Validation of the Arabic Version of the Glasgow Sleep Effort Scale Among Lebanese General Population

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This study aimed to assess the reliability and validity of the Arabic version of the Glasgow Sleep Effort Scale (GSES) as an indicator of sleep effort within the Lebanese general population. A total of 360 members of the general population were included in this e-survey study. The sample completed the following measures: GSES, Insomnia Severity Index (ISI), Dysfunctional Beliefs about Sleep-2 (DBS-2), Patient Health Questionnaire-9 (PHQ-9), and a sleep diary regarding their bedtime, sleep onset time, wake-up time, desired total sleep time, and desired time in bed. The results supported the single-factor structure through confirmatory factor analysis. It also showed internal consistency with Cronbach’s alpha and omega values of 0.857 and 0.858, respectively. Further, Convergent validity was established with significant correlations between GSES, DBS-2, ISI, and PHQ-9. This suggests that GSES is valid and reliable for measuring sleep effort among the Lebanese general population.

Keywords Psychometrics; Insomnia; Glasgow Sleep Effort Scale; Sleep effort; Arabic scale.

INTRODUCTION

Insomnia is generally considered the most common sleep disorder. It is estimated that over 1 year duration approximately 7% of the general population develop an insomnia syndrome, and approximately 28% develop insomnia symptoms [1]. According to both the International Classifications of Sleep Disorders, Third Edition (ICSD-3) and the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), insomnia involves self-reported difficulties in falling asleep, maintaining sleep, or waking up earlier than desired. These challenges need to be specifically present for at least 3 nights per week over a period of 3 months, despite having favorable circumstances and opportunities for sleep. Additionally, the impact on daily functioning across various aspects of life must be evident [2].

Sleep effort, a concept rooted in sleep-related performance anxiety, manifests as a combination of cognitive and behavioral components. Good sleepers effortlessly embrace sleep, while poor sleepers tend to engage in excessive efforts to secure a good night's rest, often characterized by cognitive elements such as obsessive thoughts about sleep and behavioral aspects like an overt attempt to induce sleep and the usage of sleep medications. Additionally, a strong correlation between sleep effort and the severity of insomnia was identified, with individuals exhibiting heightened sleep effort tending to experience more pronounced insomnia [3].
Given the fundamental importance of sleep effort in diagnosing insomnia, the evaluation of this element becomes paramount. For this reason, the Glasgow Sleep Effort Scale (GSES) was meticulously developed and psychometrically validated by Broomfield and Espie [4], serving as a reliable tool for quantifying sleep effort by means of a 7-item Likert scale questionnaire. The GSES inquiries about the participants’ state for the “past week,” thus assessing their current condition rather than being a trait measure [4]. Kohn and Espie [5] have asserted the GSES’s efficacy, introducing it as a highly valuable tool for differentiating individuals with insomnia from good sleepers. This assertion is well demonstrated by Cronbach’s alpha of 0.77, which remains consistently high with item-deletion alphabets, in addition to a strong discriminant validity even when age was controlled [4]. Originally developed and validated in the UK, the psychometric properties of the GSES were evaluated in other western [6] as well as in non-western countries, including Korea, Iran, and Turkey [7-9] and proven to be reliable. The aim of this study was to explore the reliability and validity of the Arabic version of the GSES among the Lebanese general population.

METHODS

Data collection was performed from January 31, 2023, to February 18, 2023. The inclusion criteria were as follows: 1) living in Lebanon and 2) being between 18 and 65 years. We recruited participants using a convenience sampling method, which is a non-probabilistic sampling method where participants are selected for a study based on their accessibility and convenience [10]. An online questionnaire was used for data collection, and the link to the questionnaire was shared in WhatsApp, Instagram, and Facebook applications using a snowball technique, which is a method of sampling where participants refer others to the study, creating a chain or “snowball” of recruitment [11]. The study was approved by the Institutional Review Board of University of Ulsan (IRB No. 2023R0003). Informed consent was obtained from all participants.

