ)

Çocukluk Dönemi Kronotip Anketi'nin Türkçe Geçerlilik ve Güvenilirliği

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Abstract

Objective: Chronotype refers to the time of the day that a person's physical and cognitive functions are active. Simply this is a circadian phase preference of a person. While some of the people are morning active (so called larks) others are more active at nights (The owls). The study of circadian rhythms, known as chronobiology, is all about the metabolic and psychiatric differences between people who have different chronotypes. A few tests are used to determine chronotypes. The CCTQ (Children's Chronotype Questionnaire) is a parent-report, 27-item mixed format questionnaire measuring chronotype of children in multiple domains : the midsleep point on free days (MSF), a morningness/eveningness scale(M/E) score, and a five-point chronotype (CT) score.

The aim of this study is adapting Children's Chronotype Questionnaire (CCTQ) into Turkish language and validating the instrument in Turkish population.

Materials and Methods: 101 children aged nine through eighteen constitute the sample of the study. The sample was composed of clinical (n=51) and community groups (n=50). CCTQ and Morningness Eveningness Scale for Children (MESQ) questionnaires were applied to children and parents, then the CCTQ and MESQ scores were compared to examine the validity of CCTQ.

Results: The internal consistency and external validity of the Turkish CCTQ was sufficient to compare MESQ-Turkish. As a result of this research carried out in accordance with methodological research principles, correlation between the M/E scores of CCTQ and MESQ was significant.

Conclusion: The Turkish version of CCTQ has been found to be valid and reliable in Turkish children.

Keywords: Child psychiatry, Turkish, chronotype, sleep, child

Özet

Amaç: Kronotip, kişinin fiziksel ve bilişsel olarak günün aktif olduğu dönemini ifade eder. Basitçe kişinin sirkadiyan döngü seçimidir. Kronobioloji olarak bilinen sirkadiyen faz çalışmalarını, kronotipler arasındaki farkları ortaya koyar: Güvercinler (Sabahçılar) ve Baykuşlar (Akşamcılar). Kronotipleri belirlemek için mevcut birkaç test kullanılmaktadır. ÇDKA (Çocukluk Dönemi Kronotip Anketi), aile tarafından doldurulan, karışık formatta 27 sorudan oluşan, bir çok alanı sorgulayan, çocukların kronotipini belirlemeye yardımcı olan bir formdur. Boş günlerdeki ortalama uyku miktarını (MSF), Sabahlık/Akşamlık skorunu (M/E) ve kronotip skorunu (CT) belirler.

Bu araştırmanın amacı Çocukluk Dönemi Kronotip Anketini Türkçe'ye uyarlamak ve Türk popülasyonuna geçerli bir materyal kazandırmaktır.

Gereç ve Yöntem: Çalışmanın örneklemini yaşları dokuz ve onsekiz arasında değişen 101 çocuk oluşturdu. Örneklem klinik (n=51) ve toplum grubu (n=50) olmak üzere iki gruptan meydana geldi. ÇDKA ve MESQ (Çocuklara Yönelik Günlük Ritim Belirleme Ölçeği) anketleri çocuklara ve ebeveynlerine uygulandı, sonrasında ÇDKA'nın geçerliliğini test etmek için ÇDKA ve MESQ skorları karşılaştırıldı.

Bulgular: Türkçe ÇDKA'nın iç tutarlılığı ve dış geçerliliği, MESQ-Türkçe'yle karşılaştırıldığında yeterli seviyede idi. Çalışmamızda ÇDKA ve MESQ formları sonucu elde edilen M/E skorlarının korelasyonu anlamlı olarak saptandı.

Sonuç: Türkçe ÇDKA'nın Türk çocukları için geçerli ve güvenilir bir anket olduğu saptanmıştır.

Anahtar Kelimeler: Kronotip, sabahlık, akşamlık, Türkçe CDKA, MESQ-Turkce

Introduction

Chronotype refers to the time of the day that a person's physical and cognitive functions are active. The study of circadian rhythms, known as chronobiology, is all about the

metabolic and psychiatric differences among people who have different chronotypes [1, 2]. Some people choose to wake up early in the morning and are most active in the first part of the day while others prefer to wake up later, as their peak time of the day is in the evening, and they prefer to

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sleep late at night. Morning oriented people are also known as 'early larks' and night active people are named as 'night owls' [3, 4].

