Glasgow Sleep Effort Scale: Translation and Psychometric properties of the Persian Version

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Abstract

Background: Sleep effort is a multicomponent variable associated with sleep initiation and maintenance problems. The purpose of the current study is to investigate the validity and reliability of the Glasgow Sleep Effort Scale (GSES) in Persian language.

Methods: The participants consisted of two samples: a clinical group of 120 participants with insomnia disorder meeting DSM-V criteria for insomnia and a non-clinical group of 110 participants (58%) with normal sleep who completed the following measures: GSES, Pittsburg Sleep Quality Index, Insomnia Severity Index, Dysfunctional Beliefs and Attitudes about Sleep Scale-10, Pre Sleep Arousal Scale-cognitive subscale, Depression-Anxiety- Stress Scale-21 and sleep diary. Significant correlations were observed between GSES and related measures in both groups.

Results: Principal component analysis indicated a single component accounted for 64.77% of total variance in clinical group. Result of the fit estimates for the one-factor unidimensional model meet the previously specified fit criteria and adequately fit the data in non-clinical group. Statistical findings showed that the GSES has good internal consistency in terms of Cronbach Alpha (.75 for clinical sample and .77 for non-clinical sample) and test- retest reliability ($r = .70$) for a 4 week interval. The cutoff point, sensitivity, and specificity of the scale were 6, 85% and 94.5%, respectively.

Conclusions: The Persian Version of the GSES has adequate psychometric properties in both clinical and non-clinical populations and can be used in Persian speaking countries. **Keywords:** GSES, sleep effort, reliability, validity, insomnia, Persian scale

Background

Insomnia is defined as predominant complaint of dissatisfaction with sleep quantity or quality accompanied with considerable distress or impairment (1). Studies show that insomnia is not a context specific issue and it has been widely recognized as a public health problem in the UK (2), U.S (3, 4), Australia (5), Africa (6), and Asia (7). Although most relevant studies on insomnia have been conducted in western countries and little is known about the epidemiology of insomnia as a disorder in eastern countries such as Iran. The current statistics show that the number of individuals with poor sleep quality is growing in Iran (8–10).

Prior studies have demonstrated that sleep problems are coexisting with a wide range of psychiatric disorders (11, 12). Insomnia, as a sleep problem, has been associated with a variety of individual and work-related outcomes. At the individual level, it has been found to be associated with future episodes of anxiety and depression (13), medications and health care services (e.g., Sivertsen, Krokstad, Overland, & Mykletun, 2009) and suicide ideation (14). At work level, it has been found that individuals with insomnia are more likely to experience work-related accidents in comparison with non-insomnia individuals (15). Moreover, in spite of the psychiatric disorders, insomnia can detrimentally influence the quality of life

(16). The negative outcomes associated with insomnia reveal that insomnia is detrimental and needs to be identified and measured by standard and appropriate psychological scales.

The negative impacts of insomnia are not limited to western countries and they have also been studied in Iran. For example, a qualitative study on patients with chronic insomnia referred to the sleep disorders center in Kermanshah city of Iran identified following five subthemes: insomnia as an unpleasant experience, insomnia as a worrying experience, treatment seeking behavior, a boring new daily routine and being overshadowed by depressed mood (17). Moreover, a cross-sectional study in Iran found that poor sleep quality is associated with low academic performance in Iranian medical students (18). We used the Glasgow Sleep Effort Scale (19) for the first time in Iran to identify individuals with high sleep effort consistent with the studies that used this scale in western countries (19, 20). It should be noted that this scale has not been previously translated, adapted or used in Iran. Therefore, the main aim of this study is to test the psychometric properties of the Glasgow Sleep Effort Scale (GSES) for the first time in Iran. First, this helps to use an adapted and validated scale for clinical and research investigations in Persian speaking countries, and second to provide more empirical evidence for the use of this scale in eastern countries as well.

