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Adaptation of the Light Exposure Behavior Assessment into Turkish: A Validity and Reliability Study

Işık Maruziyeti Davranışı Anketi'nin Türkçeye Uyarlanması: Geçerlik ve Güvenirlik Çalışması

Altuğ Didikoğlu[1], Zeynep Kayar[1], İclal Arabacıoğlu[1], Burcu Gemici[1], Safa Kemal Kaptan[2], Betül Yılmaz[3], Muazzez Nihal Öykü Ülker[4], Pelin Calpbinici[5]

[1]*İzmir Institute of Technology, Faculty of Science, Division of Neuroscience, İzmir, Türkiye*

[2]*Boğazici University, Faculty of Humanities and Social Sciences, Department of Psychology, İstanbul, Türkiye*

[3]*Ankara Yıldırım Beyazıt University, Faculty of Humanities and Social Sciences, Department of Psychology, Ankara, Türkiye*

[4]*İstanbul Technical University, Faculty of Science and Letters, Department of Sociology, History of Science and Technology, İstanbul, Türkiye*

[5]*Nevşehir Hacı Bektaş Veli University, Semra and Vefa Küçük Faculty of Health Sciences, Department of Obstetrics and Gynecology Nursing, Nevşehir, Türkiye*

Abstract

Objective: This study aimed to translate and culturally adapt the light exposure behavior assessment (LEBA) questionnaire into Turkish and evaluate its psychometric properties in terms of reliability and validity.

Materials and Methods: The LEBA was translated using the translation, review, adjudication, pretesting, and documentation method. Data were collected online from 445 Turkish-speaking adults residing in Türkiye and abroad. Statistical analyses included content validity, confirmatory and exploratory factor analyses, reliability testing (Cronbach's α, McDonald's ω), and non-parametric comparisons across demographic and cultural groups.

Results: The Turkish version of the LEBA demonstrated high content validity and acceptable construct validity. The exclusion of items 05 and 06 further improved the factorial fit of the model. Internal consistency was adequate overall ($\alpha = 0.70$; ω total = 0.83), although the fifth subscale showed weak reliability (ordinal $\alpha = 0.54$, $\omega = 0.53$). Weak but significant associations were observed between LEBA factors and sleep quality, particularly for the subscale "Using a phone or smartwatch in bed", which was negatively associated with sleep quality. Cross-cultural comparisons indicated convergence in light exposure behaviors between Turkish residents and expatriates. Exploratory factor analysis revealed culturally specific factors, including behaviors related to controlling light in the sleep environment.

Conclusion: The Turkish LEBA is a valid and reliable tool for assessing light-related behaviors in Turkish-speaking populations. These findings highlight the importance of cultural adaptation in evaluating light exposure behaviors and their associations with sleep and circadian health.

Keywords: Light exposure, circadian rhythm, sleep, LEBA, psychometric, sociocultural, reliability, validity, Turkish

Öz

Amaç: Bu çalışma, ışık maruziyeti davranış değerlendirme (LEBA) anketinin Türkçeye çevrilmesi, kültürel uyarlanması ve psikometrik özelliklerinin (güvenirlik ve geçerlik) değerlendirilmesini amaçlamıştır.

Gereç ve Yöntem: LEBA, gözden geçirme, uzlaşma, ön test ve belgelendirme yöntemi kullanılarak Türkçeye çevrilmiştir. Veriler, Türkiye'de ve yurt dışında yaşayan toplam 445 Türkçe konuşan yetişkinden çevrim içi olarak toplanmıştır. İstatistiksel analizlerde kapsam geçerliği, doğrulayıcı ve açımlayıcı faktör analizleri, güvenirlik analizleri (Cronbach's α, McDonald's ω) ve demografik ile kültürel gruplar arasında parametrik olmayan karşılaştırmalar yapılmıştır.

Bulgular: Türkçe LEBA yüksek kapsam geçerliği ve kabul edilebilir yapı geçerliği göstermiştir. Madde 5 ve 6'nın çıkarılması faktör modelinin uyumunu artırmıştır. Ölçeğin genel iç tutarlılığı yeterli bulunmuştur (α = 0,70; ω toplam = 0,83), ancak beşinci alt boyut düşük güvenirlik göstermiştir (ordinal α = 0,54, ω = 0,53). LEBA faktörleri ile uyku kalitesi arasında zayıf fakat anlamlı ilişkiler gözlenmiş; özellikle "yatakta telefon veya akıllı saat kullanımı" alt boyutu düşük uyku kalitesi ile ilişkilendirilmiştir. Kültürlerarası karşılaştırmalarda, Türkiye'de yaşayanlar ile yurt dışındaki Türk katılımcılar arasında ışık maruziyeti davranışlarında benzerlik saptanmıştır. Açımlayıcı faktör analizi, uyku ortamında ışığın kontrolü ile ilişkili davranışlar gibi kültüre özgü faktörleri ortaya koymuştur.

Sonuç: Türkçe LEBA, Türkçe konuşan popülasyonlarda ışıkla ilişkili davranışları değerlendirmek için geçerli ve güvenilir bir araçtır. Bulgular, ışık maruziyeti davranışlarının değerlendirilmesinde kültürel uyarlamanın ve bu davranışların uyku ile sirkadiyen sağlıkla ilişkilerinin önemini vurgulamaktadır.

Anahtar Kelimeler: Işık maruziyeti, sirkadiyen ritim, uyku, LEBA, psikometrik, sosyokültürel, güvenirlik, geçerlik, Türkçe

Address for Correspondence/Yazışma Adresi: Altuğ Didikoğlu, İzmir Institute of Technology, Faculty of Science, Division of Neuroscience, İzmir, Türkiye

E-mail: altugdidikoglu@iyte.edu.tr **ORCID-ID:** orcid.org/0000-0002-5582-6956

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Introduction

Light is an essential driver of the synchronization of circadian rhythms and sleep with the external world (1). Light exposure can shift circadian rhythms, suppress melatonin secretion at night, and directly regulate cognitive performance and sleep through neural connections from the retina (2,3). Intrinsically photosensitive retinal ganglion cells are responsible for the above-mentioned non-visual effects of light and have photopigment melanopsin, whose peak sensitivity to light is approximately 480 nm (4,5). In general, exposure to bright light in the morning can support wakefulness and cognitive performance and advance the biological clock, whereas evening-time light exposure can delay the biological clock and sleep and reduce sleep quality (6,7). Owing to the widespread use of electrical lighting and digital screens, individual retinal light exposure extends beyond natural light-dark cycles. Therefore, optimizing both natural and artificial light exposure is crucial for maintaining and improving quality of life, since inappropriate light exposure is associated with several psychiatric and physiological disorders (8,9).

Understanding human light exposure in real-world settings is inherently complex. Light today functions as more than a mere visual stimulus; it represents a dynamic medium through which individuals engage to meet their visual, aesthetic, and psychosocial needs for overall well-being (10). The increasing use of adjustable lighting systems and the incorporation of light-modulating elements, such as blinds, illustrate how people actively regulate and personalize their light environments (11). Similarly, an individual's preferred activity related to natural light exposure, such as spending time outdoors or observing the sunset, reflects their preferred light exposure (12). Cultural, religious, and traditional practices, including early morning prayers, further shape an individual's pattern of light exposure. Rather than experiencing light as a passive environmental factor, individuals consciously construct and manipulate their preferred luminous surroundings as part of their daily lives.