Morningness-eveningness changes during the lifespan. Although most of children are morning people [5], adolescents become more evening orientated [6-9]. The switch towards eveningness seems to be associated with pubertal development [10]. At the end of the adolescence period, a switch back to morningness occurs [11].

Circadian rhythm is an increasingly important area in medicine. There is a growing body of literature examining chronotype differences and their relationship with biological and psychiatric variables [12]. The owls are shown to be more likely to have medical problems, like diabetes, hypertension, asthma and fibromyalgia [13, 14].

Psychiatry is one of the main sources of chronotype research. Recent studies have demonstrated associations between anxious/depressive symptoms, substance use and eveningness in adolescents [15-17] and adults [18, 19]. Adolescents displaying eveningness were also found to be more likely to have behavioural and academic problems [20, 21].

There are several methods to determine the chronotypes. Actigraphy which is one of the main methods to assess chronotype is the continuous measurement of activity or movement with the use of a small device called an actigraph [22]. It may also have the ability to mark events such as bedtimes or wake times. Despite its high reliability, expensiveness is the major obstacle that limits the use of actigraphy in chronobiology research.

Sleep diary is another method which may be used to determine daily sleep patterns. Diary is composed of a chart with spaces for bedtime, wake time, method of final awakening, frequency of nightly awakening, sleep quality etc. [23]. Although sleep diary is also a reliable and a valid method; it requires a follow up which limits its usage.

Self-report questionnaires are the most widely used tools to determine chronotype in research setting [8, 24]. They combine the simplicity and cheapness with high reliability [25, 26]. Children's Chronotype Questionnaire (CCTQ) is one of the widely used questionnaires which was designed for measuring the chronotype of the children in multiple domains [5]. The aim of this study is adapting Children's Chronotype Questionnaire (CCTQ) into Turkish language and validating the instrument in a Turkish population.

Materials and Methods

Sampling

We constitute a study sample from clinical and community settings. The clinical cases (n=51) were randomly

selected from children and adolescents aged 9-18 who were admitted to the child and adolescent psychiatry outpatient unit of Atatürk University Medical Faculty. We also included 50 control subjects, 7 students randomly selected from each class level of a primary school from Erzurum. Six children from school sample were excluded due to lack of adequate data on questionnaires. Ethical approval was provided from the ethics committee of Ataturk University. All of the parents were informed about the study and children whose parents agreed to participate were included. Parents whose children were accepted into the study provided written informed consent. Children who had psychosis, autism spectrum disorders and intellectual disability that would affect the analysis were not included in the study.

Instruments

Children's Chrono type Questionnaire (CCTQ)

This questionnaire is an adaptation of the Munich Chronotype Questionnaire (MCTQ) [11, 26, 27] and the Morningness/Eveningness Scale for Children (MESOC) [8]. This parent-reported questionnaire for children consists of 16 items on sleep/wake parameters (e.g. bedtime, lights-off time, sleep latency, wake-up time, get-up time, fully alert time, regular naps) for scheduled days and free days, a 10 item M/E scale (range, 10-48) and a single-item on chronotypes (CT) (range, 1-5). CCTQ asks people about their sleep habits on work and free days. Because most chronotypes tend to accumulate a sleep debt on work days, which is compensated for on free days, MSF (midpoint of sleep on free days, i.e. sleep without social obligations) is adjusted for individual average sleep need. The CCTQ also includes a total score from the Morningness Eveningness (M/E) scale, which is the sum of scores of items. The score of some items are reversed. It provides a range of 10 to 48. Three different measures of children's chronotypes are as follows: morning type, intermediate type and evening type, which are classified using an M/E scale score of ≤ 23 , 24-32 and ≥ 33 . The original CCTQ were translated from English into Turkish and then back to English. We compared the original and back-translated versions regarding wording, meaning and contents for each item and created the final version. The items of the Turkish CCTQ are presented in the Appendix.

