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Article

Prevalence of Post-Stroke Fatigue and Its Association with Sleep Quality and Depression: A Cross-Sectional Study of Iraqi Stroke Survivors

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Abstract: Among the sequelae of stroke, fatigue ranks as one of the most frequent yet least recognised, and it can hold back rehabilitation while eroding quality of life. How it connects to sleep and mood remains comparatively understudied in Middle Eastern populations. Our aim was to gauge how frequent and how severe post-stroke fatigue (PSF) is and to see how it tracks with sleep, depressive symptoms, and the demographic and clinical profile of patients. We enrolled 273 stroke survi vors in a cross-sectional design. Fatigue was rated on the Fatigue Severity Scale (FSS), sleep on the Pittsburgh Sleep Quality Index (PSQI), and mood on the Patient Health Questionnaire-9 (PHQ-9). Group differences were tested with t- tests and one-way ANOVA, associations with Pearson correlation, and independent predictors with multiple linear regression; significance was set at $p < 0.05$. The report conforms to the STROBE checklist for cross-sectional studies. Fatigue was identified in 198 survivors (72.5%), with a mean FSS of 5.36 ± 1.28. Sleep was poor in 197 patients (72.2%), and 206 (75.5%) reported at least mild depressive symptoms. Fatigue severity increased as sleep wors ened ($r = 0.66$, $p < 0.001$) and as depression deepened ($r = 0.61$, $p < 0.001$), with a weaker rise across age ($r = 0.29$, $p < 0.001$). On regression, the independent contributors were poor sleep ($\beta = 0.42$, $p < 0.001$), depression ($\beta = 0.34$, $p < 0.001$), and older age ($\beta = 0.13$, $p = 0.014$), which jointly accounted for 56% of the variance in fatigue ($R^2 = 0.56$; $F = 67.82$, $p < 0.001$). Post-stroke fatigue was widespread and moved in step with poor sleep and depression, with sleep the dominant predictor. Assessing fatigue alongside sleep and mood, and treating the sleep and mood distu rbances that are amenable to therapy, may lighten the fatigue burden after stroke.

Keywords: post-stroke fatigue; stroke survivors; sleep quality; depression; Fatigue Severity Scale; Iraq.

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1. Introduction

Worldwide, stroke sits among the foremost causes of death and stands as the chief source of acquired long-term disability in adults [1]. Because prevention and acute care have improved and fewer patients die, a growing number live on with lasting deficits [2]. Fatigue is among the most frequent of those deficits, and among the easiest to miss, since it often persists long after obvious problems such as weakness or slurred speech have eased.

Post-stroke fatigue (PSF) is typically characterised as an overwhelming tiredness and lack of energy that outweigh s any exertion and that rest fails to relieve [3]. Although clinicians flagged it as a distinct entity decades ago [4,5], it is no longer regarded as ordinary tiredness; physical, cognitive, and emotional components are all recognised [6]. Present-day frameworks view it as arising where biological shifts meet psychological and

behavioural ones [7]. It has also been named a research and assessment priority by the American Heart Association [8].

Reported rates of PSF differ markedly across studies, ranging from roughly a quarter of survivors to over four in five. This variability largely reflects how fatigue is defined and measured and the timing of assessment after stroke; meta-analytic estimates cluster around one half [9]. Onset can be early, and in many patients the fatigue endures for months or years [10,11].

A range of factors has been associated with PSF, among them advancing age, female sex, comorbidities such as hypertension and diabetes, and psychological distress, though the reported strength of these associations is inconsistent, as is whether they hold in the early versus the later period after stroke [12 ,13]. Severity is most commonly quantified with the Fatigue Severity Scale (FSS) [14].

Disturbed sleep is likewise frequent and burdensome after stroke, and the Pittsburgh Sleep Quality Index (PSQI) is the instrument generally used to capture it [15]. Insomnia and related sleep disorders trouble a su bstantial share of survivors [16,17]. Because sleep is modifiable, some authors propose it as a possible avenue for reducing fatigue itself [7].

