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# *Validity and Reliability of the Turkish Version of the Parkinson Disease Sleep Scale-2*

## *Parkinson Hastalığı Uyku Ölçeği-2'nin Türkçe Geçerlik ve Güvenirliği*

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### Abstract

**Objective:** Sleep problems are one of the most common non-motor symptoms of Parkinson's disease (PD). To better manage sleep problems, they must first be identified and evaluated. The study aimed to evaluate the validity and reliability of the Turkish version of the Parkinson Disease Sleep Scale-2 (PDSS-2).

**Materials and Methods:** The study was conducted with 135 individuals with PD, between April 2019 and January 2021. The data were collected using the patient information form and the PDSS-2. The confirmatory factor analysis, psycholinguistic evaluation, and content validity testing were conducted to test the construct validity of the scale. Item total score correlation, Cronbach's alpha coefficient, and test-retest analyses were performed to test the reliability of the scale.

**Results:** The content validity ratio of the scale was calculated as 0.875 and 1. When the model related to the scale was examined with the confirmatory factor analysis, it was observed that the fit indices were at a good level. The Cronbach's alpha was found to be 0.90 for the scale and between 0.71-0.81 for the sub-dimensions, indicating high reliability. The item-total correlations were found to be sufficient (between 0.31 and 0.78). The test-retest reliability coefficient was 0.91, indicating high consistency.

**Conclusion:** It has been determined that the Turkish version of the PDSS-2 is a valid and reliable measurement tool.

**Keywords:** Parkinson disease, reliability and validity, sleep, sleep disorder

### Öz

**Amaç:** Uyku problemleri, Parkinson hastalığının (PH) en yaygın motor olmayan semptomlarından biridir. Uyku sorunlarını daha iyi yönetebilmek için ise öncelikle değerlendirilmesi ve tespit edilmesi gerekmektedir. Bu çalışma, Parkinson Hastalığı Uyku Ölçeği-2'nin (PHUÖ-2) Türkçe formunun geçerlik ve güvenilirliğini değerlendirmek amacıyla yürütülmüştür.

**Gereç ve Yöntem:** Araştırmaya, Parkinson tanısı kesinleşmiş 135 hasta dahil edilmiş ve çalışma Nisan 2019-Ocak 2021 tarihleri arasında yürütülmüştür. Veriler, Hasta Bilgi Formu ve PHUÖ-2 kullanılarak toplanmıştır. Ölçeğin geçerliğini test etmek için; psikodilbilimsel değerlendirme, kapsam geçerliğini analizleri ve yapı geçerliğini için faktörlerin uyumunu değerlendirmek amacıyla Doğrulayıcı Faktör Analizi uygulanmıştır. Ölçeğin güvenirliğini test etmek için ise; madde toplam puan korelasyonu, Cronbach alfa katsayısı ve test-tekrar test analizi uygulanmıştır.

**Bulgular:** Ölçeğin, kapsam geçerlik oranı 0,875 ve 1 olarak hesaplanmıştır. Ölçeğe ilişkin model Doğrulayıcı Faktör Analizi ile incelendiğinde uyum indekslerinin iyi düzeyde olduğu görülmüştür. Cronbach alfa ölçeğin tamamı için 0,90, alt boyutları için 0,71-0,81 arasında bulunmuştur ve yüksek güvenirliğe işaret etmektedir. Madde-toplam korelasyon katsayısına baktığımızda maddelerin hiçbirinin eşik değer olan 0.30'un altında olmadığı görülmüştür (0,31 ile 0,78 arasında). Test-tekrar test analizinde korelasyon katsayısı 0,91 olarak bulunmuştur ve yüksek güvenirliği göstermektedir.

**Sonuç:** Bu çalışma ile PDSS-2'nin Türkçe versiyonunun geçerli ve güvenilir bir ölçüm aracı olduğu belirlenmiştir.

**Anahtar Kelimeler:** Parkinson hastalığı, geçerlik ve güvenirlik, uyku, uyku sorunları

## Introduction

Parkinson's disease (PD) is a chronic and progressive neurodegenerative disease caused by an effect on the dopamine-producing neurons in a specific area of the brain (1). PD, which is the second most common neurodegenerative disease, has an increasing incidence with the aging of the population (2,3). PD has numerous motor symptoms such as tremor, bradykinesia, rigidity, and postural instability and non-motor symptoms such as cognitive changes, constipation, fatigue, sensory loss, and sleep disturbances, which increase in severity over time (2,4,5). A Parkinson's patient experiences more than 10 non-motor

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symptoms during the year (5), among which sleep disturbances are noteworthy, given their high prevalence and impact on quality of life (6,7).