The initial step in understanding human light exposure involves continuous measurement over extended periods using instruments such as sensors, photometers, or spectroradiometers. However, these approaches to measurement are limited by the high cost of equipment and the logistical challenges associated with long-term monitoring (13). Moreover, light exposure is influenced by numerous internal and external factors, including lifestyle habits, geographical location, weather conditions, and work schedules, which are often not captured by wearable light monitors (10). Consequently, while such devices provide objective data, they fail to reflect the contextual and behavioral dimensions of light exposure. An alternative and complementary approach is the use of light-use preference surveys, which can be easily, quickly, and seamlessly integrated into daily life. Such surveys enable scalable assessments of personal light exposure patterns and facilitate epidemiological research on the human light exposome.

The light exposure behavior assessment (LEBA) is an inventory developed in English to assess an individual's behaviors related to light exposure (14). This psychometrically validated tool assesses five main behaviors: the use of blue light filters, spending time outdoors, electronic device use in bed, light use preferences before sleep, and light exposure throughout the day. The LEBA can be used to understand the impact of varying light exposure on physiology and psychology and inform interventions targeting these behaviors. One study revealed associations between healthy light exposure measured by the LEBA and positive emotions, improved memory and concentration, and sleep quality (15). Another study involving participants from diverse geographical and cultural backgrounds indicated that certain subfactors of light exposure behavior may vary across cultures (16). The LEBA, which was used to examine these cultural differences, has not yet been translated into other languages. Therefore, the aim of this study is to provide a Turkish translation of the LEBA and assess its validity and reliability.

Materials and Methods

The Light Exposure Behavior Assessment

LEBA is a self-report survey designed to investigate behaviors that may influence an individual's light exposure. The initial item pool consisted of 48 questions identified by an expert panel as relevant to light exposure behaviors. Following systematic item reduction and psychometric analyses, the final version of the instrument comprised 23 items. Each statement uses a five-point Likert scale with a range of 1 (Never) to 5 (Always). Respondents are instructed to complete the survey with reference to their behaviors during the past four weeks, providing a consistent and recent observation window. The LEBA assesses five behavioral factors: (F1) wearing blue light filters, (F2) spending time outdoors, (F3) using a phone or a smartwatch in bed, (F4) controlling environmental light before bedtime, and (F5) using light in the morning or during daytime. Subscale scores were calculated as the mean of the relevant items, with F1 derived from items 01–03, F2 from items 04 (reverse-coded) and 05-09, F3 from items 10-14, F4 from items 15-18, and F5 from items 19-23 (14).

Translation Protocol

The original LEBA was developed in English and subsequently translated into Turkish using the method translation, review, adjudication, pretesting, and documentation (17). This systematic approach was designed to maximize both the linguistic accuracy and cultural validity of the instrument. Three independent bilingual translators first produced forward translations of all items. These translations were then reviewed and harmonized by an additional independent expert to resolve discrepancies and ensure conceptual equivalence. An adjudication panel, consisting of another independent specialist and the reviewer, finalized the wording. The pre-final version was then subjected to a cognitive pretest with a small sample from the target population (n = 5) to evaluate clarity, comprehensibility, and cultural appropriateness. Following this step, the adjudication panel conducted a final review and confirmed the definitive Turkish version of the instrument.

Sample and Recruitment

Data were collected between April 2024 and September 2025, spanning multiple seasons to minimize potential seasonal bias in light-related behaviors. Participants were recruited digitally through an anonymous Qualtrics survey link (Qualtrics, Provo, UT). Eligibility was restricted to adults aged 18-65 years. In Türkiye, recruitment was facilitated through three university hubs located in İzmir, İstanbul, and Nevşehir. Additionally, Turkish expatriates were recruited via advertisements posted on the Prolific platform (www.prolific.com). The inclusion criteria for expatriate participants included fluency in Turkish and reporting Turkish as their primary and native language while currently residing outside of Türkiye. Quality control procedures led to the exclusion of six survey responses because of completion durations shorter than 120 seconds, two survey responses because of completion by an individual outside the eligible age range, and one survey response because of extremely low variance (≥80% identical responses across LEBA items). No duplicate responses were identified. After these criteria were applied, the final sample for analysis included 445 valid survey responses, including 370 participants residing in Türkiye and 75 Turkish expatriates living abroad. The İzmir Institute of Technology Research Ethics Committee reviewed and approved the protocol (approval no: 26.01.2024-01/06, date: 26.01.2024). Each participant provided written informed consent before participating in the study.

Study Design

This study was designed as a translation and cultural adaptation study in which a random population completed an online survey to evaluate the reliability and validity of the LEBA in Turkish. The survey instrument comprised three main sections. The first section included demographic and health-related questions concerning age, sex, employment status, shift work, diagnosed sleep disorders, diagnosed psychological disorders, chronic diseases affecting sleep, visual impairments, and the use of visual aids with filter features (e.g., UV, orange, or blue light blocking), as well as any medically diagnosed light sensitivity or chronic illnesses causing light sensitivity. The second section consisted of the final translated version of the 23-item LEBA. In addition, participants were presented with the Turkish translations of the remaining items from the original 48-item pool that were not included in the final LEBA. The third section consisted of the Pittsburgh Sleep Quality Index (PSQI), which is designed to collect information concerning sleep, as sleep represents one of the primary physiological effects of light exposure (18).

Statistical Analysis

All statistical analyses were performed using R software (version 4.4.1), and visualizations were created with GraphPad Prism 10 (GraphPad Software, San Diego, CA). Descriptive statistics were calculated as means and standard deviations for continuous variables and as counts and percentages for categorical and ordinal variables. The item response distributions were examined using histograms and density plots.

Content Validity

Items were evaluated by a panel of ten experts who rated the relevance on a four-point scale (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant). The ratings predominantly fell between 3 and 4, indicating high relevance. The content validity index (CVI) was calculated for each item and for the overall instrument to quantify the degree of expert agreement.

Construct Validity

Prior to confirmatory factor analysis (CFA), the appropriateness of the sample and the suitability of the factor model were assessed. Multivariate normality was examined using skewness and kurtosis statistics, including Mardia's test. Post hoc sampling adequacy was evaluated using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity to confirm that correlations among items were sufficient for factor analysis. Given the ordinal nature of the survey items, a polychoric correlation matrix was employed to more accurately estimate inter-item associations. The CFA model was specified according to the factor structure proposed in the original study, with each factor treated as independent and without shared variance, and equality constraints were applied where appropriate. Model estimation was performed using the weighted least squares mean and variance adjusted (WLSMV) estimator to account for the ordinal nature of the data. Model fit was evaluated using multiple indices: scaled Comparative Fit index (CFI), scaled Tucker-Lewis index (TLI), Adjusted Goodness-of-Fit index (AGFI), Goodness-of-Fit index (GFI), Relative Fit index (RFI) and Normed Fit index (NFI) ≥ 0.90 and scaled root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR) ≤0.08, which were considered indicators of acceptable model fit. To further improve the structural equation model, modification indices and negative factor loadings were examined.

