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Psychometric properties of the Chalder Fatigue Scale 14 in women with postpartum depression: A cross-sectional study

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ABSTRACT

This study aims to assess the reliability and validity of the Chalder Fatigue Scale 14 (CFS-14) in women with postpartum depression (PPD). This cross-sectional work employed purposive sampling to recruit 247 participants from three hospitals in China. This study used reliability testing, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) with the CFS-14 and the Multidimensional Fatigue Inventory (MFI-20) as the research instruments. The findings showed: (i) Reliability: The CFS-14 demonstrated good internal consistency with a Cronbach's alpha of 0.88 and a split-half reliability of 0.86. (ii) Validity: EFA identified four factors with item loadings over 0.5 except for item 14. CFA indicated an excellent model fit. Composite reliability (CR) ranged from 0.839 to 0.887 and the square root of the average variance extracted (√AVE) ranged from 0.754 to 0.893 demonstrating good construct validity. The CFS-14 exhibited moderate to strong correlations with the MFI-20 (r = 0.456 to 0.742) supporting acceptable criterion validity. In conclusion, the instrument exhibited satisfactory reliability and validity with the CFS-14 demonstrating a solid four-factor structure instead of the original two-factor model in women with PPD after removing item 14. This enables health workers to assess fatigue and implement interventions more effectively.

Contribution/ Originality: This study examined the psychometric properties of the CFS-14 challenging the original scale's structure. The findings offer a reliable scale for clinical practice and social services while simultaneously addressing inconsistencies in prior work.

1. INTRODUCTION

Postpartum depression (PPD) is a psychiatric syndrome that is highly prevalent among women during the perinatal period. Its primary symptoms include a depressed mood, irritability, fatigue, loss of appetite, lack of interest in life and insomnia [1]. About 17.22% of people worldwide suffer from PPD, particularly in low- and middle-income regions [2] making it a significant public health concern.

Fatigue predicts somatic imbalance characterized by decreased mental and physical capacities and feelings of stress and tiredness [3]. Fatigue conceptually differs from weakness while weakness underscores somatic debility and health issues. Fatigue is perceived as a multidimensional, subjective and enduring internal experience. A study indicated that 63.8% of mothers experienced fatigue post-delivery [4] with the highest incidence happening on the tenth day postpartum at 38.8% [5]. This demonstrates that fatigue is a common issue during the postpartum period. Some studies have identified potential contributing factors such as anaemia, infection, endocrine dysfunction,

sleep disorders and ineffective parenting behaviors [6] along with a strong relationship between persistent fatigue and postpartum depression [3, 7]. These findings suggest that the causes of postpartum fatigue are intricate and it may be prevalent in populations affected by postpartum depression. Therefore, studying postpartum tiredness is crucial for women with postpartum depression because of its complexity and prevalence.

Assessment tools for fatigue are valuable in clinical and research settings. The Chalder Fatigue Scale-14 (CFS-14) developed by Trudie Chalder and her team at King's College London was crafted to evaluate fatigue severity in individuals with fatigue-related illnesses. The CFS-14 was first developed to assess exhaustion in people with chronic fatigue syndrome but it is currently used to measure fatigue in various demographics. This self-reported questionnaire swiftly assesses physical and mental fatigue, offering the following two scoring systems: the bimodal score (0 and 1) and the Likert score (0, 1, 2 and 3). The bimodal score quickly identifies the number of symptoms experienced by a participant while the Likert score gauges the fatigue severity [8] presenting itself as a rapid and versatile scale for fatigue measurement. However, some studies have raised concerns about the scale including unclear relationships between certain items and fatigue and inconsistencies between the two scoring systems [9]. Moreover, the CFS has been seen as unable to distinguish fatigue in normal individuals from that in clinical patients or between different fatigue-associated illnesses [10]. These issues indicate challenges with the instrument in practice necessitating further research to assess its quality in various contexts.

This study focuses on the reliability and validity of the CFS-14. A modified version, the CFS-11, maintains the content and Likert scoring of the original scale while excluding three items. The CFS-11 has yet to undergo psychometric evaluation in a postpartum depression population despite being supported and used in some research samples [11]. This study aims to explore the psychometric properties of the CFS-14 in women with postpartum depression without eliminating any items given the applications of both the CFS-14 and CFS-11 across diverse fields. This approach tackles various issues such as instrument reliability, the number of items and factors and the overall scale structure.