Depression is another common sequel, and because it shares low energy and tiredness with fatigue, the two are readily confused. Depressive symptoms are rated by the Patient Health Questionnaire-9 (PHQ-9) [18], which performs well as a post-stroke screening tool [19]. Roughly one third of survivors become depressed [20], and depression commonly co-occurs with fatigue and disturbed sleep [21].

Although fatigue, poor sleep, and depression frequently cluster after stroke, most evidence derives from Western cohorts, and data from Iraq and neighbouring countries remain scarce. Clarifying how sleep and mood relate to fatigue in such patients could sharpen clinical assessment and the targeting of care. We therefore set out to establish how common and how severe PSF is, to characterise sleep quality and depressive symptoms in the same patients, and to examine how fatigue relates to sleep, depression, and patient characteristics, so as to identify the factors that independently predict its severity.

2. Methods

2.1. Study design and reporting

We conducted a descry ptive cross-sectional study that also included a correlational element. Reporting adheres to the STROBE guidance for cross-sectional studies [22].

2.2. Setting and participants

Adult stroke survivors were enrolled at Ibn Rushd Teaching Hospital for Psychiatry, Najaf, Iraq, from October 2025 to May 2026. Eligibility required an age of at least 18 years, a clinically and/or radiologically confirmed stroke (ischaemic or haemorrhagic), a minimum of one month since the event, medical stability, and the ability to understand and complete the questionnaires. Excluded were patients in whom aphasia or cognitive impairment precluded a reliable interview, those with a chronic fatiguing condition or a major psychiatric illness unrelated to the stroke, and those who declined to take part. Recr uitment used convenience sampling, yielding 273 survivors.

2.3. Sample size

The enrolled sample of 273 comfortably exceeded the number needed to estimate a fatigue prevalence of about 50% to within a 6% margin at 95% confidence, and to support a five-predictor regression at the customary 10 to 15 participants per predictor.

2.4. Measures

Trained collectors obtained the data by face-to-face interview and review of medical records, administering Arabic-language versions of the instruments.

Sociodemographic and cl inical data. A brief proforma captured age, sex, marital status, education, place of residence, and employment status, together with the type of

stroke, the interval since onset, the number of previous strokes, the hemisphere involved, and the presence of hypertension, diabetes, or a smoking history.

Post-stroke fatigue. Fatigue was assessed with the nine-item FSS, each item rated from 1 to 7; a higher average (range 1–7) indicates greater fatigue [14]. Following convention, a mean of at least 4 defined clinically significant fatigue, which we further categorised as mild, moderate, or severe.

Sleep quality. The PSQI gaug ed sleep quality across the preceding month; its global score ranges from 0 to 21, with values above 5 denoting poor sleep [15].

Depression. On the PHQ-9, depressive symptom severity spans 0 to 27 and is banded as none-to-minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27) [18].

2.5. Ethical considerations

Ethical approval for the protocol was granted by the research ethics committee of the College of Medicine, University of Kufa (approval no. 211/2025). Every participant gave written consent after receiving an explanation of the study, and the work adhered to the principles of the Declaration of Helsinki.

2.6. Statistical analysis

Data were analysed in IBM SPSS Statistics, version 27. Continuous measures are summarised as mean ± standard deviation alongside the median and range, and categorical measures as frequencies with percent ages. To compare mean FSS scores, we used the independent-samples t-test for two-group contrasts and one-way ANOVA where more than two groups were involved. Associations between fatigue and sleep, depression, age, and time since stroke were examined by Pearson correlation. A m ultiple linear regression then modelled the FSS score against age, PSQI, PHQ-9, diabetes, and hypertension; we verified the standard assumptions of linearity, normally distributed and homoscedastic residuals, and acceptable multicollinearity. All tests were two-sided, and $p < 0.05$ indica ted statistical significance.

3. Results

3.1. Sociodemographic characteristics

The analysis comprised 273 stroke survivors, whose background is set out in Table 1. The largest age bands were 60–69 yea rs (98 patients, 35.9%) and 50–59 years (72, 26.4%), while 61 (22.3%) were aged 70 or above. Men accounted for 59.3% (162) and married individuals for 72.5% (198). For education, 81 patients (29.7%) had completed primary and 79 (28.9%) secondary schooling, whereas 58 (21.2%) had no formal education. Urban residents predominated (171, 62.6%), and most were unemployed or retired (204, 74.7%).