Rapid eye movement (REM) sleep behavior disorder (8,9), insomnia (5), restless legs syndrome, periodic limb movements (10), sleep disordered breathing (9), excessive daytime sleepiness, circadian rhythm disorders (8,9), and nocturia are the sleep disorders that can be observed in Parkinson's patients (6,11,12). The literature has revealed that up to 95% of Parkinson's patients experience a wide variety of sleep problems (7), and a meta-analysis including studies with the polysomnography (PSG) device has proven that patients experience abnormal sleep (9). It has been further observed that Parkinson's patients who have sleep problems experience other symptoms more and have a worse quality of life (8,13). In order to better manage sleep problems, which seriously affect the quality of life since the early stages of the disease, they must first be identified and evaluated (6,14,15). Although the use of the PSG device is accepted as the most reliable and objective measurement method in evaluating patients' sleep, its cost and complexity have led to the use of subjective sleep scales as an alternative (16). Although there are numerous scales evaluating sleep in the literature, there are limited number of scales developed specifically for PD and focusing on sleep problems. For this reason, the Movement Disorders Association established a commission to evaluate sleep scales used in Parkinson's patients, and as a result of thorough evaluations, the commission recommended six scales for use in Parkinson's patients by specifying their positive and negative aspects (17). One of these scales, the PD sleep scale (PDSS), is significant in that it was developed specifically for PD (15). However, the scale is in visual analog form and it makes limited evaluations for specific sleep disorders, which have been considered as a limitation and led to revision (17). Six items of the 15-item scale were revised so that it can make a stronger assessment of specific sleep disorders such as REM sleep behavior disorder, restless legs syndrome, and sleep apnea, and its visual analog form was converted into a Likert scale form to be more useful. In this way, the PDSS-2 was developed (18). The PDSS-2 has been adapted to many different cultures and is widely used throughout the world (14,18-20). Our study aimed to investigate the validity, reliability and applicability of the PDSS-2 in Turkish population.

## Materials and Methods

### Study Design and Participants

This methodological study was carried out to test the validity and reliability of the Turkish version of the PDSS-2. Individuals who had a definitive diagnosis of Parkinson's and place, time and person orientation, who could speak and understand Turkish, and who agreed to participate in the study were included in the study. It was aimed to reach the sample size which was 5-10 times the number of scale items. A total of 135 Parkinson's patients constituted the sample of the study. The data from 79 patients were collected face-to-face in the neurology outpatient clinic of a university hospital between April 2019 and January 2021, in Konya. The data from the other patients were gathered online via the Parkinson's associations located throughout the country since outpatient services were limited due to the Coronavirus disease-2019 (COVID-19) pandemic during the data collection process.

### Data Collection Tools Used

The Patient Information Form consisting of 7 questions (age, gender, marital status, education level, with whom the patient lives, duration of illness, having another disease) and the PDSS-2 were used to collect data. The PDSS-2 was developed by Trenkwalder et al. (18) and measures the sleep experience of patients in the last week. The Cronbach's alpha of the PDSS-2 is 0.73 for the whole scale and between 0.47 and 0.66 for the sub-dimensions. The scale consists of 15 items on a 5-point Likert form: Very often-6 to 7 days a week (1 point), often-4 to 5 days a week (3 points), sometimes-2 to 3 days a week (2 points), occasionally-1 day a week (1 point), never (0 point). In the scale, the first item assesses the general night sleep quality, while Items 2 and 3 assess falling asleep and insomnia. Items 4 and 5, 6 and 7, and 8 and 9 assess night restlessness, night psychosis, and nocturia, respectively. Items 10, 11, 12, and 13 evaluate nocturnal motor symptoms. Item 14 assesses rested awakening, and Item 15 evaluates sleep breathing disorder. The scale consists of three sub-dimensions [factor 1: Motor problems at night (questions 4,5,6,12 and 13), factor 2: PD symptoms at night (questions 7, 9, 10, 11, 15), factor 3: Disturbed sleep (questions 1,2,3,8,14)]. PDSS-2 total score ranges from 0 (no disturbance) to 60 (maximum nocturnal disturbance). The scale was developed in three centers (Germany, Austria and the United Kingdom) in two languages (English and German), and then adapted to different cultures (14,16).

### Ethics

Permission to use the PDSS-2 was obtained from the author via e-mail. Local Ethics Committee approval was obtained from the Selçuk University's Faculty of Health Sciences (approval number: 2019/109, date: 27.02.2019). Written permission was obtained from the hospital administration and the Parkinson's association. The patients participating in the study were informed about the aim of the study and data collection tools, and their consent was obtained. The stages and analyses recommended by the COnsensus-based Standards for the selection of health Measurement Instruments (COSMIN) checklist were taken into account in testing the validity and reliability of the scale (21).