Morningness Eveningness Scale for Children (MESOC)

The MESOC is a self-administered 10-item scale for adolescents designed to evaluate their diurnal preference (range, 10-43) [8]. A total score is calculated by adding the items. The score of some items are reversed. Higher scores indicate a greater preference for morningness. Classification of diurnal rhythm with using an M/E scale score of MESOC-Turkish ver-

sion [28] is provided by ≤ 21 , 22-34 and ≥ 35 scores for evening type, intermediate type and morning type chronotypes respectively.

Procedure

We applied MESC and CCTQ to all children, and only CCTQ to parents. Parents and children were invited to fill out the questionnaires before the child's discharge from outpatient clinic for clinical setting. In community setting, parents were informed by teachers, and then children whose parents accepted were included in the study. Parents were requested to fill the questionnaires at school.

Statistics

We used three different methods to examine the validity of CCTQ. Firstly, we compared the consistency of chronotypes identified by CCTQ and MESC. Secondly, because lower scores in MESC and higher scores in CCTQ indicate more evening orientation, we hypothesized that a negative correlation between scores gathered from two scales may indicate that they are consistent in what they measure. Therefore we checked the correlation of total scores to check this hypothesis. Finally, we calculated Cronbach alpha to test the internal consistency. The data were analysed by using IBM Statistical Package for Social Sciences (SPSS) 21.0 for Windows (SPSS Inc, Chicago, Illinois, USA). The total scores of the M/E scale in the CCTQ were presented as the mean and median according to groups. The scores were almost normally distributed; therefore, we examined the difference in the distributions of scores using the chi-square test and the means using the Student's t-test. Pearson-correlations were used to examine the associations of M/E scores between two questionnaires to check for concurrent validity. One-way ANOVA was used to determine the significant relationship between M/E types and clinical/school groups. Cronbach alpha was calculated for each item to identify the internal consistency of CCTQ. Computations were based on the pairwise deletion of missing data. All analyses were conducted using two tailed tests, and a p value ≤ 0.05 was considered statistically significant.

Results

The mean age of the participants was 12.5 ± 2.1 years ($X \pm SD$); 51.5% ($n=52$) of respondents were boys; 48.5% ($n=49$) were girls. The mean MidSleep point on free days (MSF) was 8.86 hours for clinical and 9.70 for the community group; the difference between groups was statistically significant ($p=0.05$). The mean MSF was 9.20 for boys and 9.36 for girls ($p>0.05$). The M/E scores was 28.81 among boys and 28.63 among girls ($p>0.05$). Eleven participants (10.8%) were classified as morning type while 14 (13.8%) (6 boys and 8 girls) were evening type. The remaining of the group ($n=76$, 75.2%) was classified as intermediate type. The CCTQ identified 11 morningness, 14 eveningness type cases while MESC detected 10 morningness and 8 eveningness type cases. Table 1 compares the M/E type results of CCTQ and MESC.

There was a significant negative correlation between M/E and MESC total scores in contrast to MESC, ($p<0.001$, $r = -0.429$). Results of the correlational analysis are presented in Table 2. A positive correlation was found between MSF ($p<0.001$, $r = 0.637$), M/E score ($p<0.001$, $r = 0.670$) of child and parent CCTQ forms. A positive correlation was found between the single-item question on chronotype interpretation (CT) and M/E scale score of the questionnaire ($p<0.001$, $r = 0.420$) Figure 1 shows the scatter graph that imply the negative rela-

Table 2. Analysis of comparison of MESC and CCTQ Scores

	MESC-CCTQ	
	r	p value
All participants	-0.429	0.00
Boys	-0.540	0.00
Girls	-0.353	0.13
Clinical group	-0.395	0.04
Community group	-0.530	0.00

p values derived from Mann-Whitney U. MESC: morningness eveningness scale for children; CCTQ: children's chronotype questionnaire