2. LITERATURE REVIEW

The investigation of postpartum fatigue depends on precise fatigue measurement facing challenges due to its subjective nature and the influence of various factors. To tackle this issue, researchers commonly employ multidimensional tools assessing not just fatigue intensity but also frequency, duration, and its impact on quality of life. The main scales include the Fatigue Severity Scale (FSS), the Multidimensional Fatigue Inventory (MFI), the Chalder Fatigue Scale 14 (CFS-14) and the Fatigue Impact Scale (FIS). These tools capture fatigue's physiological, psychological, and functional aspects providing an in-depth insight into an individual's fatigue condition.

The CFS-14 is extensively used across diverse populations. However, the scale has significant ambiguities and conflicts that demand further study. Notably, most CFS-14 studies have centred on populations with somatic ailments such as myalgic encephalomyelitis, chronic fatigue syndrome [12] and chronic stroke [13] neglecting its utilization in high-prevalence cohorts like women with postpartum depression (PPD). Consequently, the reliability and validity of the CFS-14 within women experiencing PPD are inadequately explored hindering its precise application in this demographic and risking potential measurement inaccuracy. Moreover, existing literature reveals conflicting results regarding the scale's structural elements with some data supporting a two-factor model and others a three-factor setup [14-16]. These disparities impede accurate assessments of the scale's framework, complicating its broader applicability. Therefore, this research used reliability analysis, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to assess the reliability and validity of the CFS-14 in women with PPD. Theoretically, this study enhances the meticulous evaluation of the instrument, providing reliability endorsement for studies utilizing the scale, thereby enriching existing research, reconciling structural discrepancies, and broadening the instrument's research domain. Practically, this investigation aids clinical screening and fatigue evaluation in this population assisting healthcare practitioners in proficient clinical management.

Based on the above, this study proposed the following research questions:

(i) What is the reliability of the CFS-14?

(ii) What is the validity of the CFS-14?

The research hypotheses were as follows:

H_1: CFS-14 has good internal consistency.

H_2: CFS-14 has good split-half reliability.

H_3: CFS-14 has good construct validity.

H_4: CFS-14 has good criterion validity.

3. METHODOLOGY

3.1. Participants and Sampling

This cross-sectional quantitative study aimed to assess the reliability and validity of the CFS-14 among women experiencing postpartum depression (PPD). Between June and August 2024, the researcher obtained approval from the ethics committee to conduct a survey involving PPD women at three hospitals in southwestern China. The study employed purposive sampling facilitated by healthcare personnel through the medical record system.

The data collection process comprised two stages: screening and formal testing. The inclusion criteria for participants consisted of: a) achieving a score of 13 or higher on the Beck Depression Inventory (Second Edition) [17]. b) Showing voluntary participation. c) Possessing a minimum educational level equivalent to middle school, with the ability to complete the questionnaire autonomously. d) Being within 0-8 weeks postpartum, a critical period characterized by a higher prevalence of depression and the availability of clinical data [18] and e) enjoying good overall health as evidenced by medical records with no other physical ailments that could influence fatigue. Data in this study were gathered through both online and paper-based questionnaires. Participants meeting the criteria were allotted 20 minutes to simultaneously complete the CFS-14 and MFI-20 in the same setting, enhancing measurement precision.

Most factor analyses necessitate a sample size exceeding 200 following Kyriazos' guideline [19]. The study enrolled 280 participants from hospitals. 247 valid samples were retained, representing a retention rate of 88.21% after the exclusion of missing or ineligible data. Thus, the sample size and quality met the requirements for subsequent analyses. The demographic results will feature comprehensive information such as age, educational background, number of children, delivery mode, family living arrangement, and economic status to facilitate comparisons across studies.