### Statistical Analysis

SPSS (Statistical Package for Social Sciences) Version 25 and Analysis of Moment Structures Version 23.0 programs were used for data analysis. Psycholinguistic evaluation and content validity testing [content validity index (CVI) and content validity ratio (CVR)] were used to test the validity of the PDSS-2, and the confirmatory factor analysis (CFA) was used to evaluate the compatibility of factors for construct validity. The CFA has several goodness-of-fit indices. In this study, the CFA was performed using the results of chi-square/degree of

freedom [$\chi^2$/standard deviation (SD)], comparative fit index (CFI), root mean square error of approximation (RMSEA), standardized root mean square (SRMR) goodness of fit index (GFI), adjusted GFI (AGFI), incremental fit index (IFI), parsimony normed fit index (PNFI), and Parsimony CFI (PCFI). Item total score correlation, Cronbach's alpha coefficient, and test-retest analysis were performed to test the reliability of the PDSS-2. In addition, descriptive statistics (number, percentage, mean, SD) were used. The level of significance was set at $p<0.05$ for all tests.

## Results

### Participants' Characteristics

The mean age of Parkinson's patients in the study was 59.96±12.41, the mean time to diagnosis was 9.14±6.81, and the age of diagnosis was 53.47±12.05. The majority of the participants were male (60.7%), married (78.5%), and primary school graduates (38.5%); they were living with their family members (94.1%); they had another chronic disease (57%) Table 1 presents the sociodemographic and clinical characteristics of the PD patients.

### Psycholinguistic Evaluation and Content Validity

The psycholinguistic characteristics of the scale were examined in the following order: First, three independent linguists who are fluent in English and Turkish translated the scale into Turkish (1). Then, the original items of the scale and their Turkish equivalents were compared, and another independent language expert was consulted (2). The translations were evaluated by the researchers and the draft form of the scale was created. The draft form was sent to eight academicians who are experts in their fields in order to ensure both language and content validity, with the equivalent of each item in the original language. The Davis technique was used to calculate the CVR and CVI of the scale items. The CVI of the scale items was 0.98. The CVR was found to be 1 for Items 1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13, 14, and 15, and 0.875 for Items 4 and 7.

**Table 1. Sociodemographic and clinical characteristics of the PD patients (n=135)**

| **Variable** | **Mean (SD)** | |
|---|---|---|
| Age | 59.96 (12.03) | |
| Disease duration (year) | 9.11 (6.71) | |
| Age at diagnosis (year) | 53.49 (12.05) | |
| **Sex** | **n** | **%** |
| Female | 53 | 39.3 |
| Male | 82 | 60.7 |
| **Marital status** | | |
| Married | 106 | 78.5 |
| Single | 29 | 21.5 |
| **Education level** | | |
| No literacy | 11 | 8.1 |
| Primary | 52 | 38.5 |
| High | 40 | 29.6 |
| University and over | 32 | 23.7 |
| **Living status** | | |
| live with family members | 127 | 94.1 |
| Live alone | 8 | 5.9 |
| **Having chronic disease** | | |
| Yes | 77 | 57 |
| No | 58 | 43 |

SD: Standard deviation, PD: Parkinson's disease

### Confirmatory Factor Analysis

The CFA performed to test construct validity revealed that the model fit index values ($\chi^2$/SD, CFI, RMSEA, SRMR, GFI, AGFI, IFI, PNFI, PCFI) of the three-factor structure were at an excellent and acceptable level. Good fit index values and fit index values obtained from the scale are presented in Table 2. It was also seen that the factor loadings of the items in the model vary between 0.36 and 1.65. The CFA diagram of the scale are presented in Figure 1. In line with these results, it can be said that the measurement tool is valid and feasible.

### Reliability Analysis

The internal consistency analysis revealed that the total reliability coefficient (Cronbach α) was 0.905 and the subscale reliability coefficients were α=0.785 for Factor 1, α=0.818 for Factor 2, and α=0.716 for Factor 3. The item-total correlation (ITC) coefficient ranged between 0.31-0.78. No items caused a higher Cronbach's alpha coefficient when deleted. Item analysis of the PDSS-2 are presented in Table 3.