REVIEW OF RESEARCH BACKGROUND

There are several cognitive-behavioral models by which we can explain the maintenance of insomnia, however, each of them suggests various factors (i.e., physiological, cognitive, emotional and behavioral) that play a central role in maintenance of insomnia (21). Espie, Broomfield, MacMahon, Macphee, and Taylor (2006) studied psychophysiological insomnia through attention-intention effort pathway. They studied three essential processes including selective attention to sleep-related cues, explicit intention (an attention for action mechanism) and sleep effort that impede sleep-wake automaticity. Sleep effort, a central factor in the maintenance of insomnia, was introduced as a multicomponent construct, including cognitive (e.g. "I must sleep" schema) and behavioral (e.g. performance effort) elements (19). Sleep effort itself involves two related processes: direct effort (e.g. vigorously attempt to fall asleep) and indirect effort (e.g. expand sleep opportunity) (22).

Previous research demonstrated that in patients with mood and anxiety disorders, sleep effort is negatively related to quality of sleep, even after controlling other factors (e.g. trait vulnerabilities for emotional disorders) (23). This provokes the notion that the role of sleep effort in sleep disturbances occurred in the context of emotional disorders is more than vulnerabilities caused by those disorders merely (23). In addition, sleep effort is one of the basic mechanisms that explain differences in subjective and objective insomnia. For example, there are studies show that sleep effort is the predictor of severity of subjective insomnia, while dysfunctional beliefs about insomnia is predictor of objective insomnia (24). The available treatments to reduce sleep effort in patients with insomnia show that patients who received paradoxical intention therapy (e.g., deliberate practice of remaining awake) had lower sleep effort and performance anxiety in comparison with control group (25). This urges researchers to develop measures that can precisely identify the individuals with high sleep effort for treatment purposes.

Therefore, a correct identification of sleep effort would facilitate the treatment procedure. Also, it contributes researchers to develop new treatments for insomnia patients and new preventive programs in controlling insomnia in larger scales.

Glasgow Sleep Effort Scale (GSES) is a 7-item self-report scale that is developed to measure core components of an overall model on persistent preoccupation with sleep (19). Broomfield and Espie (2005) state that although there are some instruments available to measure sleep effort, measuring the sleep effort requires a specific instrument which addresses this factor diagnostically. That was the main reason they developed GSES (19). Kohen and Espie (2005) demonstrated GSES is among the best instruments to differentiate insomniac patients from good sleepers (26).

The pilot version of the GSES developed after a rigorous analysis of the existing tools which lead to a model of on sleep effort, incorporating seven central components of sleep effort (19). Although, the pilot version of GSES was used earlier in two separate studies (25, 26), the psychometric properties of this scale was not examined. In the first validation study (19), GSES was conducted on a sample of 89 patients diagnosed with insomnia based on DSM-IV, and 102 of good sleepers. Internal consistency of the scale using Cronbach's alpha was .77 in patients. GSES was statistically correlated with DBAS ($r = .50$, $p = 0.0001$) which represented its concurrent validity. GSES had good discriminant validity even after controlling for age, and it could differentiate good sleepers from insomniac patients. Results showed a cut-off point of 2 on GSES could accurately detect 93.2% of insomniac patients and 87.3% of good sleepers. Factor analysis of scale explored one factor which could explain 62.6 percent of the total variance of scale (19). Another research in a sample of Portuguese higher education students ($n = 2995$, age mean = 23.9) suggested the Cronbach's Alpha of .79. Factor analysis of scale demonstrated one factor which explained 45 percent of total variance (20). However, both studies lack to report test-retest reliability of the GSES. In this study, we also will cover this lack by measuring and reporting the test-retest reliability of this scale.

Although the psychometric properties of this scale have been studied in some other languages and countries (19, 20), this scale has not been extensively tested, validated and used in non-western populations such as Asian and Middle East countries. Therefore, by evaluating the psychometric properties of the GSES in Iran, using two clinical and non-clinical samples, we aim to provide more empirical evidence in support of this scale in eastern countries. Moreover, testing and reporting the test-retest reliability is the second novelty of this study that has not been investigated by prior studied. Besides, this study determines an appropriate cut-off that responds to the sensitivity and specificity of the Persian version of the GSES based on DSM-5.