Reliability

Internal consistency and reliability analyses were conducted for the LEBA factors using a polychoric correlation matrix to account for the ordinal nature of the items. Cronbach's alpha (α), ordinal alpha, and McDonald's omega (ω) coefficients were calculated for each factor. At the global scale level, Cronbach's α, ordinal α, McDonald's ω total, and ω hierarchical were computed to assess the overall reliability of the instrument.

Criterion Validity

Convergent validity with sleep outcomes was assessed using Spearman's rank correlations between the LEBA factor scores and the PSQI total score (range 0-21; higher scores indicate poorer sleep quality), its seven subcomponents, self-reported sleep duration (hours), and sleep midpoint (clock time). Results were visualized using heatmaps. In addition, associations between LEBA subscale scores and employment status (as a major determinant of real-world light exposure) were examined using the Kruskal–Wallis test followed by Dunn's multiple comparisons test for post hoc comparisons. Further validation analyses were performed to test the associations between the LEBA subscales and self-reported clinically diagnosed conditions, including sleep disorders, psychiatric disorders, chronic conditions with sleep impairment, ocular problems, light sensitivity, and the use of filtered visual aids, using Wilcoxon rank-sum tests. The false discovery rate correction method was applied to control for multiple comparisons.

Cross-Cultural Validity

To examine whether the LEBA subscale scores differed across cultural and environmental contexts, three subgroups were compared: Turkish participants residing in Türkiye, Turkish expatriates, and an external dataset from Malaysia (15). Group differences in each LEBA subscale were tested using the Kruskal-Wallis test, with post hoc Dunn's multiple comparisons test. As a further test of cultural influences on light-exposure behavior, the content validity of the original LEBA item pool was revisited. Specifically, the 48 items developed during the original LEBA construction were reanalyzed in the Turkish sample. A polychoric correlation matrix was analyzed using a scree plot and parallel analysis to identify the appropriate number of latent factors. An exploratory factor analysis (EFA) was subsequently performed with principal axis factoring and varimax rotation. Items with factor loadings <0.30 or cross-loadings >0.30 were iteratively excluded. The final retained factor structure, including the number of factors, item composition, and conceptual meaning, was compared with the five subscales of the LEBA to evaluate overlap and potential cultural differences.

Results

Sample Description

The final sample for analysis consisted of 445 participants (M age = 29.18 years, standard deviation (SD) = 10.58). Of these, 62.22% were female, and 37.78% were male. In terms of employment, 8.09% were not employed, 50.56% were students, 6.07% worked part-time, and 35.28% worked full-time. Among the total sample, 19.57% reported night-shift work. When stratified by residency, 370 participants were Turkish residents (M age = 28.16, SD = 10.96; 64.31% female), and 75 were Turkish expatriates living abroad (M age = 34.19, SD = 6.46; 52.00% female).

In terms of health characteristics, 1.80% reported a physician-diagnosed sleep disorder, with insomnia (n = 4) and sleep apnea (n = 4) reported. A total of 11.24% reported a psychiatric disorder, most commonly anxiety disorders (n = 33) and depression (n = 26), followed by attention-deficit/hyperactivity disorder (n = 13), among others. Additionally, 4.04% reported a chronic disorder affecting sleep, 7.87% reported light sensitivity, and 2.70% reported a chronic condition affecting light sensitivity. Eye disorders, including glaucoma (n = 2), macular degeneration (n = 1), cataracts (n = 1), and color blindness (n = 2), were reported by 65.84% of the participants, along with refractive errors. All these participants reported using glasses or contact lenses, and 47.71% reported wearing filtered glasses.

Content Validity of the Turkish LEBA

The Turkish translation of the LEBA items can be found in Table 1. Content validity was evaluated using ratings from 10 expert reviewers for the 23-item LEBA long version. The item-level content validity indices ranged from 0.90 to 1.00, with a mean score per item between 3.6 and 4.0. The scale-level CVI, calculated by averaging across items, was 0.99, and the proportion of items on which all the experts rated the item as relevant was 0.91.

During the translation and adaptation process, one item ("I use an alarm with a dawn simulation light") was identified as potentially problematic, as dawn simulation devices are not widely known or used in Türkiye, and participants reported difficulty understanding the concept. The feedback collected at the end of the survey revealed several additional points: some participants noted that the questionnaire increased their awareness of light sensitivity and sleep habits, and many described it as useful and reflective. However, several limitations also emerged, including concerns about whether the instrument adequately captured the unique experiences of pregnant and breastfeeding mothers, who reported frequent nighttime awakenings due to childcare.

The distribution of item response patterns is presented in Table 2. Preliminary analyses indicated significant multivariate non-normality (Mardia's skewness = 5933.91, $p < 0.001$; kurtosis = 21.35, $p < 0.001$). The KMO measure of sampling adequacy (MSA) was acceptable (overall MSA = 0.64), with individual item values ranging from 0.54 to 0.80. Bartlett's test of sphericity was significant, χ^2 (253) = 2713.17, $p < .001$, indicating that the correlation matrix was suitable for factor analysis. Polychoric correlations were calculated to account for the ordinal nature of the items, ranging from –0.65 to 0.88, with 7.51% of correlations exceeding |0.30|, suggesting adequate inter-item relationships for factor extraction. The strongest associations were observed between LEBA01–LEBA02 (ρ = 0.88), LEBA13–LEBA14 (ρ = 0.80), LEBA15–LEBA18 (ρ = 0.77), and LEBA01–LEBA03 (ρ = 0.76). A few moderate negative associations also emerged (e.g., LEBA04–LEBA05, ρ = –0.65). Overall, these results support subsequent CFA, although the violation of multivariate normality indicates that robust estimation methods, such as the WLSMV adjusted estimator, CFA was conducted to test the five-factor structure proposed in the original study (14). Consistent with the initial specification, equality constraints were imposed on the loadings of LEBA01–LEBA02 and LEBA15–LEBA18, and a residual covariance was freely estimated between LEBA13 and LEBA14 to account for shared variance. LEBA04 was reverse coded to align its scoring direction with the latent construct. The initial model demonstrated a reasonable but suboptimal fit, $\chi^2(231)$ = 1228.24, CFI = 0.896, TLI = 0.886, GFI = 0.949, AGFI = 0.923, NFI = 0.880, RFI = 0.869, SRMR = 0.110, RMSEA = 0.074. On the basis of negative factor loadings and high modification indices, LEBA05 and LEBA06 were removed, and the error terms of LEBA07 and LEBA08 were allowed to correlate. The respecified model showed improved fit, $\chi^2(189)$ = 801.72, CFI = 0.928, TLI = 0.920, GFI = 0.963, AGFI = 0.942, NFI = 0.912, RFI = 0.902, SRMR = 0.111, RMSEA = 0.066, indicating

Table 1. Original LEBA items and their Turkish translations.