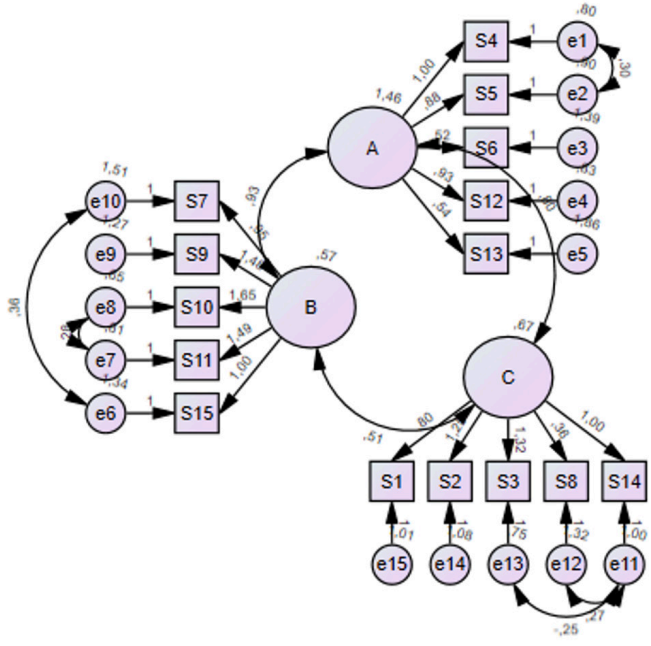


**Figure 1.** Confirmatory factor analysis diagram of the Parkinson disease sleep scale-2

To assess its invariance over time, the scale was administered to 30 participants in the study group twice, 15 days apart. It was observed that there was a high level of correlation and no significant difference between the mean values obtained in the first and second measurements (r=0.914 t=1.353 p>0.05). Table 4 presents the test-retest results for PDSS-2. Based on these findings, it can be stated that all of the items in the Turkish form of the PDSS-2 have high reliability.

**Table 2. Fit indices of the CFA of the PDSS-2 (n=135)**

| Fit indices | Good fit values | Acceptable fit values | Fit values of PDSS-2 |
|---|---|---|---|
| $\chi^2$/SD | <3 | <5 | 2.114 |
| RMSEA | 0.00< RMSEA <0.05 | 0.05< RMSEA <0.08 or 0.10 | 0.091 |
| SRMR | 0.00< SRMR <0.05 | 0.05< SRMR <0.08 or 0.10 | 0.068 |
| GFI | 0.95< GFI <1.00 | 0.85 or 0.90< GFI <0.95 | 0.866 |
| AGFI | 0.90< AGFI <1.00 | 0.80 or 0.85< AGFI <0.90 | 0.804 |
| IFI | 0.95< IFI <1.00 | 0.90< IFI <0.95 | 0.906 |
| CFI | 0.95< CFI <1.00 | 0.90< CFI <0.95 | 0.903 |
| PCFI | PCFI >0.50 | - | 0.706 |
| PNFI | PNFI >0.50 | - | 0.652 |

CFA: Confirmatory factor analysis, $\chi^2$/SD: Chi-square/degree of freedom, CFI: Comparative fit index, RMSEA: Root mean square error of approximation, SRMR: Standardized root mean square, GFI: Goodness of fit index, AGFI: Adjusted GFI, IFI: Incremental fit index, PCFI: Parsimony CFI, PNFI: Parsimony normed fit index, SD: Standard deviation, PDSS-2: Parkinson's disease sleep scale-2

**Table 3. Item analysis of the PDSS-2**

| Items | The average score when the item is excluded | Variance when the item is excluded | Item-total correlation coefficient | Reliability coefficient when the item is excluded |
|---|---|---|---|---|
| S1 | 27.59 | 177.706 | 0.439 | 0.904 |
| S2 | 27.18 | 169.535 | 0.565 | 0.900 |
| S3 | 26.93 | 169.316 | 0.607 | 0.899 |
| S4 | 27.33 | 162.194 | 0.748 | 0.893 |
| S5 | 27.54 | 165.056 | 0.712 | 0.895 |
| S6 | 27.51 | 173.759 | 0.500 | 0.902 |
| S7 | 28.12 | 171.837 | 0.516 | 0.902 |
| S8 | 26.57 | 181.650 | 0.316 | 0.908 |
| S9 | 27.09 | 163.455 | 0.669 | 0.896 |
| S10 | 27.49 | 161.356 | 0.785 | 0.892 |
| S11 | 27.60 | 164.436 | 0.720 | 0.894 |
| S12 | 27.50 | 164.834 | 0.704 | 0.895 |
| S13 | 27.86 | 174.092 | 0.419 | 0.906 |
| S14 | 26.80 | 171.893 | 0.575 | 0.900 |
| S15 | 28.07 | 170.502 | 0.573 | 0.900 |