Methods

Participants

This study included two clinical and non-clinical samples. The clinical sample ($n = 120$) were recruited from the Sleep Disorder Clinic of Baharloo Hospital in Tehran, during the period from September 2016 to

July 2017. Participants were included if they would meet the DSM-V criteria (sleep initiation, sleep maintenance, or early morning awakening problems which occurs three times per week, lasting for at least three months and makes clinically significant distress) for insomnia disorder (1). Individuals diagnosed by other sleep disorders (e.g. sleep apnea, restless leg syndrome), severe psychiatric disorders (such as bipolar disorder), substance abuse problems, and instable use of sleep or psychotropic medications were excluded. Non-clinical group ($n = 110$) were good sleepers who were recruited from the study announcements at different locations. They met Research Diagnostic Criteria (RDC) for Normal Sleepers (27). Of the total sample that was primarily invited to participate, less than 20% ($n = 19$) refused to participate. Fifty-three percent of the clinical sample and 58% of the non-clinical sample were female. In clinical group, 37.4% of the sample identified their education level as diploma, 39.4 as bachelor, 20.6% as master, and 2.6% as Ph.D. In non-clinical group, 41.2% of the sample identified their education level as diploma, 35.6 as bachelor, 19.8% as master, and 3.4% as Ph.D. The clinical sample had an average age of 39.20 years ($SD = 5.61$, range: 18-71) and the non-clinical sample had an average age of 36.5 ($SD = 4.82$, range: 18-72). The insomnia duration mean of the clinical sample was 8.42 years ($SD = 7.41$) with an age mean of 29.64 years ($SD = 14.23$). The average sleep onset latency (SOL), total time of awakenings after sleep onset (WASO), early morning awakening (EMA), total actual sleep time (TST), and total time spent in bed (TIB) as gleaned from the sleep diary were 97.31, 115.26, 48.61, 358.2, and 619.8 minutes, respectively. In addition, sleep efficiency of the clinical group was 57.8%.

Measures

Glasgow Sleep Effort Scale (GSES)

This scale consists of 7 items and it was developed by Broomfield and Espie (2005). This scale assesses a present state of sleep effort. Responses are recorded on a 3-point Likert scale from not at all (0), to some extent (1), very much (2). Higher scores indicate greater effort to sleep over the past week. An item example is *"I make too much of an effort to fall asleep, when it should happen naturally"*. Psychometric properties of this scale has been examined in insomniac patients and good sleepers (19). Results showed that GSES had adequate internal consistency (Cronbach's Alpha = .77) and it can differentiate good sleepers from insomniac patients appropriately (19).

Dysfunctional Beliefs and Attitudes about Sleep Scale-10 (DBAS-10)

This scale assesses dysfunctional cognitions and beliefs about sleep and it was developed by Espie, Inglis, Harvey, and Tessier (2000). Each item is rated from 0 to 10 which higher scores indicate stronger agreement with dysfunctional beliefs. An item example is *"I need 8 hours of sleep to feel refreshed and function well during the day"*. Internal consistency of DBAS-10 in terms of Cronbach Alpha is .69 and it can differentiate good sleepers from insomniac patients. Factor analysis of DBAS-10 demonstrated 3 factors including: Beliefs about the immediate negative consequences of insomnia (5 items), Beliefs about the long-term negative consequences of insomnia (3 items) and Beliefs about the need for control over insomnia (2 items) (28). In an Iranian clinical sample ($n = 120$), test-retest reliability of DBAS-10 for 2-weeks' time interval was .83% and its internal consistency was .82% (29).

Depression Anxiety Stress Scale (DASS-21)

DASS-21 (30) is a short form of DASS-42 (31) designed to measure symptoms of depression, anxiety and stress in adults. Respondents are asked to indicate the extent to which each of the statements is applied to them on a 4-point Likert scale starting from never (1) to always (4) (31). This scale has demonstrated appropriate convergent, discriminant and construct validity (30). Also, a study conducted on an Iranian sample of college students ($n = 638$) reported test-retest reliability of .81, .78 and .80 and Cronbach Alphas of .85, .75 and .87 for depression, anxiety and stress of this scale respectively (32).