Item no.	English original	Turkish translation
1	I wear blue-filtering, orange-tinted, and/or red-tinted glasses indoors during the day.	Gün içinde kapalı mekanlarda mavi filtreli, turuncu veya kırmızı camlı gözlük takarım.
2	I wear blue-filtering, orange-tinted, and/or red-tinted glasses outdoors during the day.	Gün içinde açık havada mavi filtreli, turuncu veya kırmızı camlı gözlük takarım.
3	I wear blue-filtering, orange-tinted, and/or red-tinted glasses within 1 hour before attempting to fall asleep.	Uykuya dalmaya çalışmadan önceki 1 saat içinde mavi filtreli, turuncu veya kırmızı camlı gözlük takarım.
4	I spend 30 minutes or less per day (in total) outside.	Dışarıda günlük toplam 30 dakika veya daha az vakit geçiririm.
5	I spend between 30 minutes and 1 hour per day (in total) outside.	Dışarıda günlük toplam 30 dakika ila 1 saat arasında vakit geçiririm.
6	I spend between 1 and 3 hours per day (in total) outside.	Dışarıda günlük toplam 1 ila 3 saat arasında vakit geçiririm.
7	I spend more than 3 hours per day (in total) outside.	Dışarıda günlük toplam 3 saatten fazla vakit geçiririm.
8	I spend as much time outside as possible.	Dışarıda olabildiğince çok vakit geçiririm.
9	I go for a walk or exercise outside within 2 hours after waking up.	Uyandıktan sonraki 2 saat içinde yürüyüş ya da egzersiz için dışarı çıkarım.
10	I use my mobile phone within 1 hour before attempting to fall asleep.	Uykuya dalmaya çalışmadan önceki 1 saat içinde cep telefonumu kullanırım.
11	I look at my mobile phone screen immediately after waking up.	Uyanır uyanmaz telefonumun ekranına bakarım.
12	I check my phone when I wake up at night.	Gece uyandığımda telefonumu kontrol ederim.
13	I look at my smartwatch within 1 hour before attempting to fall asleep.	Uykuya dalmaya çalışmadan önceki 1 saat içinde akıllı saatime göz atarım.
14	I look at my smartwatch when I wake up at night.	Gece uyandığımda akıllı saatime göz atarım.
15	I dim my mobile phone screen within 1 hour before attempting to fall asleep.	Uykuya dalmaya çalışmadan önceki 1 saat içinde cep telefonu ekranımın parlaklığını kısarım.
16	I use a blue-filter app on my computer screen within 1 hour before attempting to fall asleep.	Uykuya dalmaya çalışmadan önceki 1 saat içinde bilgisayarımın ekranında mavi filtre uygulaması kullanırım.
17	I use as little light as possible when I get up during the night.	Gece yataktan kalktığımda mümkün olduğunca az ışık kullanırım.
18	I dim my computer screen within 1 hour before attempting to fall asleep.	Uykuya dalmaya çalışmadan önceki 1 saat içinde bilgisayar ekranımın parlaklığını kısarım.
19	I use tunable lights to create a healthy light environment.	Sağlıklı bir aydınlatma sağlamak için rengi veya parlaklığı ayarlanabilen ışıklar kullanırım.
20	I use LEDs to create a healthy light environment.	Sağlıklı bir aydınlatma sağlamak için LED kullanırım.
21	I use a desk lamp when I do focused work.	Odaklanma gerektiren bir iş yaparken masa lambası kullanırım.
22	I use an alarm with a dawn simulation light.	Gün doğumunu taklit eden ışıklı bir alarm kullanırım.
23	I turn on the lights immediately after waking up.	Uyanır uyanmaz ışıkları açarım.

Light exposure behavior assessment, ("ışık maruziyeti davranışı anketi"). Instructions: Please indicate how often you performed the following behaviors in the past 4 weeks ("Lütfen son 4 hafta içinde aşağıdaki davranışları ne sıklıkla gerçekleştirdiğinizi belirtiniz"). Response categories: Never ("Asla"), Rarely ("Nadiren"), Sometimes ("Bazen"), Often ("Sıklıkla"), and Always ("Her zaman"). Factors: F1 (items 01– 03) – wearing blue light filters; F2 (items 04–09) – spending time outdoors; F3 (items 10–14) – using phone or smart watch in bed; F4 (items 15–18) – controlling environmental light before bedtime; F5 (items 19–23) – using light in the morning or during daytime.

LEBA: Light exposure behavior assessment.

Table 2. Summary of LEBA item-level results (n = 445).

	Summary statistics			Response pattern				
Item	Mean	Median	SD	Never	Rarely	Sometimes	Often	Always
F1: Wearing blue light filters								
LEBA01	1.6	1.6	1.2	70.79% (315)	11.69% (52)	5.62% (25)	5.84% (26)	6.07% (27)
LEBA02	1.8	1.8	1.2	64.49% (287)	13.26% (59)	9.21% (41)	6.97% (31)	6.07% (27)
LEBA03	1.5	1.5	1.1	80.00% (356)	6.97% (31)	4.49% (20)	4.27% (19)	4.27% (19)

Table 2. Continued.								
	Summary statistics			Response pattern				
Item	Mean	Median	SD	Never	Rarely	Sometimes	Often	Always
F2: Spending time outdoors								
LEBA04	3.9	3.9	1.1	4.72% (21)	9.21% (41)	17.08% (76)	32.58% (145)	36.40% (162)
LEBA05	2.6	2.5	1.2	19.10% (85)	31.01% (138)	28.99% (129)	15.51% (69)	5.39% (24)
LEBA06	3.0	3.0	1.1	12.36% (55)	20.67% (92)	33.48% (149)	26.52% (118)	6.97% (31)
LEBA07	3.4	3.4	1.1	4.72% (19)	22.47% (100)	19.78% (88)	35.96% (160)	17.53% (78)
LEBA08	3.3	3.3	1.2	6.52% (29)	21.80% (97)	26.52% (118)	28.76% (128)	16.40% (73)
LEBA09	2.2	2.2	1.1	30.79% (137)	34.83% (155)	21.80% (97)	9.21% (41)	3.37% (15)
F3: Using phone and smartwatch in bed								
LEBA10	4.1	4.1	1.0	2.70% (12)	6.97% (31)	11.01% (49)	40.22% (179)	39.10% (174)
LEBA11	3.9	3.9	1.0	2.92% (13)	8.31% (37)	13.03% (58)	44.04% (196)	31.69% (141)
LEBA12	3.1	3.1	1.2	12.81% (57)	19.78% (88)	23.15% (103)	31.01% (138)	13.26% (59)
LEBA13	1.6	1.6	1.1	69.66% (310)	11.69% (52)	7.42% (33)	7.64% (34)	3.60% (16)
LEBA14	1.5	1.5	0.9	76.63% (341)	8.76% (39)	7.64% (34)	5.62% (25)	1.35% (6)
F4: Controlling environmental light before bedtime								
LEBA15	3.5	3.5	1.3	11.91% (53)	11.69% (52)	17.98% (80)	29.21% (130)	29.21% (130)
LEBA16	2.1	2.1	1.5	58.43% (260)	10.11% (45)	8.99% (40)	9.66% (43)	12.81% (57)
LEBA17	3.9	3.9	1.1	4.49% (20)	9.66% (43)	11.69% (52)	42.25% (188)	31.91% (142)
LEBA18	3.0	3.0	1.5	22.92% (102)	15.96% (71)	15.51% (69)	24.94% (111)	20.67% (92)
F5: Using light in the morning and during daytime								
LEBA19	2.2	2.2	1.3	42.47% (189)	20.22% (90)	16.85% (75)	11.46% (51)	8.99% (40)
LEBA20	2.6	2.6	1.4	32.81% (146)	16.18% (72)	20.90% (93)	20.00% (89)	10.11% (45)
LEBA21	2.5	2.5	1.3	30.79% (137)	24.04% (107)	19.33% (86)	19.55% (87)	6.29% (28)
LEBA22	1.3	1.3	0.7	85.39% (380)	6.97% (31)	4.94% (22)	1.35% (6)	1.35% (6)
LEBA23	2.4	2.4	1.2	25.84% (115)	34.38% (153)	21.57% (96)	13.03% (58)	5.17% (23)

LEBA: Light exposure behavior assessment, SD: Standard deviation.

good overall model adequacy despite a slightly elevated SRMR, which is considered acceptable for ordinal indicators analyzed with WLSMV estimation. The standardized factor loadings ranged from 0.13 to 0.94, with most exceeding 0.60, suggesting adequate item representation of the latent constructs. The full CFA results are presented in Table 3.