3.2. Instruments

The Chalder Fatigue Scale-14 is a self-report questionnaire used to evaluate a participant's level of fatigue. The scale comprises 14 items divided into two main dimensions: physical fatigue (the first 8 items) and mental fatigue (the last 6 items). The CFS-14 is designed to assess different types of fatigue easily and efficiently, making it suitable for use with a wide range of individuals in clinical and research settings. In this study, a Likert scale (0, 1, 2, and 3) was utilized to provide a more precise assessment of fatigue intensity. This scoring system has been applied in numerous studies, surpassing traditional bimodal scores [20]. The Cronbach's alpha for the CFS-14 has varied between 0.88 and 0.9 [21]. The CFS-14 is presented in Table 1A.

The multidimensional fatigue inventory is a self-report instrument consisting of 20 items that evaluate the following five different types of fatigue: mental, physical, reduced motivation, decreased activity, and overall fatigue using a five-point Likert scale. Participants rate each item from 1 to 5 based on the intensity of their fatigue with total scores ranging from 20 to 100. Higher total scores indicate greater levels of fatigue. The scale has demonstrated strong reliability across various studies with Cronbach's alpha consistently exceeding 0.89 [22]. The MFI-20 is presented in Table 2A.

3.3. Data Analysis

After participants completed the CFS-14, the cleaning criteria involved deleting scales with items that were either marked multiple times or left blank. Cases where all 14 items had the same response were also excluded. The remaining data underwent basic checks and preparation in SPSS 27. Descriptive statistics, reliability analysis, and exploratory factor analysis (EFA) were performed using SPSS 27 while confirmatory factor analysis (CFA) was carried out with AMOS 23. Descriptive statistics were used to analyze participant demographic information. Reliability analysis was used to assess the reliability of the CFS-14. EFA was used to explore its factor structure, and CFA was used to evaluate the reasonableness of the factor structure. The indicators and criteria for analysis were as follows: (i) Internal consistency was assessed using Cronbach's alpha (α) with a value above 0.7 considered acceptable [23]. (ii) Split-half reliability was evaluated using the Spearman-Brown formula with a value above 0.7 indicating good reliability [24]. (iii) Construct validity was evaluated in two stages. EFA was first used to explore the underlying structure and CFA was subsequently employed to confirm it. For EFA, the factor structure needed to meet specific criteria: the Kaiser-Meyer-Olkin (KMO) measure should be above 0.7, the p-value of Bartlett's test should be below 0.05 and factor loadings should exceed 0.5 [23]. For CFA, a well-fitting model requires the following: Chi-square Minimum Discrepancy divided by Degrees of Freedom (CMIN/DF)≤ 3, Comparative Fit Index (CFI) > 0.9, Tucker-Lewis Index (TLI) > 0.9, Goodness of Fit Index (GFI) > 0.9, and Root Mean Square Error of Approximation (RMSEA) < 0.08. Composite reliability (CR) should be above 0.6, and the Average Variance Extracted (AVE) should be above 0.5 [25]. (iv) Criterion validity is demonstrated by the correlation between the CFS-14 and the MFI-20 with a moderate or higher correlation, i.e., Pearson's correlation coefficient (r) ≥ 0.5 [26]. In a nutshell, these indicators comprehensively assess the psychometric properties of the CFS-14 among postpartum depression women.

4. RESULTS

4.1. Demographics of Sample

A total of 247 women with postpartum depression (PPD) participated in the study excluding 33 incomplete samples. The participants' ages ranged from 18 to 34 with a mean age of 25.81±4.73 years.

Table 1. Information for participants (N=247).

Factors	Frequency (N, %)	Cumulative percentage (%)
Educational background		
Middle school	28 (11.3)	11.3
High school	74 (30.0)	41.3
Undergraduate	123 (49.8)	91.1
Postgraduate	22 (8.9)	100.00
Number of babies		
0 (Miscarriage or infant death within 28 weeks)	14(5.7)	5.7
1	148(59.9)	65.6
2	69(27.9)	93.5
3 or more	16(6.5)	100.00
Mode of delivery		
Normal birth	161(65.2)	65.2
Caesarean birth	86 (34.8)	100.00
Family living style		
Self, partner and children	135 (54.7)	54.7
Owners and children are only living on their own	22 (8.9)	63.6
Self, partner, children, and parents	90 (36.4)	100.00
Economic condition		
Well off	28 (11.3)	11.3
Moderate	159 (64.4)	75.7
Difficult	60 (24.3)	100.00

Table 1 shows that the majority of the sample had an undergraduate education (49.8%) or had completed high school (30%). Most participants were first-time mothers (59.9%) and had delivered vaginally (65.2%). Following childbirth, the majority lived with their partners and children (54.7%) while a significant portion also resided with their parents (36.4%). Most participants reported a moderate income level (64.4%). These demographic characteristics facilitated comparisons with findings from other studies highlighting both similarities and differences.