Pittsburgh Sleep Quality Index (PSQI)

This is a 19-item index consisting of 7 components and was developed by Buysse, et al (1989). The components are subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Individuals rated each item on a 4-point scale from 0 to 3. Cronbach Alpha and test-retest reliability of this scale were reported as .83 and .85, respectively (33). This scale previously has been examined on an Iranian sample and the Cronbach Alpha was reported .52 for patient group ($n=125$) and .78 for control group ($n = 133$). Also, the sensitivity and specificity of the Persian version were reported .94.5 and .72 respectively (34).

Insomnia Severity Index (ISI)

This is a 7-item scale which was developed by Bastien, Vallieres, and Morin (2001). The items measure the severity of problem in going to sleep, staying asleep, waking up too early, satisfaction with sleep, noticeability of sleep problem, distress and interference caused by sleep problem. Total score of this scale ranges from 0 to 28, which higher scores indicate more perception of insomnia. Cronbach Alpha of the scale in insomniac patients was .74 and it consists of three components: Impact (3 items), severity (3 items), satisfaction (3 items) (35). Cronbach Alpha of this scale for a group of Iranian patients was .82 and its item-total correlation coefficient was reported from .56 to .91 (36).

Pre-sleep Arousal Scale (PSAS)

This scale includes 16 items and it was developed by Nicassio, Mendlowitz, Fussell, and Petras (1985) to assess both cognitive and somatic components of arousal. Participants are asked to rate each item from 1 (not at all) to 5 (extremely) (37). Test-retest reliability of the scale in a sample of college students ($n = 30$) has been .72 and .76 for cognitive and somatic components respectively. Also, Cronbach Alpha of cognitive and somatic components were .67 and .84 for normal sleepers and .76 and .81 for insomniacs respectively (37). Cronbach Alpha of the Persian version in a sample of college students was .72 for somatic and .84 for cognitive subscale. Test-retest reliability of the scale in two week time interval was .88 (38).

Consensus Sleep Dairy (CSD)

Sleep diary is a self-report scale that gathers information about pattern and quality of sleep over two weeks (39). CSD has three versions as the core (includes a standard set of 9 items), the expanded for the morning (includes optional morning completion items), and the expanded for evening (includes optional morning and evening completion). It assesses sleep onset latency, wakefulness after sleep onset, terminal WASO, total wake time, time in bed, and total sleep time (40). Validity, usability, and clinical utility of the scale is proved previously (41). Core version of the CSD was used in the current study.

Procedure

The study was approved by the ethics committee at Tehran University of Medical Sciences [Ethics code: IR.TUMS.REC.1396.2947]. All participants provided written informed consent before their participation. They were informed that their participation in the study is completely voluntarily. They could withdraw at any time without restriction. In addition, they were informed that only the research team will have access to the data for academic purposes and the data will be treated confidentially and anonymously.

The English version of GSES was carefully translated into Persian by a group of specialists, including two psychiatrists, three sleep clinicians and two clinical psychologists. The translated version was back-translated to English by two linguistics. Following that, a bilingual individual compared the back-translated and original versions of the scale to check the quality and precision of the back-translated version based on the original one. This led to the finalized Persian version of this scale. To avoid any potential misunderstanding in regard to wording, the current Persian version was piloted with 30 participants, who were asked to rate readability and clarity of the Persian items on a response scale ranging from 0 (*not understandable*) to 5 (*completely understandable*). Over 95% of the participants chose the “completely understandable” which indicated no need for further item revisions.

The clinical group included individuals who were seeking treatment at sleep disorders clinic of Baharloo hospital in Tehran. Non-clinical group were good sleepers who responded to study announcements and they were invited via e-mail. Regarding the clinical group, those who volunteered were interviewed by a sleep medicine specialist to evaluate the inclusion criteria. Then, the eligible participants were asked to complete a sleep diary for 2-weeks with the aim to evaluate if they have SOL or WASO more than 30 minutes. After that, participants were referred to a clinical psychologist and were asked to complete the study measures. The data collection consisted of CSD, DASS-21, DBAS-10, PSAS-C, PSQI and ISI scales.