Reliability of the LEBA

The LEBA subscales were calculated after items 05 and 06 were excluded because of inadequate factorial validity. Internal consistency and reliability analyses were conducted for the five factors. Factor 1 demonstrated excellent reliability (α = 0.84, ordinal α = 0.91, ω = 0.87). Factor 2 demonstrated marginal reliability (α = 0.63, ordinal α = 0.67, ω = 0.55). Factor 3 demonstrated comparable moderate reliability (α = 0.65, ordinal α = 0.71, ω = 0.55). Factor 4 reached acceptable levels (α = 0.66, ordinal α = 0.72, ω = 0.74). Factor 5, however, showed poor internal consistency (α = 0.47, ordinal α = 0.54, ω = 0.53). At the global scale level, Cronbach's α was 0.70, and McDonald's ω total was 0.83, indicating adequate overall internal consistency. However, ω hierarchical was 0.29, suggesting that most reliable variance was attributable to the group (factor-specific) components rather than a general factor. Overall, these findings indicate that certain subscales (particularly F5) exhibit weak internal consistency and should be interpreted with caution.

Associations between LEBA Subscales and Sleep, Health, and Employment Status

Composite LEBA factor scores were calculated after items 05 and 06 were excluded (Figure 1A). Descriptive statistics indicated that mean scores ranged from 1.62 (SD = 1.01) for Factor 1 to 3.18 (SD = 0.78) for Factor 2. Median values were generally close to the means, with interquartile ranges suggesting moderate variability across factors. Shapiro–Wilk tests indicated significant deviations from normality for all factors ($p < 0.001$), supporting the use of non-parametric methods in subsequent analyses.

Sleep quality was assessed using the PSQI. The mean PSQI global score was 6.30 (SD = 2.88; range = 0-17), with higher scores indicating poorer sleep quality. Subscale means ranged from 0.19 (sleep medication use) to 1.51 (daytime dysfunction). The mean reported sleep duration was 7.34 hours (SD = 1.57), and the mean midsleep time was 4:10 a.m. (M = 4.18, SD = 1.31). Spearman correlations revealed generally weak associations between LEBA factors and PSQI indicators

(Figure 1B). Notably, Factor 1 (Wearing blue light filters) showed a small but significant positive correlation with sleep disturbances on the PSQI ($\rho = 0.11$, $p = 0.027$). Factor 3 (using a phone or a smartwatch in bed) was weakly but significantly associated with the global PSQI score ($\rho = 0.21$, $p < 0.001$) and midsleep timing ($\rho = 0.20$, $p < 0.001$), suggesting that later light exposure coincided with poorer sleep quality and a delayed sleep midpoint. Factor 4 (controlling environmental light before bedtime) showed a weak positive correlation with daytime dysfunction ($\rho = 0.17$, $p < 0.001$).

Factor 1 (Wearing blue light filters) was highly significantly different across health-related variables (Figure 1C). Participants who reported using glasses with filters scored significantly higher on Factor 1 ($W = 36519$, $p < 0.001$). Similarly, individuals reporting ocular problems also differed significantly in terms of Factor 1 scores ($W = 16303$, $p < 0.001$). These results indicate that Factor 1 differentiates individuals on the basis of the use of visual aids with filtering features.

A Kruskal-Wallis test was conducted to examine whether employment status groups differed in terms of LEBA factor

Table 3. The original (Model 1) and improved (Model 2) CFA models of the LEBA dataset.

	Model 1					Model 2				
Item	**Estimate**	**Std.err**	**z-value**	**P(>|z|)**	**Std.est**	**Estimate**	**Std.err**	**z-value**	**P(>|z|)**	**Std.est**
F1: Wearing blue light filters										
LEBA01	1.000				0.936	1.000				0.936
LEBA03	0.837	0.034	24.451	0.000	0.783	0.837	0.034	24.451	0.000	0.783
LEBA02	1.000				0.936	1.000				0.936
F2: Spending time outdoors										
LEBA07	1.000				0.657	1.000				0.562
LEBA08	1.046	0.058	17.895	0.000	0.687	1.096	0.080	13.699	0.000	0.616
LEBA04	1.196	0.054	22.162	0.000	0.785	1.288	0.408	3.160	0.002	0.723
LEBA09	0.212	0.075	2.812	0.005	0.139	0.465	0.125	3.719	0.000	0.261
LEBA05	-1.060	0.063	-16.709	0.000	-0.697					
LEBA06	-0.485	0.061	-8.010	0.000	-0.319					
F3: Using phone and smartwatch in bed										
LEBA10	1.000				0.748	1.000				0.748
LEBA11	1.217	0.085	14.258	0.000	0.910	1.217	0.085	14.258	0.000	0.910
LEBA12	0.829	0.052	15.903	0.000	0.620	0.829	0.052	15.903	0.000	0.620
LEBA13	0.168	0.076	2.208	0.027	0.126	0.168	0.076	2.208	0.027	0.126
LEBA14	0.286	0.082	3.467	0.001	0.214	0.286	0.082	3.467	0.001	0.214
F4: Controlling environmental light before bedtime										
LEBA15	1.000				0.875	1.000				0.875
LEBA16	0.705	0.048	14.586	0.000	0.617	0.705	0.048	14.586	0.000	0.617
LEBA18	1.000				0.875	1.000				0.875
LEBA17	0.256	0.057	4.507	0.000	0.224	0.256	0.057	4.507	0.000	0.224
F5: Using light in the morning and during daytime										
LEBA19	1.000				0.808	1.000				0.808
LEBA20	0.754	0.150	5.017	0.000	0.609	0.754	0.150	5.017	0.000	0.609
LEBA21	0.374	0.087	4.285	0.000	0.302	0.374	0.087	4.285	0.000	0.302
LEBA22	0.347	0.132	2.622	0.009	0.280	0.347	0.132	2.622	0.009	0.280
LEBA23	0.210	0.083	2.524	0.012	0.170	0.210	0.083	2.524	0.012	0.170
Model statistics:	$\chi^2(231) = 1228.240$, CFI (scaled) = 0.896, TLI (scaled) = 0.886, GFI = 0.949, AGFI = 0.923, NFI = 0.880, RFI = 0.869, SRMR = 0.110, RMSEA (scaled) = 0.074					$\chi^2(189) = 801.720$, CFI (scaled) = 0.928, TLI (scaled) = 0.920, GFI = 0.963, AGFI = 0.942, NFI = 0.912, RFI = 0.902, SRMR = 0.111, RMSEA (scaled) = 0.066				

Confirmatory factor analysis using the weighted least squares mean and variance adjusted estimator. Model 1 specified equality constraints on the loadings of LEBA01–LEBA02 and LEBA15–LEBA18; included a residual covariance between LEBA13 and LEBA14; reverse-coded LEBA04; included latent factors modelled as independent. Model 2 further refined the structure by removing LEBA05 and LEBA06 and allowing the error terms of LEBA07 and LEBA08 to correlate.