4.2. Reliability Analysis

The Cronbach's alpha for the CFS-14 was 0.88 with each item's alpha exceeding 0.86 indicating good internal consistency. Split-half reliability was assessed by splitting the survey items into two halves and calculating the correlation coefficient. The result between the two halves was 0.76 and the reliability was 0.86 suggesting good stability of the instrument. Overall, the reliability of the CFS-14 is acceptable.

4.3. Validity Analysis

The original CFS-14 covers both physical and mental fatigue aspects. In this research, EFA was used to identify the underlying factors followed by CFA to examine the construct validity of the scale. Criterion validity was also evaluated contributing to a comprehensive assessment of the factor structure and validity.

(i) Exploratory Factor Analysis: The EFA results indicated a Kaiser-Meyer-Olkin (KMO) value of 0.86 (>0.6) and Bartlett's test produced a result of 1772.12 with df=91 and $p<0.01$. These results suggest that the items are interrelated, meeting the prerequisites for factor analysis. Principal component analysis revealed four eigenvalues greater than 1. The cumulative explained variance of the factors before rotation was 39.86%, 15.99%, 8.56%, and 7.46%, totalling 71.86% of the variance. The data were subjected to Varimax rotation leading to the extraction of 14 items into four factors. Item 14 was excluded due to a factor loading below 0.5 (see Table 2). The remaining 13 items were divided into the following categories: (a) Physical fatigue (items 5, 6, 7 and 8) illustrating the impact of fatigue on the body. (b) Cognitive issues (items 4, 9, 10 and 13) representing the negative effects of fatigue on cognitive functions. (c) Sleep disturbances (items 1, 2 and 3) reflecting participants' sleep conditions and low energy levels. (d) Speech impairments (items 11 and 12) indicating the effects of fatigue on speaking abilities. After rotation, these factors explained 20.47%, 19.43%, 17.64%, and 14.33% of the variance, respectively with a cumulative explained variance of 71.86%. The communalities surpassed 0.5 suggesting that these factors possess moderate to high explanatory capabilities with the exception of item 14.

Table 2. Rotated component matrix of CFS-14.

Items	F1	F2	F3	F4	Communalities
1. Do you have problems with tiredness?	0.120	0.058	0.889	0.164	0.835
2. Do you need to rest more?	0.138	0.175	0.814	0.282	0.791
3. Are you feeling sleepy or drowsy?	0.107	0.144	0.848	0.217	0.798
4. Do you have problems starting things?	0.159	0.730	0.041	0.194	0.598
5. Do you start things without difficulty but get weak as you go on?	0.808	0.220	0.176	0.097	0.742
6. Are you lacking in energy?	0.783	0.188	0.118	0.045	0.664
7. Do you have less strength in your muscles?	0.753	0.335	0.071	0.075	0.689
8. Do you feel weak?	0.798	0.183	0.058	0.159	0.698
9. Do you have difficulty concentrating?	0.194	0.826	0.102	0.032	0.731
10. Do you have problems thinking clearly?	0.254	0.807	0.201	0.056	0.759
11. Do you make slips of the tongue when speaking?	0.092	0.055	0.267	0.878	0.854
12. Do you find it more difficult to find the correct word?	0.082	0.120	0.227	0.898	0.878
13. How is your memory?	0.369	0.696	0.103	0.099	0.640
14. Have you lost interest in the things you used to do?	0.271	0.262	0.243	0.426	0.382

(ii) Confirmatory Factor Analysis: For the CFS-14, the results of the confirmatory factor analysis (CFA) showed the following fit indices: CMIN/DF = 1.457 (< 3), CFI = 0.984 (> 0.9), TLI = 0.978 (> 0.9), GFI = 0.951 (> 0.9), and RMSEA = 0.043 (< 0.08). These findings indicate a strong fit of the CFS-14. The Composite Reliability (CR) values for the scale ranging from 0.839 to 0.887 (see Table 3) indicate good explanatory power of the items on the variables. The Average Variance Extracted (AVE) reflects the convergence of dimensions with Table 3 showing that the square roots of AVE for the CFS-14 surpass the correlation coefficients supporting good discriminant validity. In a nutshell, the CFS-14 demonstrates robust construct validity. The standardized regression weights, factor structure of the CFS-14 and inter-factor correlations are presented in Figure 1.