Statistical analysis

SPSS-21 IBM statistical package was used for statistical analysis. Cronbach's Alpha and mean inter-item correlation coefficients were computed for GSES to assess internal consistency. Given the number of correlations and comparisons, the p-values were adjusted based to Bonferroni procedure: an initial α of .05 was divided by the number of measures shown in Table 1. The factor structure of the GSES was evaluated by explanatory factor analysis (EFA) in the clinical group.

A confirmatory factor analysis using LISREL, version 8.72 (42) was used to examine the one-factor structure of the GSES (19) in the non-clinical group. Confirmatory factor analysis offers a variety of statistical tests and indices designed to assess the goodness-of-fit of identified models (43-45). For this purpose, in the present study, the goodness-of-fit was evaluated using the following statistics: the goodness-of-fit index ($GFI > .9$), the adjusted goodness-of-fit index ($AGFI > .90$), the non-normal fit index ($NNFI > .90$), the comparative fit index ($CFI > .90$), the root mean square residual ($RMSR < .08$), the normal chi-square ($3 > \chi^2/df < 2$), the root mean square error of approximation ($RMSEA$) and its 90% confidence interval ($< .05$) (43-45).

To evaluate convergent validity, the correlation coefficient between GSES and DBAS-10, PSAS- C, DASS-21, ISI and PSQI were investigated. For the purpose of test-retest analysis, Pearson correlation coefficients were calculated in a subsample who was selected randomly from the clinical sample ($n = 50$) and completed the GSES twice with a 4 week time interval.

Results

A number of steps composed of consistency, descriptive and graphical analysis checks (e.g., box plots, histograms, and scatter plots outlier detection) were conducted to screen data. At the beginning, data screening and the assumption of normality was examined which revealed a small skewness in the items 3 and 6 of the GSES. Because of non-normal sample distribution of some items, non-parametric statistics (Mann-Whitney U test) were used in item level and mean level group (clinical vs. non-clinical) and gender (male vs. female) differences. To make a decision regarding removing or remaining outliers, original mean and 5% trimmed mean, $p > .05$ were compared. Excluding five cases as the outliers did not affect the major findings of the analysis; thus the present results are reported including all the data with the presence of the outliers. Data were analyzed with original data without removing outliers as along with powerful estimation of related statistical parameters (46). Factor Structure of GSES To evaluate the component structure of the GSES in clinical group, using principal components analysis (19), one component was extracted without rotation. Two criteria was considered regarding components extraction, the Kaiser criterion (eigenvalues > 1), and Cattell's scree plot (table 1, figure 1). Acceptable conditions for conducting principal components analysis, that is, inter item correlation coefficients about or above .30; Kaiser–Meyer–Olkin measure of sampling adequacy = .90, above the recommended minimum value of .50; significant Bartlett's test of sphericity; and $\chi^2(21) = 941.63$, $p < .001$ were found (47, 48). Mainly, a single principal component was found (eigenvalue = 3.08), which explained 64.77% of total variance (Table 1). We used LISREL version 8.72 (42) to measure the extent to which data collected from the non-clinical sample was compatible with the aforementioned model in literature (19, 20). Following the original scale(19) we built a one-factor model in which all 7 items were loaded on a single factor. Preliminary analysis of data showed that normality was violated. As such, the generalized weighted least squares estimation method was used as distribution of the data which was less sensitive to normality (49). PRILIS software (42) was also used to estimate the polychoric correlations and their Asymptotic Covariance Matrix (ACM) of the sample variance and covariance. We also tested the factorial structural