Table 1. Analysis of comparison of MESC and CCTQ M/E Types

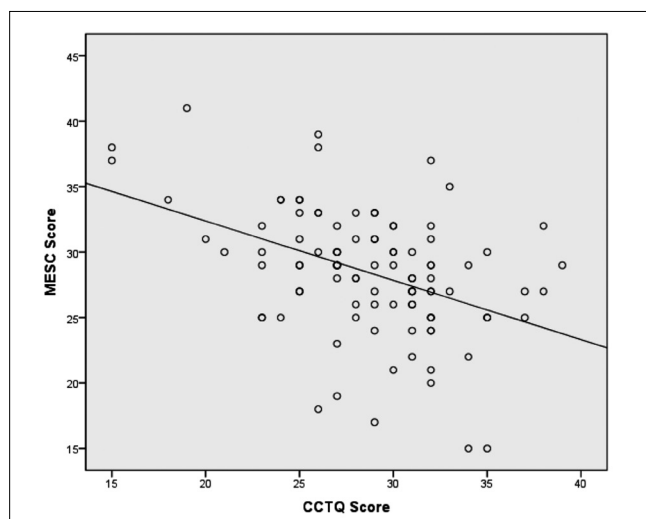
MESC Type		CCTQ M/E Type		
		Morningness	Intermediate	Eveningness
MESC Type	Morningness	40.0% (n:4)	50.0% (n:5)	10.0% (n:1)
	Intermediate	8.4% (n:7)	78.3% (n:65)	13.3% (n:11)
	Eveningness	0.0% (n:0)	75.0% (n:6)	25.0% (n:2)

MESC M/E Type: chronotype for morningness eveningness scale for children; CCTQ M/E Type: chronotype for children's chronotype questionnaire

Table 3. Reliability and item correction analysis of CCTQ

Question Number	Mean	Standart Deviation	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
17	1.89	0.948	27.19	21.054	0.177	0.655
18	2.14	0.970	26.94	19.676	0.334	0.625
19	3.56	0.984	25.51	19.052	0.404	0.610
20	3.68	0.871	25.40	19.442	0.429	0.608
21	1.75	0.699	27.33	21.542	0.226	0.644
22	2.70	0.965	26.38	19.397	0.373	0.617
23	4.29	0.887	24.79	20.126	0.324	0.627
24	2.84	1.120	26.24	17.883	0.460	0.594
25	3.27	1.264	25.81	19.174	0.246	0.650
26	2.95	1.033	26.13	20.293	0.229	0.647

CCTQ: children's chronotype questionnaire

**Figure 1. Correlation Graph of MESC and CCTQ.**

tion between CCTQ and MESC scores. Figure of correlation is the visual prove of the negative relation of these questionnaires.

Cronbach alpha of Turkish CCTQ was 0.653. Item means, corrected item-total correlations and Cronbach alpha values if item deleted are shown in Table 3.

Discussion

One of the main finding of this study was the consistency between Turkish forms of MESC and CCTQ. There was a significant negative correlation between CCTQ (M/E) and MESC-T

scores as hypothesized. This result supports that Turkish CCTQ provides external validity. The mean values obtained in the CCTQ M/E scores were also similar (mean value, 28.72) with the scores obtained by Werner and colleagues in the validation of original form of CCTQ (mean value, 28.2) [5].

Results of this study show that Turkish CCTQ provides internal consistency with a Cronbach alpha of 0.653. This result was also consistent with those of Werner et al. [5] who found that Cronbach Alpha of CCTQ was 0.81. It was similar to that for the adolescent version of MES (Morningness/Eveningness Scale) by Carskadon and colleagues [8]. It means the internal consistency of Turkish CCTQ was acceptable. Also CT and M/E scores were positively correlated. It is apparent from this correlation that CT and M/E scores resemble to each other which means that improve internal consistency of CCTQ.

There was no difference in the time of day preference across genders in our study. The results of studies of chronotypes regarding gender difference are controversial. While some studies have shown that girls tend to be more morningness than boys, others report no gender difference about the preferences in the sample investigated [25, 29, 30]. The distribution of the time of day preferences in this study, in which intermediate type was the leading group followed by eveningness and morningness types, was consistent with the findings of previous studies conducted on similar age groups [31].