Table 1. Sociodemographic characteristics of stroke survivors (N = 273)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	< 50	42	15.4
	5 0–59	72	26.4
	60–69	98	35.9
	≥ 70	61	22.3
Gender	Male	162	59.3
	Female	111	40.7
Marital status	Married	198	72.5
	Single	19	7.0
	Widowed	42	15.4

Variable	Category	Frequency (n)	Percentage (%)
	Divorced	14	5.1
Education	Illiterate	58	21.2
	Primary	81	29.7
	Secondary	79	28.9
	University	55	20.1
Residence	Urban	171	62.6
	Rural	102	37.4
Occupation	Employed	69	25.3
	Unemployed / Retired	204	74.7

3.2. Clinical characteristics

The clinical profile is presented in Table 2. Ischaemic stroke predominated, in roughly three-quarters of the cohort (208, 76.2%). In 118 patients (43.2%) more than a year had elapsed since the event, whereas 74 (27.1%) remained within six months of it. First-ever strokes made up 219 cases (80.2%). Right-hemisphere involvement occurred in 125 patients (45.8%) and left-hemisphere involvement in 113 (41.4%). Hypertension affected 189 patients (69.2%), diabetes 117 (42.9%), and current or former smoking 88 (32.2%).

Table 2. Clinical characteristics of stroke survivors (N = 273)

Variable	Category	Frequency (n)	Percentage (%)
Stroke type	Ischemic	208	76.2
	Hemorrhagic	65	23.8
Time since stroke	< 6 months	74	27.1
	6–12 months	81	29.7
	> 12 months	118	43.2
Number of strokes	First	219	80.2
	Recurrent	54	19.8
Affected side	Right	125	45.8
	Left	113	41.4
	Bilateral	35	12.8
Hypertension	Yes	189	69.2
	No	84	30.8
Diabetes mellitus	Yes	117	42.9
	No	156	57.1
Smoking	Current / Former	88	32.2
	Never	185	67.8

3.3. Prevalence of fatigue, poor sleep, and depression

Fatigue, sleep, and depression findings are collated in Table 3. Fatigue was recorded in 198 patients, a prevalence of 72.5%. Across the full sample, it was mild in 56 patients (20.5%), moderate in 81 (29.7%), and s evere in 61 (22.3%). Poor sleep was found in 197 patients (72.2%). Depressive symptoms of at lea st mild degree occurred in 206 patients (75.5%), reaching moderate-to-severe intensity in 122 (44.7%), while only 67 (24.5%) had none.

Table 3. Prevalence of post-stroke fatigue, sleep quality, and depression (N = 273)

Variable	Ca tegory	Frequency (n)	Percentage (%)
Post-Stroke Fatigue	Present	198	72.5
	Absent	75	27.5
Fatigue Severity	Mild	56	20.5
	Mo derate	81	29.7
	Severe	61	22.3
Sleep Quality	Good	76	27.8
	Poor	197	72.2
Depression	None	67	24.5
	Mild	84	30.8
	Moderate	75	27.5
	Moderately Severe	34	12.5
	Severe	13	4.7

Note: The fatigue-severity bands (mild, moderate, severe) are expressed as percentages of the entire sample and jointly comprise the 198 patients (72.5%) classified with post-stroke fatigue.

3.4. Descriptive statistics of the study measures

The three continuous measures are reported in Table 4. The mean FSS of 5.36 ± 1.28 (median 5.6; range 1.3–7.0) reflects a high ov erall level of fatigue. The mean PSQI of 9.24 ± 3.41 (median 9.0; range 1–19) lay well above the threshold for poor sleep, and the mean PHQ-9 was 9.87 ± 5.08 (median 10; range 0–25).