The GSES is a rating scale which was developed to assess an individual’s persistent sleep effort [4]. It contains 7 items related to preoccupation with sleep and effort to fall asleep. The Arabic version was translated using translation and back-translation methods (Supplementary Material in the online-only Data Supplement). The Insomnia Severity Index (ISI) is a self-report rating scale that can assess an individual’s insomnia severity [12]. We applied the Arabic version of the ISI, and Cronbach’s alpha was 0.839 among this sample. The Dysfunctional Beliefs about Sleep-2 (DBS-2) is a 2-item ultra brief scale which was developed to measure one’s dysfunctional beliefs about sleep [13]. The Arabic version of the DBS-2, translated using translation and back-translation methods, was applied in this study, and the split-half coefficient among this sample was 0.713. The Patient Health Questionnaire-9 items (PHQ-9) is a self-report rating scale that can assess an individual’s depression [14]. We applied the Arabic version of this scale. In this study, we also applied the DBST index, the discrepancy between desired time in bed (dTIB) and desired total sleep time (dTST). The dTST was obtained from the responses to the question, “How many hours do you want to sleep per day?” and the desired TIB was obtained from the response to the question, “From what time to what time do you want to sleep?” The DBST was calculated as dTIB – dTST [15].

Statistical Analysis

Construct validity of the Arabic version of the GSES was checked with confirmatory factor analysis (CFA). Before that, normality assumption was checked based on skewness and kurtosis of each item with ±2 [16]. Data suitability and sampling adequacy was checked using the Kaiser-Meyer-Olkin (KMO) values and Bartlett’s sphericity test. CFA was conducted and satisfactory model fit was defined as a standardized root-mean-square residual (SRMR) value of 0.05 [17], a root-mean-square-error of approximation (RMSEA) value of 0.7 [17] and a comparative fit index (CFI) and Tucker Lewis index (TLI) value of 0.90 [18]. Multi-group CFAs were done across sex (male vs. female) or having insomnia (ISI < 8 vs. ISI ≥ 8). Reliability of internal consistency was examined based on Cronbach’s alpha and McDonald’s omega. The convergent validity with the previous existing rating scales such as ISI, DBS-2, or PHQ-9, and the DBST index was checked using Spearman’s correlation analysis. The JASP version 0.14.1.0 software (JASP Team, Amsterdam, the Netherlands) was used for statistical analysis.

RESULTS

Among all 472 participants who agreed to participate in and completed this survey, 360 responses were finally analyzed excluding 112 responses whose answer to the DBST index was incomplete. The mean age was 25.2 ± 8.2 years, and 76.4% were female (Supplementary Table 1 in the online-only Data Supplement).

Before CFA, sampling adequacy and data suitability was confirmed based on 0.869 of KMO value and Bartlett’s test of sphericity, p < 0.01. Normality assumption was confirmed based on a skewness and kurtosis of all items within ±2 (Table 1). CFA showed a good model fit for a single-factor model of the Arabic GSES (CFI = 0.988, TLI = 0.982, RMSEA = 0.055, SRMR = 0.059). Multi-group CFA also showed that the Arabic version of the GSES can measure one’s sleep effort in a same way across sex (male vs. female; CFI = TLI = 0.997, RMSEA = 0.022, SRMR = 0.061) or having insomnia (ISI < 8 vs. ISI ≥ 8, CFI = 0.982, TLI = 0.973, RMSEA = 0.057, SRMR = 0.072).

The Arabic version of the GSES showed a good reliability of internal consistency based on 0.857 of Cronbach’s alpha and
0.858 of McDonald’s omega. It shows a good convergent validity with the pre-existing rating scales such as ISI (ρ = 0.64, p < 0.01), DBS-2 (ρ = 0.38, p < 0.01), PHQ-9 (ρ = 0.45, p < 0.01). The GSES was not significantly correlated with age nor with the DBST index, though it was correlated with desired bedtime (dB) (ρ = -0.11, p < 0.05) and dTIB (ρ = 0.12, p < 0.05) (Table 2).

**DISCUSSION**

In this study, we found that the Arabic version of the GSES demonstrated satisfactory reliability and validity for assessing sleep effort in the Lebanese general population, regardless of sex and the presence of insomnia. The GSES scale also exhibited good convergent validity with the ISI, DBS-2, and PHQ-9 scales in the Lebanese general population.

We confirmed the single factor structure of the GSES through CFA, mirroring findings from other language adaptation and validation studies of the GSES. Consistent results were observed in Persian, Portuguese, Turkish, and the original English language studies, supporting the presence of a singular factor [4,6,8,9,19].