We also found that CCTQ Turkish form was highly specific for morningness and eveningness, two edges of population, and highly sensitive for the children with quite normal sleep patterns. These are desired specifications for tools assessing chronotype including CCTQ and supports the validity of Turkish form [32].

Low item-total correlations were obtained in some items of the CCTQ. Additionally, internal consistency coefficient did not improve by deleting any item. Several factors may account for this difference, such as culture and social habits [33, 34]. Simultaneously, the low correlation in the items can be explained by clock hours. Clock time habits are strongly based on local social, climatic and cultural conditions [35].

Our study had a few limitations. Because the present study was conducted in a geographically limited area, the sample was not enough to represent children countrywide. There are also cultural differences in sleeping arrangement which may have affected the results of the study. To cover these issues, a large-scale study is required to compare the findings on sleep/wake patterns and chronotypes among children which will also assess the cultural aspects such as sleeping with parents or siblings. The present study used the CCTQ to assess the chronotypes of school-aged children based on the observations of their parents. This type of parent-reported response can be confusing in part by subjectivity. Also test-retest reliability could not be checked due to resource-related issues.

In conclusion the internal consistency and external validity of the Turkish CCTQ was sufficient to compare MESC-Turkish. The Turkish version of CCTQ has been found to be valid and reliable in Turkish children and can be used to assess chronotypes in Turkish population.

Ethics Committee Approval: Ethics committee approval was received for this study from the local ethics committee of Atatürk University Faculty of Medicine.

Informed Consent: Written informed consent was obtained from parents of children who participated in this study.

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References

- Kerkhof GA, Lancel M. EEG slow wave activity, REM sleep, and rectal temperature during night and day sleep in morning-type and evening-type subjects. *Psychophysiology* 1991; 28: 678-88.
- Wolfson AR, Carskadon MA. Sleep schedules and daytime functioning in adolescents. *Child development* 1998; 69: 875-87.
- Tankova I, Adan A, Buela-Casal G. Circadian typology and individual differences. A review. *Personality and Individual Differences* 1994; 16: 671-84.
- Friedrich Cofer L, Grice JP, Sethre-Hofstad L, et al. Developmental perspectives on morningness-eveningness and social interactions. *Human Development*. 1999; 42: 169-98.
- Werner H, Lebourgeois MK, Geiger A, Jenni OG. Assessment of chronotype in four- to eleven-year-old children: Reliability and validity of the children's chronotype questionnaire (CCTQ). *Chronobiol Int* 2009; 26: 992-1014.
- Randler C. Psychometric properties of the German version of the composite scale of morningness. *Biological Rhythm Research* 2008; 39: 151-61.
- Randler C. Morningness-eveningness comparison in adolescents from different countries around the world. *Chronobiol Int* 2008; 25: 1017-28.
- Carskadon MA, Vieira C, Acebo C. Association between puberty and delayed phase preference. *Sleep* 1993; 16: 258-62.
- Russo PM, Bruni O, Lucidi F, Ferri R, Violani C. Sleep habits and circadian preference in Italian children and adolescents. *J Sleep Res* 2007; 16: 163-9.
- Randler C, Bilger S. Associations among sleep, chronotype, parental monitoring, and pubertal development among German adolescents. *J Psychol* 2009; 143: 509-20.
- Roenneberg T, Kuehnele T, Pramstaller PP, et al. A marker for the end of adolescence. *Curr Biol* 2004; 14: R1038-R9.
- Korczak A, Martynhak B, Pedrazzoli M, Brito A, Louzada F. Influence of chronotype and social zeitgebers on sleep/wake patterns. *Braz J Med Biol Res* 2008; 41: 914-9.
- Merikanto I, Lahti T, Puolijoki H, et al. Associations of chronotype and sleep with cardiovascular diseases and type 2 diabetes. *Chronobiol Int* 2013; 30: 470-7.
- Kantermann T, Theadom A, Roenneberg T, Cropley M. Fibromyalgia syndrome and chronotype late chronotypes are more affected. *J Biol Rhythms* 2012; 27: 176-9.
- Giannotti F, Cortesi F, Sebastiani T, Ottaviano S. Circadian preference, sleep and daytime behaviour in adolescence. *J Sleep Res* 2002; 11: 191-9.
- Adan A, Prat G, Sánchez-Turet M. Effects of nicotine dependence on diurnal variations of subjective activation and mood. *Addiction* 2004; 99: 1599-607.
- Gau SS-F, Soong W-T, Merikangas KR. Correlates of sleep-wake patterns among children and young adolescents in Taiwan. *Sleep: Journal of Sleep and Sleep Disorders Research* 2004.
- Gau SS-F, Merikangas KR. Similarities and differences in sleep-wake patterns among adults and their children. *Sleep* 2004; 27: 299-304.
- Chelminski I, Ferraro FR, Petros TV, Plaud JJ. An analysis of the "eveningness-morningness" dimension in "depressive" college students. *Journal of Affective Disorders* 1999; 52: 19-29.
- Gau SS, Shang CY, Merikangas KR, Chiu YN, Soong WT, Cheng AT. Association between morningness-eveningness and behavioral/emotional problems among adolescents. *J Biol Rhythms* 2007; 22: 268-74.
- Caci H, Robert P, Boyer P. Novelty seekers and impulsive subjects are low in morningness. *Eur Psychiatry* 2004; 19: 79-84.