PDSS-2: Parkinson's disease sleep scale-2

**Table 4. Test-retest results for PDSS-2 (n=30)**

| | First evaluation | Second evaluation | | | |
|---|---|---|---|---|---|
| | Mean (SD) | Mean (SD) | t-test | p | r* |
| Total score | 30.00 (12.00) | 31.23 (12.10) | -1.353 | 0.187 | 0.914 |
| Factor 1 | 9.16 (4.65) | 9.83 (4.31) | -1.836 | 0.077 | 0.905 |
| Factor 2 | 8.33 (5.45) | 8.83 (5.01) | 1.822 | 0.079 | 0.962 |
| Factor 3 | 12.50 (3.01) | 12.56 (3.81) | -0.134 | 0.894 | 0.707 |

*p<0.001, SD: Standard deviation, PDSS-2: Parkinson's disease sleep scale-2

## Discussion

Validity is the ability of a measuring instrument to accurately measure what it is intended to be measured without confusing it with any other features (22). While evaluating the validity of the scale, CVI and CVR were calculated and the CFA was performed, unlike the validity and reliability studies conducted in other languages (14,19,23). In the study, first of all, the content validity, which evaluates the extent to which the scale and each item in the scale serve the purpose (24), was tested using the Davis technique. The draft form of the scale was presented to eight experts, consisting of physicians and academician nurses with a PhD degree who have studies on Parkinson's, to receive their opinions on the scale. The experts were requested to evaluate the comprehensibility, language, and relevance of the items to the subject, by rating each item on a four-point scale as (1) "not appropriate", (2) "item needs major revision", (3) "item needs minor revision", and (4) "appropriate". The scores for each item were calculated in accordance with the Davis technique (24). Since the CVR for each item was higher than 0.80, which was accepted as the cut-off point, it was seen that the scale had good content validity and no items were removed from the scale. Necessary adjustments were made in the items by taking the opinions and suggestions of the experts about the language of the scale.

One of the important analyses to be made to test the validity of the scale is the construct validity analysis, which is evaluated using the exploratory factor analysis (EFA) and the CFA. The EFA creates a model by explaining the factor structure of the scale, and the CFA uses to confirm the number of factors and their relationship with items (21,25). During the PDSS-2 development phase, Trenkwalder et al. (18) used the EFA while evaluating the construct validity of the scale and determined that the scale had three sub-dimensions. In scale adaptation studies, the reapplication of the EFA may cause a deterioration in the structure of the scale (26). Therefore, in this study, the CFA was used to assess construct validity, which could examine whether the findings were consistent with the theoretical construct. In addition, COSMIN also states and recommends that the CFA is a high-quality indicator (21). Our study revealed that the model fit and the model fit indices of the 15 items and the three-factor structure of the scale were at an acceptable

level, and the factor loadings of the items in the scale were greater than 0.30 (25) in the path diagram.

In the study, reliability was evaluated using three approaches. The test-retest method (n=30) was used to evaluate the invariance of the scale against time; Cronbach α and the corrected ITC were used to test internal consistency. An internal consistency coefficient above 0.70 indicates that the scale has a very high reliability (22). In the study, it was determined that the internal consistency coefficients of the scale and its sub-dimensions were higher than the original form of the study (18) and its versions in other languages (14,19,27). When the ITC coefficients were examined, it was seen that none of the items were below the threshold value of 0.30 (28), and therefore reliable. The correlation coefficient in the test-retest analysis performed to evaluate the invariance over time was found to be higher than 0.70, which is another important finding showing the reliability of the scale (22).

### Study Limitations

There are several limitations of this study. Firstly, the sample size could have been larger. Secondly, the data from some patients were gathered online via since outpatient services were limited due to the COVID-19 pandemic during the data collection process.

## Conclusion

The study revealed that the Turkish version of the PDSS-2 is a valid and reliable measurement tool. The new version was made a part of the literature. We believe that the scale will be widely used to detect sleep problems in PD.

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### Ethics

**Ethics Committee Approval:** Local ethics committee approval was obtained from the Selçuk University's Faculty of Health Sciences (decision no: 2019/109, date no: 27.02.2019).

**Informed Consent:** The patients participating in the study were informed about the aim of the study and data collection tools, and their consent was obtained.

**Peer-review:** Internally peer-reviewed.

### Authorship Contributions

Concept: A.T.K., S.A., Design: A.T.K., S.A., Data Collection or Processing: A.T.K., Analysis or Interpretation: A.T.K., S.A., Literature Search: A.T.K., S.A., Writing: A.T.K.

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

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