Table 3. Regression weights, convergent validity and composite reliability.

Factors	Items	SR	CR	AVE		F1	F2	F3	F4	√AVE
F1	5	0.807	0.853	0.592	F1	1	0.664	0.369	0.298	0.769
	6	0.737								
	7	0.778								
	8	0.754								
F2	4	0.637	0.839	0.568	F2		1	0.387	0.290	0.754
	9	0.797								
	10	0.842								
	13	0.722								
F3	1	0.841	0.879	0.708	F3			1	0.572	0.841
	2	0.846								
	3	0.838								
F4	11	0.905	0.887	0.797	F4				1	0.893
	12	0.880								

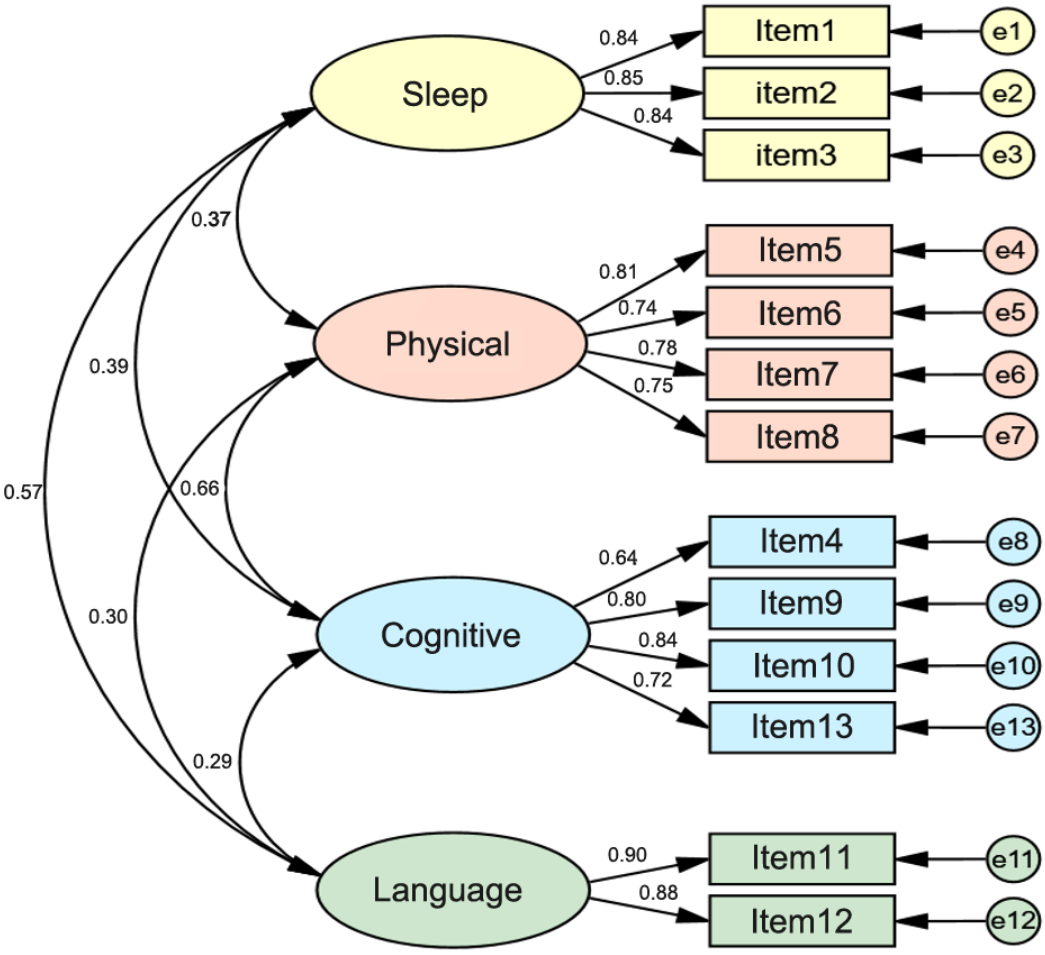

Figure 1. The path diagram of CFS-14.