22. Sadeh A, Hauri PJ, Kripke DF, Lavie P. The role of actigraphy in the evaluation of sleep disorders. *Sleep* 1995; 18: 288-302.
23. Monk TH, Reynolds CF, Kupfer DJ, et al. The Pittsburgh Sleep Diary. *Journal of Sleep Research* 1994; 3: 111-20.
24. Horne JA, Ostberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *Int J Chronobiol* 1976; 4: 97-110.
25. Chelminski I, Petros TV, Plaud JJ, Ferraro FR. Psychometric properties of the reduced Horne and Ostberg questionnaire. *Personality and Individual Differences* 2000; 29: 469-78.
26. Zavada A, Gordijn MC, Beersma DG, Daan S, Roenneberg T. Comparison of the Munich chronotype questionnaire with the Horne-Östberg's morningness-eveningness score. *Chronobiol Int* 2005; 22: 267-78.
27. Roenneberg T, Wirz-Justice A, Mellow M. Life between clocks: daily temporal patterns of human chronotypes. *J Biol Rhythms* 2003; 18: 80-90.
28. Önder İ, Beşoluk Ş. Adaptation of the morningness eveningness scale for children into Turkish. *Biological Rhythm Research* 2013; 44: 313-23.
29. Tonetti L, Fabbri M, Natale V. Sex difference in sleep-time preference and sleep need: a cross-sectional survey among Italian pre-adolescents, adolescents, and adults. *Chronobiol Int* 2008; 25: 745-59.
30. Escribano C, Díaz-Morales JF, Delgado P, Collado MJ. Morningness/eveningness and school performance among Spanish adolescents: Further evidence. *Learning and Individual Differences* 2012; 22: 409-13.
31. Hidalgo M, Caumo W. Sleep disturbances associated with minor psychiatric disorders in medical students. *Neurol Sci* 2002; 23: 35-9.
32. Simpkin CT, Jenni OG, Carskadon MA, et al. Chronotype is associated with the timing of the circadian clock and sleep in toddlers. *J Sleep Res* 2014; 23: 397-405.
33. Benedito-Silva AA, Menna-Barreto L, Alam MF, et al. Latitude and social habits as determinants of the distribution of morning and evening types in Brazil. *Biological Rhythm Research* 1998; 29: 591-7.
34. Borisenkov MF. The pattern of entrainment of the human sleep-wake rhythm by the natural photoperiod in the north. *Chronobiol Int* 2011; 28: 921-9.
35. Ogińska H. Can you feel the rhythm? A short questionnaire to describe two dimensions of chronotype. *Personality and Individual Differences* 2011; 50: 1039-43.