of the scale using confirmatory factor analysis (CFA). The results of the fit estimates for the one-factor model meet the previously specified fit criteria and adequate fit to the data. The chi-square test results were significant for all models, but that is to be expected with models with large degrees of freedom and relatively large sample sizes (50). An examination of the fit indices approved the parsimonious aspect of the model [S-B $\chi^2/df = 1.80$; CFI = .97; NNFI = .96; SRMR = .086, GFI = .94, AGFI = .92 and RMSEA = .086 ([CI] 90% = .025, .13]. Reliability, convergent and discriminant validity of GSES Fifty participants (41% male, 34% single; mean age of 37.5 years old) were recruited randomly from clinical group. They completed the GSES twice with a 4-week time interval to examine the test-retest reliability. The correlation between the first and second administrations was statistically significant ($r = .70, p < .01$) which indicates relatively temporal stability of the GSES. The inter-correlation matrix in Table 2 shows that almost all the items correlated with each other in a positively from non-significant to moderately significant coefficients (r range = .01 to .58) Cronbach's Alpha of the scale was found .75 for the clinical sample and .77 for the non-clinical sample which indicates a moderate internal consistency (51). The results showed that the removal of any item did not increase the level of internal consistency (table 1). The minimum corrected item-total correlation was .22 in the clinical group versus .35 in the non-clinical group. Convergent and divergent validity of the GSES was assessed by calculating Pearson's correlations between all study measures. Statistically Significant correlations between total score of GSES and DBAS-10 ($r = .45, p < .001$), PSAS-C ($r = .48, p < .001$), depression ($r = .30, p < .001$), anxiety ($r = .31, p < .001$), stress ($r = .34, p < .001$) components of DASS-21, ISI ($r = .46, p < .001$), and PSQI ($r = .48, p < .001$) were found in clinical group. Mann-Whitney U test as the non-parametric test was used to test diagnostic validity of the GSES. The results in Table 1 indicated statistically significant differences between clinical and non-clinical group in GSES's items, and total score ($p = .001$), suggesting that GSES significantly discriminated clinical group from the non-clinical group. Sensitivity and specificity of the GSES A ROC curve, indicating sensitivity (or true positive rate) and specificity (or true negative rate) of every possible cut-off score, was constructed (52). Youden's index (.79, CI=.71-.85, cut-off = 6, 95%, Confidence interval with bootstrap interval = 4-6) was applied to assess the optimal cut-off point (using this formula: sensitivity + specificity-1.00, (52, 53). Sensitivity and specificity indices were computed for all the possible GSES cut-off scores. The GSES scores were analyzed to classify both clinical and non-clinical group. GSES score ranges from 0 to 14. A GSES score of 6 or higher yielded a sensitivity of 85% and a specificity of 94.55%, highlighting that 5.45 % of the non-clinical group and 85.00 % of the clinical group exceeded the cut-off of 6. The area under the curve was .95 [(95% CI) = .91 to .97, $p < .001$].

Discussion

This study translated, tested, validated a Persian version of the GSES for both educational and clinical purposes in Persian speaking countries to provide a standardized and validated scale on sleep effort consistent with the recommendation of sleep experts in using more standardized assessments in sleep research (53). This validation contributes to the usability and the generalizability of this scale in both western and non-western countries. This is particularly important about non-western countries because it

provides additional evidence on the adequate psychometric properties of this scale in non-western countries which introduces this scale as a reliable scale in these countries.

The first aim of this study was to evaluate the factor structure previously proposed by Broomfield and Espie (2005), and Meia-Via et al. (19, 20). Principal component analysis revealed a single component in clinical group matched with original scale (19) (and similar validations in other countries (20). Results of the confirmatory factor analysis using non-clinical sample, confirmed the one-factor unidimensional model. This is consistent with two previous studies that found a single component accounting for 44.8% (19) and 62.6% (20) of total variance, respectively. Thus, our results obtained in Iran confirmed the same one-factor model proposed by two previous studies.

The results also indicated that Persian version of GSES has adequate internal consistency among Iranian clinical (Cronbach Alpha = .75) and non-clinical (Cronbach Alpha = .77) groups. These findings are consistent with previous studies demonstrating good internal consistency of the GSES (19, 20). Notably, since no research has previously examined the test-retest reliability of the GSES, this study was the first attempt to demonstrate a good test-retest reliability ($r = .70$) of the GSES in a clinical population. Totally, the Cronbach's Alpha coefficients, and test-retest coefficient approve the reliability of the Persian version of the GSES.