(iii) Criterion Validity: The MFI-20 is extensively used for fatigue screening among various cohorts [27, 28] rendering it a suitable reference instrument for this research. Table 4 displays the relationship between the scores of the 247 females with PPD regarding the two tools. The findings reveal a significant and positive relationship between the MFI-20 and the CFS-14 (excluding item 14) with $p < 0.01$. A robust relationship was observed between the CFS-14 and the overall MFI-20 score ($r = 0.742$) along with a moderate relationship between the dimensions of the CFS and MFI-20 ($r = 0.456$ to 0.611). This implies that the CFS-14 is an efficient fatigue measurement, comparable to other well-established scales.

Table 4. Correlation.

Instruments	CFS-14	F1	F2	F3	F4
MFI-20	0.742**	0.611**	0.572**	0.504**	0.456**

Note: **p<0.01.

5. DISSCUSSION

5.1. Reliability for CFS-14

The internal consistency of the CFS-14 among postpartum depression (PPD) women was good ($\alpha = 0.88$) consistent with findings from other studies ($\alpha = 0.84$) [29]. Chalder supports the split-half reliability of 0.86 [15]. Both studies indicate that the CFS-14 has robust reliability. This implies that the CFS-14 consistently produces similar results when administered at different times in various conditions or by different researchers. This may be due to the high quality of the instrument or the hospital-based research setting. Caution is still necessary if using the instrument in a non-clinical setting. This supports research H1 and H2.

5.2. Validity for CFS-14

(i) Factor Loadings: The factors of the CFS-14 demonstrated good explanatory power explaining 71.86% of the variance. The factor loadings for items 1 to 13 were above 0.5 while the loading for item 14 was below 0.5. Ceballos-Munuera similarly found that item 14 had a low factor loading in a Spanish sample [30]. This indicates that item 14 is largely unrelated to the identified factors. Another study also removed item 14 [14]. Therefore, deleting item 14 is justified possibly because it does not capture fatigue characteristics adequately, shows weak correlation with other items or may be more related to other health issues.

Furthermore, several elements should not always be eliminated from the CFS-14, even if the Fatigue Scale-11 (CFS-11) is a simplified version of the CFS-14 that has been used in several research throughout the years. The available evidence and this study only support the deletion of item 14 due to the suitability of the CFS-14 for clinical samples with severe fatigue like PPD women whereas the CFS-11 is more suitable for assessing healthy individuals and those with mild fatigue [31, 32]. For instance, a study focused on a non-clinical sample such as community residents [33]. Hence, removing item 14 is more justified in both versions whereas the removal of the remaining items requires additional research support before making a cautious decision.

(ii) Factor Structure: The study advocates for a four-factor model for the CFS-14 comprising physical fatigue, cognitive problems, sleep problems and language disorders. Previous research has questioned the original two-factor structure of the scale. Some studies suggest that after excluding item 14, the CFS-14 can be divided into four factors: cognitive difficulties, sleep difficulties, low energy and self-rated depression indicators [34]. Other evidence also proposes a revision from the two-factor structure to sleep problems, attention distress, low energy, and subjective cognitive difficulties after eliminating item 14 [30]. These findings challenge the assumption that the instrument is one-dimensional or two-dimensional. The adjustments may stem from challenges in validating the original scale's factor structure, the impact of the measurement process, and participants' subjective factors. Additionally, slight variations in factor labels and item categorization may be due to sample characteristics and

demographic differences. Nevertheless, both the current study and existing evidence acknowledge that the CFS-14 encompasses cognitive, sleep and energy dimensions, thereby refining and clarifying the original scale.