A Cronbach’s alpha of 0.857 was identified, and it showed that the reliability of internal consistency of the single factor of GSES was good. Furthermore, it showed a good convergent validity with the pre-existing scales such as the ISI, DBS-2, or PHQ-9. In this study, we also explore the convergent validity of the Arabic GSES with the DBST index, which was reported to be a new index for insomnia severity [20]. It was reported that the GSES score was significantly correlated with the DBST index among the Korean general population, but we could not observe the similar results among the Lebanese general population in the current study. These negative findings can be explained as, first, the mean age of participants in this study was younger compared to them in the previous study [20]. Second, cultural differences may influence the meaning of the DBST index in relation to insomnia severity. There is a need for further research among other cultures as well.

There are limitations in this study. First, validation of the Arabic GSES was done among the general population rather than clinical samples of insomnia patients. Further study needs to be conducted among insomnia patients to explore the validity and

| Table 1. Factor structure of the Arabic version of the GSES among Lebanese general population (n = 360) |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Items                          | Response scale (%)             | Descriptive                     | CITC   | CID   |
| Item 1                         | 38.6 48.3 13.1                 | 0.74 ± 0.67                     | 0.36   | 0.602 |
| Item 2                         | 16.4 57.5 26.1                 | 1.10 ± 0.65                     | -0.09  | 0.404 |
| Item 3                         | 67.8 23.6 8.6                  | 0.41 ± 0.64                     | 1.32   | 0.676 |
| Item 4                         | 46.4 40.6 13.1                 | 0.67 ± 0.70                     | 0.56   | 0.684 |
| Item 5                         | 65.3 28.3 6.4                  | 0.41 ± 0.61                     | 1.20   | 0.710 |
| Item 6                         | 71.4 22.8 5.8                  | 0.34 ± 0.58                     | 1.51   | 0.686 |
| Item 7                         | 50.0 38.1 11.9                 | 0.62 ± 0.69                     | 0.67   | 0.628 |

0, not at all; 1, to some extent; 2, very much; M, mean; SD, standard deviation; CITC, corrected item-total correlation; CID, Cronbach’s alpha if item deleted; CI, confidence interval.

| Table 2. Spearman’s correlation coefficients of each variables among participants (n = 360) |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Variables                      | Age                             | GSES                           | ISI                             | DBS-2                          | PHQ-9                          | dTST                           | dBt                            | dWT                             | dTIB                            |
| GSES                            | -0.04                           |                               |                                 |                                |                                |                                |                                |                                |                                |
| ISI                             | -0.12*                          | 0.64**                        |                                 |                                |                                |                                |                                |                                |                                |
| DBS-2                           | -0.07                           | 0.38**                        | 0.30**                          |                                |                                |                                |                                |                                |                                |
| PHQ-9                           | -0.15**                         | 0.45**                        | 0.62**                          | 0.25**                         |                                |                                |                                |                                |                                |
| dTST                            | 0.02                            | 0.09                          | 0.11*                          | 0.02                           | 0.16**                         |                                |                                |                                |                                |
| dBt                             | -0.12*                          | -0.11*                        | -0.02                           | -0.01                          | 0.04                           | -0.08                          |                                |                                |                                |
| dWT                             | 0.00                            | 0.04                          | 0.06                           | -0.11*                         | 0.14**                         | 0.44**                         | 0.31**                         | 0.79**                         |
| dTIB                            | 0.09                            | 0.12*                         | 0.06                           | -0.07                          | 0.12*                          | 0.54**                         | -0.28**                         | 0.51**                         | 0.66**                         |
| DBST index                      | 0.08                            | 0.04                          | -0.01                          | -0.10                          | 0.00                           | -0.19**                         | -0.22**                         | 0.51**                         | 0.66**                         |

*p < 0.05; **p < 0.01.

GSES, Glasgow Sleep Effort Scale; ISI, Insomnia Severity Index; DBS-2, Dysfunctional Beliefs about Sleep-2 items; PHQ-9, Patient Health Questionnaire-9 items; dTST, desired total sleep time; dBt, desired bedtime; dWT, desired wake-up time; dTIB, desired time in bed; DBST index, discrepancy between desired time in bed and desired total sleep time.
reliability of the scale. Second, the mean age of the participants was relatively low (25.2 ± 8.2), and the sample may not represent the elderly population, where insomnia is more prevalent.

Despite the limitation, this study confirmed that the Arabic version of the GSES was a reliable and valid rating scale which can measure one’s persistent sleep effort.

Supplementary Materials
The online-only Data Supplement is available with this article at https://doi.org/10.17241/smr.2024.02215.

Availability of Data and Material
The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Author Contributions

Conflicts of Interest
The authors have no potential conflicts of interest to disclose.

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