Table 4. Descriptive statistics of the study variables (N = 273)

Variable	Mean ± SD	Median	Minimum	Maximum
Fatigue Severity Scale (FSS)	5.36 ± 1.28	5.6	1.3	7.0
Pittsburgh Sleep Quality Index (PSQI)	9.24 ± 3.41	9.0	1	19
PHQ-9 Depression Score	9.87 ± 5.08	10	0	25

3.5. Association between fatigue and participant characteristics

Variation in fatigue by patient characteristics is detailed in Table 5. Women reported higher scores than men (5.62 ± 1.33 vs 5.18 ± 1.22; t = 2.18, p = 0.030), and scores rose with age, from 4.78 ± 1.10 in those under 50 to 5.81 ± 1.35 in those aged 70 or more (F = 5.26, p = 0.002). Scores did not differ appreciably between ischaemic and haemorrhagic stroke (5.31 ± 1.29 vs 5.49 ± 1.24; t = 1.21, p = 0.227). Greater fatigue was reported by patients with hypertension (5.49 ± 1.24 vs 5.07 ± 1.31; t = 2.31, p = 0.022) and b y those with diabetes (5.58 ± 1.20 vs 5.19 ± 1.31; t = 2.84, p = 0.005).

Table 5. Association between post-stroke fatigue (FSS) and participant characteristics (N = 273)

Variable	Categories	Mean FSS ± SD	Statistical Test	p-value
Gender	Male	5.18 ± 1.22	t = 2.18	0.030
	Female	5.62 ± 1.33		
Age Group	< 50	4.78 ± 1.10	F = 5.26	0.002
	50–59	5.12 ± 1.16		
	60–69	5.54 ± 1.24		

Variable	Categories	Mean FSS ± SD	Statistical Test	p-value
	≥ 70	5.81 ± 1.35		
Stroke Type	Ischemic	5.31 ± 1.29	t = 1.21	0.227
	Hemorrhagic	5.49 ± 1.24		
Hypertension	Yes	5.49 ± 1.24	t = 2.31	0.022
	No	5.07 ± 1.31		
Diabetes	Yes	5.58 ± 1.20	t = 2.84	0.005
	No	5.19 ± 1.31		

Note: FSS = Fatigue Severity Scale. Between-group means were tested by the independent-samples t-test for two groups and by one-way ANOVA for three or more groups.

3.6. Correlation and regression analyses

The correlation and regression results are given in Table 6. Fatigue increased with poorer sleep ($r = 0.66$, $p < 0.001$) and with great er depression ($r = 0.61$, $p < 0.001$), showed a milder positive association with age ($r = 0.29$, $p < 0.001$), and declined modestly as time since stroke lengthened ($r = -0.14$, $p = 0.020$).

The model accounted for 56% of the variance in fatigue ($R^2 = 0.56$, adjusted $R^2 = 0.55$; $F = 67.82$, $p < 0.001$). The leading predictor was poor sleep ($B = 0.27$, $\beta = 0.42$, $p < 0.001$), then depression ($B = 0.18$, $\beta = 0.34$, $p < 0.001$) and older age ($B = 0.02$, $\beta = 0.13$, $p = 0.014$). With these terms in the model, neither diabetes ($\beta = 0.08$, $p = 0.085$) nor hypertension ($\beta = 0.05$, $p = 0.263$) made a significant contribution.

Table 6. Correlation an d multiple linear regression analysis of factors associated with post-stroke fatigue (N = 273)

Part A. Correlation analysis

Variable	Correlation (r)	p-value
Sleep Quality (PSQI)	0.66	< 0.001
Depression (PHQ-9)	0.61	< 0.001
Age	0.29	< 0.001
Time Since Stroke	-0.14	0.020

Part B. Multiple linear regression predicting fatigue

Predictor	B	SE	Std. β	t	p-value
Age	0.02	0.01	0.13	2.48	0.014
Poor Sleep (PSQI)	0.27	0.04	0.42	6.98	< 0.001
Depression (PHQ-9)	0.18	0.03	0.34	5.84	< 0.001
Diabetes Mellitus	0.19	0.11	0.08	1.73	0.085
Hypertension	0.11	0.10	0.05	1.12	0.263

Note: Outcome variable = FSS score. Model fit: $R^2 = 0.56$; adjusted $R^2 = 0.55$; $F = 67.82$; $p < 0.001$. B = unstandardised coefficient; SE = standard error; β = standardised coefficient.