LEBA: Light exposure behavior assessment, CFA: Confirmatory factor analysis, CFI: Comparative Fit index, TLI: Tucker–Lewis index, GFI: Goodness-of-Fit index, AGFI: Adjusted Goodness-of-Fit index, NFI: Normed Fit index, RFI: Relative Fit index, SRMR: Standardized root mean square residual, RMSEA: Root mean square error of approximation.

scores, with pairwise comparisons presented in Figure 1D. For Factor 1, there was no significant difference between groups ($\chi^2(3) = 3.40$, $p = 0.334$), indicating similar scores across employment groups. Significant differences were found for Factor 2 ($\chi^2(3) = 26.46$, $p < .001$), Factor 3 ($\chi^2(3) = 28.20$, $p < 0.001$), Factor 4 ($\chi^2(3) = 38.67$, $p < 0.001$), and Factor 5 ($\chi^2(3) = 12.59$, $p = 0.006$). In general, unemployed participants scored lower than other employment groups did on Factors 2, 3, and 4. These results indicate that employment status is associated with differences in LEBA factor scores, except for Factor 1.

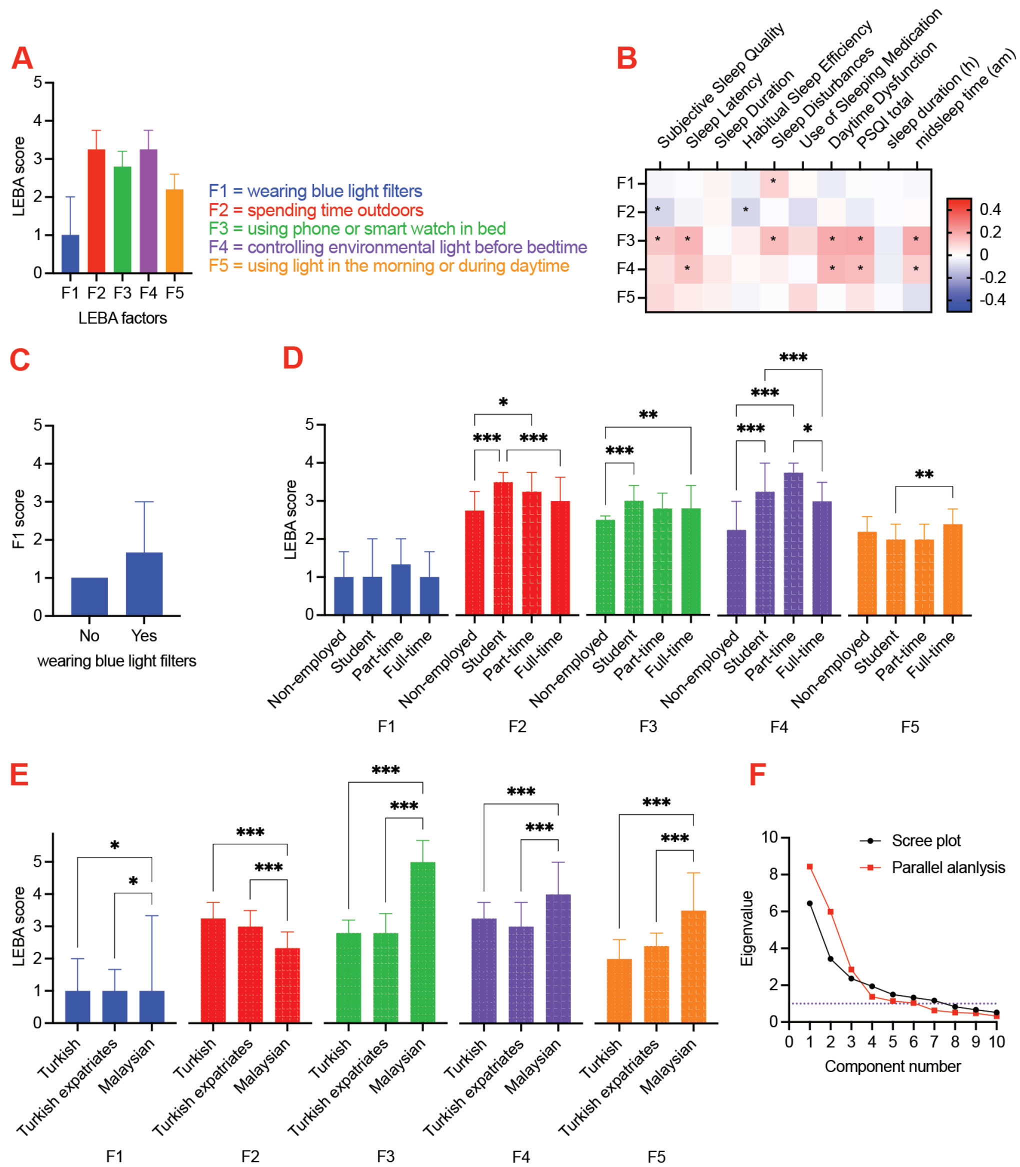

Figure 1. (A) Median and interquartile ranges of the LEBA factor subscale scores. (B) Spearman correlation coefficients between LEBA factors, PSQI scores, sleep duration, and sleep midpoint time are displayed as heatmaps (*p < 0.05). (C) Median and interquartile ranges of LEBA Factor 1 scores among participants with and without filtered glasses. (D) Comparison of LEBA factor scores by employment status (median and interquartile ranges). Kruskal-Wallis test with Dunn's correction for multiple pairwise comparisons; *p < 0.05, **p < 0.01, ***p < 0.001, p < 0.001. (E) Comparison of LEBA factor scores by country of residency (median and interquartile ranges). Kruskal–Wallis test with Dunn's correction for multiple pairwise comparisons; *p < 0.05, **p < 0.01, ***p < 0 0.001. (F) Scree plot showing the eigenvalues for the first ten components, including the results of parallel analysis.
LEBA: Light Exposure Behavior Assessment, PSQI: Pittsburgh Sleep Quality index.

Effects of Country of Residency and Language on LEBA Scores

A Kruskal-Wallis test revealed significant differences in LEBA factor scores across residency groups (Figure 1E): Factor 1 ($\chi^2(2) = 11.30$, $p = 0.004$), Factor 2 ($\chi^2(2) = 194.71$, $p < 0.001$), Factor 3 ($\chi^2(2) = 433.10$, $p < 0.001$), Factor 4 ($\chi^2(2) = 85.71$, $p < 0.001$), and Factor 5 ($\chi^2(2) = 265.58$, $p < 0.001$). Post hoc pairwise comparisons revealed notable differences: Malaysian participants scored higher on Factors 1, 3, 4, and 5 than Turkish residents and Turkish expatriates did, whereas Turkish residents and Turkish expatriates scored higher on Factor 2 than Malaysians did.