The CFS-14 showed a good fit and differentiation in the confirmatory factor analysis (CFA) following the removal of item 14. The√AVE surpassed the correlation coefficients indicating strong factor differentiation. These CFA results validate the accuracy of the four-factor structure of the CFS-14 confirming its construct validity. Improved differentiation assists healthcare providers in identifying core symptoms in women. For example, specific cognitive-behavioral therapy could be recommended if fatigue is linked to cognitive challenges. This categorization enhances the original scale and supports research H3.

(iii) Criterion Validity: The MFI-20's and the CFS-14's overall scores seem to be highly correlated whereas the two instruments' aspects show a moderate relationship. This indicates that participants' scores on the CFS-14 reflect similar patterns to those on the MFI-20. Strong association between the MFI-20 and CFS-14 is supported [35]. The fundamental factors between the two instruments remain closely related despite the removal of some original CFS items. Many healthcare professionals currently utilize both the MFI-20 and CFS-14 for fatigue screening in clinical environments [36]. The CFS-14 facilitates a quick fatigue assessment whereas the MFI-20 offers a more detailed evaluation with its fewer items and dual scoring systems. Employing both tools together enhances diagnostic accuracy and captures the complexity and diversity of fatigue supporting research hypothesis H4.

5.3. Comparative Summary

This study identified several similarities and differences combining the analyses and evidence.

(i) Reliability: The internal consistency of the CFS-14 aligns with findings from other studies reinforcing the instrument's robustness across various conditions and settings including postpartum depression.

(ii) Validity: The results show that most items in the CFS-14 loaded strongly onto their respective factors, except for item 14 which had factor loadings below 0.5. Other studies have similarly recommended the removal of item 14, indicating a consensus on its inferior quality. There is some debate about items 5 and 10. For example, these items are not included in the CFS-11, although they are included in other psychometric research. This variability may be acceptable across different populations and settings but further research is necessary to draw definitive conclusions.

(iii) Factor structure: This study supports a four-factor model for the CFS-14, encompassing physical fatigue, cognitive problems, sleep problems, and language disorders along with some evidence. This challenges the two-factor structure. A finer division better reflects the data's characteristics while the CFS-14 still measures physical and mental fatigue. These new factors are inherently linked to the individual's physical and mental states.

(iv) Criterion validity: The combined use of the CFS-14 and MFI-20 is supported by some evidence showing that the two instruments can complement each other. This highlights that fatigue is a complex and subjective experience and using multidimensional tools provides a more accurate assessment of its sources and characteristics.

6. LIMITATIONS

This study has several limitations. Retest reliability was not assessed, limiting the ability to interpret result repeatability within the same population. Although internal consistency, split-half reliability, and CR were good, measuring retest reliability is essential when feasible under experimental conditions. Moreover, the study focused on Chinese women with postpartum depression, cautioning against generalizing the findings to other populations. A larger random sampling scope could reduce sampling error given the research conditions.

7. RECOMMENDATIONS

Despite the widespread use of CFS-14, its structure remains challenging to adapt across different diseases and cultures with various factor structures observed in different countries and samples. However, this variability is gradually decreasing. The four-factor structure shows more scientific and logical consistency compared to one-dimensional or two-dimensional models. Future cross-cultural and longitudinal studies are recommended to address minor discrepancies in item attribution and further validate the study, contributing to the establishment of a universally recognized and usable version for multiple populations.

8. CONCLUSION

Fatigue is a prevalent clinical symptom among women with postpartum depression. This study explored the psychometric properties of CFS-14 in this population revealing good internal consistency and split-half reliability, establishing this instrument as reliable. Exploratory Factor Analysis (EFA) identified four factors: physical fatigue, cognitive problems, sleep problems and language disorders. The remaining items aligned well with these factors with the exception of item 14. Confirmatory Factor Analysis (CFA) yielded acceptable fit indices, CR and AVE values, validating good construct validity. In a nutshell, the items effectively represent, differentiate, and elucidate these factors. Concurrently, the study assessed the criterion validity of CFS-14 using the MFI-20 demonstrating moderate to strong relationships between the two instruments strengthening its criterion validity. These robust psychometric properties affirm CFS-14 as a dependable and valid scale for healthcare providers and psychologists in fatigue assessment and treatment planning. Nevertheless, more samples and evidence are necessary to explore item attribution and removal for improved uniformity and applicability of the instrument.