4. Discussion

In this cohort of 273 stroke survivors, fatigue was common, affecting nearly three in four, and its severity was governed chiefly by poor sleep, depression, and older age. Together these three variables explained over half of the variance in fatigue scores, sleep being the most influential.

Our prevalence of 72.5 % is high relative to the broader literature. Whereas pooled estimates generally fall near 45–50 % [9], figures of 70% or more are not uncommon,

particularly in chronic, community-based samples and when a higher fatigue threshold is applied [23]. Two aspects of our sample likely raised the r ate: most participants were more than a year past their stroke, and vascular comorbidity was prevalent. This accords with the increasingly held view that chronic post-stroke fatigue often relates less to the stroke itself than to what ensues afterwards [24].

Sleep was strongly linked to fatigue, both in the bivariate correlation ($r = 0.66$) and as the foremost predictor in the regression ($\beta = 0.42$). This is consistent with other studies that treat poor sleep as a central correlate and probable driver of fatigue [25]. Sleep disturbance is common after stroke [16,17] and, unlike most s troke-related determinants, is treatable, which makes it a logical starting point for addressing fatigue.

Depression was the next strongest predictor ($\beta = 0.34$), in keeping with the well-recognised bidirectional relationship between low mood and post-stroke fatigue [21] and with the several somatic symptoms the tw o conditions share [19]. They are nonetheless distinct, and fatigue frequently persists in individuals without clinical depression [26]. Given that depression after stroke is prevalent, readily overlooked, and treatable [27], and that current guidance identifies it as a priority [28], concurrent screening for both is warranted.

Fatigue was more pronoun ced in older patients ($\beta = 0.13$) and in women, a pattern reported in several earlier studies [29,30]. The associations with hypertension and diabetes evident in the univariate comparisons vanished once sleep and mood were accounted for, suggesting that these conditions act largely through disturbed sleep and low mood, or merely mark the accumulation of illness in longer-standing p atients rather than exerting a direct effect [12]. The weak inverse correlation with time since stroke ($r = -0.14$) is compatible with the gradual, partial resolution of fatigue documented over extended follow-up [10,11].

These findings carry practical implications for the stroke team. Because fatigue is both common and consequential, routine e nquiry is worthwhile, for instance using the FSS [14] at follow-up appointments [8]. As sleep and mood were the principal correlates of fatigue and both are treatable, managing poor sleep, through guidance on sleep hygiene and treatment of insomnia, together with treating depression [28], is likely to yield the greatest benefit.

4.1. Limitations

Several limitations should be acknowledged. The cross-sectional design reveals associations but cannot establish causal direction among fatigue, sleep, and depression. Recruitment from a single centre by convenience sampling constrains generalisability. Reliance on self-report may introduce response bias, and because the fatigue, sleep, and depression scales overlap in symptom content, their intercorrelations may be somewhat inflated [19]. We also omitted potentially relevant variables, such as stroke severity, lesion location, degree of physical disability and dependence in daily activities, and medication use, any of which could account for part of the unexplained variance.

4.2. Generalisability

Consequently, the results are most applicable to community-dwelling, ambulant stroke survivors of the kin d examined here, and should be extrapolated cautiously to acutely presenting patients or to those with severe disability or communication impairment.

5. Conclusion

Fatigue w as widespread among these stroke survivors, affecting almost three in four, and its severity related most strongly to poor sleep, followed by depression and older age. Joint assessment of fatigue, sleep, and mood should form part of routine post-stroke care, and the treatable co mponents, namely sleep and depression, represent the most useful targets for reducing fatigue. Longitudinal and interventional studies are now required to

determine the direction of these associ ations and to test whether improving sleep and treating depression genuinely alleviate fatigue.

Declarations

Ethics approval and consent to participate: The study protocol was approved by the research ethics comm ittee of the College of Medicine, University of Kufa (approval no. 211/2025); every participant gave written consent after receiving an explanation of the study.

Consent for publication: Not applicable.

Availability of data and materials: The data underlying this article can be obtained from the corresponding author upon reasonable request.

Competing interests: The authors report no competing interests.

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