EFA of Turkish Light Exposure Behaviors

Using the 48 original LEBA items, Horn's parallel analysis indicated six components (Figure 1F). Iterative removal of items with low or cross-loadings resulted in a final six-factor model (Table 4). Factor loadings ranged from 0.33 to 0.96, with the six new factors together accounting for 50% of the total variance (0.11, 0.10, 0.08, 0.08, 0.08, 0.06). Factor 1 (wearing blue light filters) and Factor 2 (spending time outdoors) largely replicated the original LEBA domains, although Factor 2 excluded items 06 and 09. Factor 3 (using a phone or a smartwatch in bed) included items reflecting nighttime awakenings and screen use, suggesting a broader "screen-in-bed" construct. In this version, items 12-14 related to smartwatch use and phone usage during night awakenings were replaced with an added item ("I use my computer/laptop/tablet within 1 hour before attempting to fall asleep"). Factor 4 (controlling environmental light before bedtime) also aligned with the original structure but incorporated the item "I use a blue-filter app on my mobile phone screen within 1 hour before attempting to fall asleep" instead of item 17, which referred to light use during nighttime awakenings. Factor 5 (using light in the morning or daytime) emerged with modifications, excluding items 22 and 23 on dawn simulation lamps and light exposure immediately after waking, but adding two items on sunglass and visor use while outdoors in bright daylight. Finally, a culturally specific sixth factor emerged, representing behaviors not captured in the original LEBA, indicating a potential context-dependent dimension that warrants further investigation. This new factor included items such as "I purposely leave a light on in my sleep environment while sleeping", "I use as little light as possible when I get up during the night", "I turn on the lights when I get up during the night", "I close curtains or blinds to prevent light from entering the bedroom if I want to sleep", "I turn on my ceiling room light when it is light outside" and "I use an alarm with a dawn simulation light." These items clustered around a theme of managing artificial and natural light within the sleep environment, reflecting culturally specific sleep–light regulation behaviors.

Table 4. Factor loadings for the EFA model (6-Factor model).

Question no.	Question	Item no.	PA1	PA2	PA3	PA4	PA5	PA6
32	I dim my mobile phone screen within 1 hour before attempting to fall asleep.	LEBA15	0.68					
33	I dim my computer screen within 1 hour before attempting to fall asleep.	LEBA18	0.73					
34	I use a blue-filter app on my mobile phone screen within 1 hour before attempting to fall asleep.		0.85					
35	I use a blue-filter app on my computer screen within 1 hour before attempting to fall asleep.	LEBA16	0.88					
16	I wear blue-filtering, orange-tinted, and/or red-tinted glasses indoors during the day.	LEBA01		0.94				
17	I wear blue-filtering, orange-tinted, and/or red-tinted glasses outdoors during the day.	LEBA02		0.83				
36	I wear blue-filtering, orange-tinted, and/or red-tinted glasses within 1 hour before attempting to fall asleep.	LEBA03		0.79				
08	I spend 30 minutes or less per day (in total) outside.	LEBA04			-0.73			
09	I spend between 30 minutes and 1 hour per day (in total) outside.	LEBA05			-0.55			
11	I spend more than 3 hours per day (in total) outside.	LEBA07			0.71			
12	I spend as much time outside as possible.	LEBA08			0.69			
37	I purposely leave a light on in my sleep environment while sleeping.					0.69		
38	I use as little light as possible when I get up during the night.	LEBA17				-0.67		
39	I turn on the lights when I get up during the night.					0.55		
03	I look at my mobile phone screen immediately after waking up.	LEBA11					0.70	

Table 4. Continued.								
Question no.	**Question**	**Item no.**	**PA1**	**PA2**	**PA3**	**PA4**	**PA5**	**PA6**
27	I use my mobile phone within 1 hour before attempting to fall asleep.	LEBA10					0.96	
28	I use my computer/laptop/tablet within 1 hour before attempting to fall asleep.						0.55	
46	I use tunable lights to create a healthy light environment.	LEBA19						0.62
04	I use an alarm with a dawn simulation light.	LEBA22				0.33		
13	I use sunglasses when I go outside in bright daylight.							0.46
14	I wear a visor or cap when I go outside in bright daylight.							0.50
25	I use a desk lamp when I do focused work.	LEBA21						0.39
26	I turn on my ceiling room light when it is light outside.					0.42		
42	I close curtains or blinds to prevent light from entering the bedroom if I want to sleep.					-0.50		
45	I use LEDs to create a healthy light environment.	LEBA20						0.48

Exploratory factor analysis was conducted using principal axis factoring with varimax rotation on a polychoric correlation matrix. PA1 = F4: Controlling environmental light before bedtime. PA2 = F1: Wearing blue light filters. PA3 = F2: Spending time outdoors. PA4 = New factor: Controlling light within the sleep environment. PA5 = F3: Using phone and smartwatch in bed. PA6 = F5: Using light in the morning and during daytime.

EFA: Exploratory factor analysis, PA: Principal axis

Discussion

The present study evaluated the validity, reliability, and cultural adaptation of the LEBA for Turkish-speaking populations. To our knowledge, this is the first study to examine the psychometric properties of the LEBA in a Turkish context and explore potential cross-cultural differences in light exposure behaviors. Overall, the findings provide partial support for the Turkish version of the LEBA as a useful tool while highlighting areas that may require refinement.

The expert review results provided strong evidence for content validity. Item-level and scale-level content validity indices indicated that the translated items were relevant and conceptually sound. However, one item related to the use of dawn simulation alarms was identified during the cognitive pretest as culturally problematic, reflecting limited familiarity with such devices in Türkiye. This suggests that while the LEBA captures a broad range of light exposure behaviors, certain items may need sociocultural adaptation to ensure conceptual clarity and applicability across diverse populations.

The CFA provided moderate support for the five-factor model proposed in the original LEBA validation. The respecified model, excluding items 05 and 06, demonstrated acceptable overall fit. These items exhibited negative factor loadings, indicating an inverse relationship with the intended latent construct. Although reverse coding could statistically address this issue when subscales are computed via summation, the persistent negative loadings suggested potential conceptual ambiguity rather than a simple scoring-direction artifact. Items 05 and 06 assess spending 0.5 to 3 hours outdoors and were designed to capture greater daylight exposure. However, in the present sample, the responses appeared to reflect perceptions of insufficient time spent outdoors, implying that the items may have been interpreted relative to subjective adequacy rather than absolute duration. This pattern may stem from cultural or contextual influences, including lifestyle differences, work–study schedules, and varying normative expectations regarding outdoor activity. Additionally, environmental factors such as urban living conditions and seasonal daylight variability may further affect item interpretation.