Construct validity of the GSES was supported by significant correlations between its total score and related measures in the expected directions supported by literature. Statistical analysis showed a significant positive correlation between GSES and subscales of DASS-21, indicating that GSES is not simply measuring depression, anxiety or stress. Moreover, a significant correlation was found between GSES and DBAS-10 and between GSES and PSAS-C, demonstrating the convergent validity of the scale in relation to existing cognitive sleep measures. The significant observed correlations between GSES and two widely used sleep screening questionnaires (i.e. ISI and PSQI) indicated that sleep effort is related to severity and quality of sleep. The current study provided support for the ability of GSES to discriminate individuals with insomnia disorder from individuals with normal sleep, supporting previous studies (19, 20). A cut-off score of 6 correctly identified 85% of insomnia patients and 94.55% of good sleepers. We found a lower sensitivity and a higher specificity and cut-off point in our sample: This means that a higher level of sleep effort is needed to identify a person with significant sleep effort in an Iranian sample. The results make it possible to screen and identify patient groups according to their GSES scores and consequently targeting these beliefs in treatment protocols.

The original study (19) showed that the GSES could discriminate between individuals with and without insomnia separated based on DSM-IV criteria. Also, Portuguese study (20) indicated that GSES was capable of distinguishing three subgroups (i.e., no sleep problems, insomnia symptoms, and other sleep problems) based on a self-report measure. As our participants were diagnosed according to DSM-V criteria, results of the present study demonstrated that GSES is able to discriminate individuals with and without insomnia according to DSM-V criteria which is another novelty of our study.

Suggestions And Limitation

Although, the present sample included individuals with different age, it did not evaluate the outcomes across the life span. Therefore, it is not specified if the results hold up in older or younger age groups. Thus, it is important to replicate the current study in different age groups and various settings and with larger sample sizes in Iran. In addition, our sample did not consist of participants diagnosed according to structured diagnostic interviews of sleep disorders. This was because no structured interview of sleep disorders has been validated in Persian language. Future studies are needed to validate structured diagnostic interviews of sleep disorders in Iran to help Iranian researchers in selecting more accurate samples with insomnia. Moreover, the current study was conducted using self-report measures. This may distort the relationships among the variables by shared method variance and participants prone to under- or over-estimation of the symptoms. An examination of the relationships between GSES and common objective measures (e.g. polysomnography and actigraphy) is suggested for future studies validating this scale.

Despite several limitations, the present study provides an evidence for intercultural validity of GSES. One of the unique strength of the current study is that, the clinical and non-clinical samples were matched regarding age and gender and this is not usually seen in insomnia research. Additionally, in order to increase the generalizability to real-world clinical populations, participants were not excluded from the study if they were taking a stable dose of medications. Since GSES can be used for the clinical assessment and change (19), the Persian version of the scale provides Iranian clinicians with a standard and validated tool for screening insomnia patients suited to psychological treatments and examining the efficacy of treatments on sleep effort among this population.

Conclusion

The current study makes the first attempt to evaluate psychometric properties of the GSES in a non-western country, using both clinical and non-clinical samples. This study indicates that the Persian version of the GSES is a valid and reliable instrument for applying in Persian speaking populations. At the moment, several measurements are used for the same participants to study their insomnia, this cost-effective self-report scale reduces the burden on such studies. GSES could be used as a valid scale to assess one of the most important maintaining factors of insomnia. It is hoped that the validation of the Persian version will encourage Persian-speaking clinicians and researchers to use it during assessment and treatment of the patients with insomnia.

Abbreviations

GSES

Glasgow Sleep Effort Scale ; DBAS-10:Dysfunctional Beliefs and Attitudes about Sleep Scale-10; DASS-21:Depression Anxiety Stress Scale; PSQI:Pittsburgh Sleep Quality Index; ISI:Insomnia Severity Index ; PSAS:Pre-sleep Arousal Scale ; CSD:Consensus Sleep Dairy ; SOL:sleep onset latency; WASO:wakefulness

after sleep onset; EMA:early morning awakening; TST:total actual sleep time; and TIB:time spent in bed; SD:standard deviation; EFA:explanatory factor analysis; GFI:goodness-of-fit index; AGFI:adjusted goodness-of-fit index; RMSR:root mean square residual ; RMSEA:root mean square error of approximation ; ACM:Asymptotic Covariance Matrix; CFA:confirmatory factor analysis.