9. APPENDICES

The CFS-14 used in this study was obtained from Chalder et al. [21]. The MFI-20 was obtained from Smets et al. [37]. The detailed scales can be found in the related literature.

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Institutional Review Board Statement: The Ethical Committee of the Guiyang Maternal and Child Health Care Hospital, China has granted approval for this study on 8 June 2024 (Ref. No. HREC/MC20240031).
Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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Appendices:

Instructions:

We would like to know more about any problems you have had with feeling tired, weak or lacking in energy in the last month. You have 10 minutes to answer. Please read the items and options carefully before responding.

Please circle the options according to the following requirements.

Circle the "0" if you **better than usual.**

Circle the "1" if you **no worse than usual.**

Circle the "2" if you **worse than usual.**

Circle the "3" if you are **much worse than usual.**

Table 1A. Chalder fatigue scale 14.

Items	Options			
1. Do you have problems with tiredness?	0	1	2	3
2. Do you need to rest more?	0	1	2	3
3. Are you feeling sleepy or drowsy?	0	1	2	3
4. Do you have problems starting things?	0	1	2	3
5. Do you start things without difficulty but get weak as you go on?	0	1	2	3
6. Are you lacking in energy?	0	1	2	3
7. Do you have less strength in your muscles?	0	1	2	3
8. Do you feel weak?	0	1	2	3
9. Do you have difficulty concentrating?	0	1	2	3
10. Do you have problems thinking clearly?	0	1	2	3
11. Do you make slips of the tongue when speaking?	0	1	2	3
12. Do you find it more difficult to find the correct word?	0	1	2	3
13. How is your memory?	0	1	2	3
14. Have you lost interest in the things you used to do?	0	1	2	3

Source: Chalder, et al. [21].

Instructions:

By means of the following statements we would like to get an idea of how you have been feeling lately. There is, for example, the statement:"I FEEL RELAXED". If you think that this is entirely true, that indeed you have been feeling relaxed lately, please, circle the "1". The more you disagree with the statement, the bigger the number you can circle in the direction of "no, that is not true". You have 10 minutes to answer. Please read the items and options carefully before responding.

Table 2A. Multidimensional fatigue inventory (MFI-20).

Items	Options						
1. I feel fit.	Yes, that is true	1	2	3	4	5	No, that is not true
2. Physically, I feel only able to do a little.	Yes, that is true	1	2	3	4	5	No, that is not true
3. I feel very active.	Yes, that is true	1	2	3	4	5	No, that is not true
4. I feel like doing all sorts of nice things.	Yes, that is true	1	2	3	4	5	No, that is not true
5. I feel tired.	Yes, that is true	1	2	3	4	5	No, that is not true
6. I think I do a lot in a day.	Yes, that is true	1	2	3	4	5	No, that is not true
7. When I am doing something, I can keep my thoughts on it.	Yes, that is true	1	2	3	4	5	No, that is not true
8. Physically I can take on a lot.	Yes, that is true	1	2	3	4	5	No, that is not true
9. I dread having to do things.	Yes, that is true	1	2	3	4	5	No, that is not true
10. I think I do very little in a day.	Yes, that is true	1	2	3	4	5	No, that is not true
11. I can concentrate well.	Yes, that is true	1	2	3	4	5	No, that is not true
12. I am rested.	Yes, that is true	1	2	3	4	5	No, that is not true
13. It takes a lot of effort to concentrate	Yes, that is true	1	2	3	4	5	No, that is not true

Items	Options						
on things.							
14. Physically I feel I am in a bad condition.	Yes, that is true	1	2	3	4	5	No, that is not true
15. I have a lot of plans.	Yes, that is true	1	2	3	4	5	No, that is not true
16. I tire easily.	Yes, that is true	1	2	3	4	5	No, that is not true
17. I get little done.	Yes, that is true	1	2	3	4	5	No, that is not true
18. I don't feel like doing anything.	Yes, that is true	1	2	3	4	5	No, that is not true
19. My thoughts easily wander.	Yes, that is true	1	2	3	4	5	No, that is not true
20. Physically I feel I am in an excellent condition.	Yes, that is true	1	2	3	4	5	No, that is not true

Source: Smets, et al. [37].