The internal consistency of Factor 5 (using light in the morning or during daytime) was notably low. From a measurement perspective, reduced reliability indicates increased measurement error and diminished precision of subscale scores; therefore, findings associated with this factor should be interpreted with caution. Several factors may account for these results. First, daytime light exposure behaviors are inherently context-dependent and strongly influenced by external constraints, including occupational schedules, commuting routines, and seasonal variability, which may introduce substantial situational noise. Second, the relatively young and student-dominated sample may have exhibited restricted variability in behaviors such as the use of desk lamps during focused work, attenuating inter-item correlations. Third, certain items within this factor, particularly those assessing the use of dawn simulation alarms and tunable lighting systems, may reflect technologies that are not yet widely adopted or culturally familiar in Türkiye, thereby reducing response consistency. Additionally, behaviors related to turning on lights immediately after waking may be influenced by seasonal daylight availability, which may be perceived as less critical at the latitudes represented in the present sample. Cultural differences in the perception, regulation, and prioritization of daytime light exposure, for example, norms regarding sunlight exposure, indoor lighting preferences, and the use of shading strategies, may have further contributed to heterogeneity in item interpretation. Finally, variability in participants' awareness of circadian health and attitudes toward light-related behavioral regulation may also have influenced response patterns.

Factor 1 (wearing blue light filters) distinguished individuals with ocular problems and those who reported using glasses with filtering features, providing initial evidence for the discriminant validity of the LEBA. Employment status also emerged as a significant correlate, with students and full-time employees reporting greater engagement in several light-related behaviors than unemployed participants did. These patterns support that occupational demands and daily routines influence light exposure behaviors and that the Turkish LEBA is a valid tool for measuring them (19,20).

Consistent with prior literature linking light exposure to sleep timing and quality, weak but significant associations emerged between the LEBA subscales and PSQI outcomes (21,22). Notably, phone and smartwatch use in bed was associated with poor sleep quality and delayed midsleep timing, supporting evidence that evening screen exposure contributes to circadian misalignment (23). Similarly, controlling environmental light before bedtime was associated with daytime dysfunction, suggesting that light-related behaviors may extend their influence on daytime functioning (24). However, the effect sizes were generally small, indicating that while the LEBA captures meaningful behaviors, sleep quality is influenced by multiple additional factors.

According to the original LEBA development study, the factorial characteristics of light exposure behavior are the same for both native and non-native English speakers (14). However, significant differences in LEBA scores were observed across language groups in this study. Malaysians scored higher on most factors, except for Factor 2 (outdoor light exposure), in which both Turkish groups scored higher and showed convergence. These differences may reflect sociocultural norms that shape outdoor activity preferences, potential linguistic or response biases in the self-report instrument, or the possibility that the construct of light exposure behavior is not entirely equivalent across cultures. Moreover, in one study, correlations between LEBA items and objective light exposure metrics emerged in Switzerland but were absent in Malaysia, suggesting that subjective reports of light exposure are influenced by cultural context and may not directly correspond to objectively measured light exposure (16). Previous literature also indicates that ethnicity may modulate light sensitivity; for instance, greater light-induced melatonin suppression has been observed in Caucasians than in Asian participants, and lower nocturnal melatonin excretion has been reported in African Americans than in European Americans (25,26). Collectively, these results highlight the importance of cross-cultural evaluation in understanding light exposure behaviors.

EFA of the broader 48-item pool revealed a six-factor structure that differed from that of the original five-factor LEBA model. The emergence of an additional factor in the EFA does not necessarily contradict the CFA findings but rather suggests that light-exposure-related behaviors may be organized somewhat differently within this cultural context. Importantly, the remaining five factors were thematically consistent with the original LEBA framework, and the majority of the items were retained. The most notable thematic deviations involved the absence of smartwatch-related items and the inclusion of behaviors related to wearing hats or sunglasses during bright outdoor daytime conditions. These differences further support the potential influence of contextual factors, such as socioeconomic accessibility to wearable technologies and seasonal daylight variability. From a practical standpoint, we do not recommend replacing the theoretically grounded five-factor LEBA structure with the exploratory six-factor solution without replication in independent Turkish cohorts. Instead, the EFA findings should be considered hypothesis-generating, highlighting potential culture-sensitive behavioral dimensions that warrant further investigation.

Notably, the new factors identified in the EFA clustered around behaviors related to managing light within the sleep environment, including leaving lights on during sleep, controlling light exposure during nighttime awakenings, and regulating the entry of external light via curtains or blinds. This pattern may reflect sociocultural influences specific to the Turkish context. Possible interpretations include culturally shaped norms regarding privacy within the home, security-related behaviors, comfort-seeking strategies, fear or avoidance of darkness, and household practices concerning energy use. Additionally, variability in awareness of circadian health and attitudes toward light-related behavioral regulation may contribute to these response patterns. The identification of this factor suggests that sleep-environment light management may represent a meaningful, context-dependent behavioral construct not fully captured by the original LEBA framework.

Satellite-based high-resolution analyses have revealed an increase in the total luminous energy emitted from Türkiye into space in recent years (27-29). Given that Türkiye is among the countries at heightened risk for nocturnal light pollution and a high incidence of sleep disorders, it is crucial to identify culturally specific dimensions and adapt standardized assessment tools accordingly (30). In clinical and public health contexts, the Turkish version of the LEBA may serve as a valuable instrument for detecting maladaptive light exposure patterns, informing interventions to improve sleep and circadian health, and supporting research on light-related risks for public health (9).

Study Limitations

Several limitations should be acknowledged. First, the sample included relatively young individuals, most of which were students; thus, the generalizability of the findings may be limited, particularly to older adults. Age-related differences in lifestyle, occupational demands, sleep patterns, and light exposure behaviors may influence responses to the LEBA, and future studies should include more age-diverse samples. Second, reliance on self-report measures introduces the possibility of recall and social desirability bias. Test–retest reliability was not examined. Integrating objective light exposure measures, such as actigraphy with light sensors, would strengthen the evidence of validity. Although the data were collected from three different regions in Türkiye, they may not fully reflect the cultural diversity of light-related practices across the country. Replication in independent samples is necessary to confirm the stability of the factor structure. Additionally, external data from Malaysia were collected via an 18-item LEBA, which differed from the version applied in this study.

Conclusions

In summary, the Turkish version of the LEBA demonstrated strong content validity, acceptable factorial validity, and adequate overall reliability. The subscale "Using light in the morning or during daytime" showed low reliability and should therefore be interpreted cautiously. The second factor, "Spending time outdoors," should be calculated excluding specified items. The emergence of a culturally specific factor structure underscores the importance of cultural adaptation in LEBA. We do not recommend adopting an exploratory six-factor structure without replication in independent samples; however, the collection of an additional question on lighting preferences during sleep could be beneficial in Türkiye. Associations with sleep and health outcomes provide preliminary evidence for construct validity and highlight the importance of light exposure in sleep and circadian health. The Turkish LEBA represents a promising tool for advancing research and practice in circadian public health.

Ethics

Ethics Committee Approval: The İzmir Institute of Technology Research Ethics Committee reviewed and approved the protocol (approval no: 26.01.2024-01/06, date: 26.01.2024).

Informed Consent: Each participant provided written informed consent before participating in the study.

Footnotes

Authorship Contributions

Concept: A.D., S.K.K., P.C., Design: A.D., Z.K., İ.A., B.Y., S.K.K., M.N.Ö.Ü., P.C., Data Collection or Processing: A.D., Z.K., İ.A., B.G., S.K.K., P.C., Analysis or Interpretation: A.D., B.G., Literature Search: A.D., Z.K., İ.A., Writing: A.D., Z.K., İ.A., B.G., S.K.K., B.Y., M.N.Ö.Ü., P.C.

Conflict of Interest: No conflict of interest was declared by the authors.

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