Declarations

Ethics approval and consent to participate

All participants received an explanation of the study's goal and were provided with a written informed consent. Written consent was obtained from all participants. This study was approved by the Ethical Committee at Research Center of Tehran University of Medical Sciences, Tehran, Iran. (IR.TUMS.REC.1396.2947)

Consent for publication

Not applicable.

Availability of data and materials

The datasets analyzed during the current study are not publicly available due permission was not obtained from the participants to publicly share anonymized participant data but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interest.

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Authors' contributions

HDAV designed the study, supervised data collection, drafted the introduction, method and discussion sections and revised the manuscript. FAV conducted data collection, provided administrative support, and interpreted the data. MC checked the data accuracy, checked the match between data and conclusions, revised the whole manuscript, and added the suggestion and limitation section. KhSH supervised data collection and provided administrative, technical and material support. FD provided administrative and financial support. MH conducted all statistical analysis, interpreted the data and drafted the results section. All authors have read and approved the manuscript.

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Tables

Table 1.Component Loadings, means, standard deviations, internal consistency coefficients, and mean inter-item correlations of the Glasgow Sleep Effort Scale Items (GSES) and its total scores in clinical and non-clinical group.

I	Component	H ²	Mean		S.D.		Mean		S.D.						Mann-Whitney U	
											Corrected	Cronbach's				
											Item-Total	Alpha if Item				
											Correlation	Deleted				
items			CG	NCG	CG	NCG	men	women	men	women	CG	NCG	CG	NCG	group	gender
1. I make too much of an	.69	.71	1.48	.40	.72	.52	.93	1.26	.81	.84	.53	.48	.68	.70	9.79**	2.72**
2. I feel that I should be	.61	.31	1.36	.74	.71	.72	.72	1.14	.78	.86	.22	.35	.75	.75	6.24**	3.35**
3. At night, I put off going	.49	.35	.73	.09	.81	.28	.45	.56	.70	.77	.25	.44	.75	.72	6.95**	.836
4. If I can't fall asleep I get	.69	.71	1.54	.47	.67	.60	.91	1.25	.84	.86	.56	.50	.67	.70	9.74**	2.68**
5. I feel like I'm not very	.84	.79	1.73	.20	.56	.42	1.17	1.51	.84	.75	.50	.46	.69	.71	12.68**	2.94**
6. Before going to bed I get	.72	.78	1.34	.15	.75	.38	1.06	1.25	.77	.81	.64	.53	.65	.70	10.73**	1.72
7. I worry about the	.71	.72	1.48	.35	.68	.55	1.09	1.30	.80	.79	.49	.59	.69	.68	10.15**	1.91
GSES total score	-		9.68	2.41	3.07	2.28	6.34	8.29	4.00	4.22	.75	.77(.33)	-	-	11.89**	3.26**
											(.29)					

Notes: 1 = Cronbach`s alpha, 2 = mean inter-item correlation, CG= clinical group, NCG= non-clinical group

Table 2. Glasgow Sleep Effort Scale (GSES) item-by-item spearman`s rho correlation matrix

	GSES ₁	GSES ₂	GSES ₃	GSES ₄	GSES ₅	GSES ₆	GSES ₇
GSES ₁		.13	.30**	.44**	.51**	.37**	.27**
GSES ₂	.12		.22*	.23**	.16	.16	.48**
GSES ₃	.25**	.025		.23*	.45**	.37**	.31**
GSES ₄	.56**	.14	.17		.27**	.43**	.40**
GSES ₅	.40**	.23*	.14	.34**		.31**	.32**
GSES ₆	.44**	.33**	.25**	.58**	.38**		.47**
GSES ₇	.37**	.20*	.19*	.32**	.45**	.39**	

Notes: * $P < .01$, ** $P < .05$, (CG= 120; NCG=110), the correlations among the GSES` items for CG (above the diagonal) and for NCG (below the diagonal).

Figures

Figure 1

The scree plot of GSES displays the number of the factor versus its corresponding eigenvalue. When no rotation is done, the eigenvalues of the correlation matrix equal the variances of the factors.