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Physical activity, fatigue severity, and health-related quality of life of community-dwelling stroke survivors: a cross-sectional study

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Abstract

Background Physical inactivity among stroke survivors (SSV) may result from fatigue, physical disabilities, and psychosocial factors, all of which adversely affect health-related quality of life (HRQL). Studies on combined interactions among physical activity (PA), fatigue severity (FS), and HRQL in SSV are scarce. This study was aimed to determine the relationships among PA, FS, and HRQL in community-dwelling SSV and to predict the association with selected socio-demographic and clinical variables.

Methods This analytical cross-sectional correlation study involved 102 consented community-dwelling SSV. Respondents were purposively recruited from physiotherapy outpatient clinics of selected secondary and tertiary hospitals in southwest Nigeria. PA, FS, and HRQL of the SSV were assessed using the Stroke Physical Activities Questionnaire (SPAQ), Fatigue Severity Scale (FSS), and Stroke-Specific Quality-of-Life (SS-QoL) scale, respectively. Information on respondents' socio-demographic and clinical characteristics was also collected. Data were analyzed using descriptive and inferential statistics at $p < 0.05$ significance level.

Results Respondents' mean age was 59.98 ± 11.59 years. The majority were females (52.9%), had ischemic stroke (72%), and with right-side weakness (54%) of over 6 months (80%). Respondents' mean scores on SPAQ, FSS, and SS-QoL scales are 1867.47 ± 1817.93 MET min/week, 31.94 ± 11.29, and 156.47 ± 26.62, respectively. There were no significant associations between selected socio-demographic/clinical variables and physical activity levels except in gender ($\chi^2 = 6.737$; $p = 0.034$), fatigue severity except in side of affectation ($\chi^2 = 5.839$; $p = 0.054$), and HRQL except in level of education ($\chi^2 = 23.497$; $p = 0.001$) and side of affectation ($\chi^2 = 7.389$; $p = 0.007$). There was a moderate and significant correlation ($R = 0.426$; $p < 0.05$) among PA, FS, and HRQL. Regression analysis revealed no significant associations with the socio-demographic/clinical variable except the side of affectation for HRQL, low ($R = 0.223$) level of prediction of socio-demographic/clinical variables for PA (F 8, 93 = 0.607; $p > 0.05$), and fair ($R = 0.326$) level of prediction for FS (F 8, 93 = 1.386; $p > 0.05$).

Conclusion Moderate correlations among fatigue severity, physical activity, and health-related quality of life in stroke survivors suggested that enhancing one domain can benefit others, while the limited predictive ability

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of socio-demographic and clinical variables highlighted the need to consider cultural and psychological factors in post-stroke outcomes.

Keywords Physical activity, Fatigue severity, Health-related quality of life, Stroke survivors

Background

Stroke is a significant global health concern and one of the most disabling chronic diseases among adults. It ranks as the second-leading cause of death and the third-leading cause of both mortality and disability combined [1]. According to the Global Burden of Disease (GBD) Study 2019, there were approximately 12.2 million new cases of stroke and 101 million prevalent cases, resulting in 143 million disability-adjusted life years (DALYs) and 6.55 million deaths worldwide [1]. Alarmingly, 70% of strokes and 87% of stroke-related death and disability-adjusted life years occur in low- and middle-income countries (LMIC) [2].

The impact of stroke-related disabilities extends beyond individual health, affecting families and economies of countries while significantly reducing the quality of life of survivors [2]. Post-stroke fatigue (PSF) is a common phenomenon affecting up to 50% of stroke survivors (SSV) with considerable implications for their health-related quality of life (HRQL) [3–5]. SSV experience double the frequency of self-reported fatigue compared to apparently healthy individuals [3]. PSF can hinder return to work and limit physical function, daily activities, and rehabilitation potentials, making it an important but often neglected stroke outcome [4, 5]. Socioeconomic and cultural factors in Nigeria and other LMIC, such as limited income, education, and spiritual beliefs attributing stroke to supernatural causes, hinder recovery by delaying care and amplifying fatigue [6–8]. Social stigma, traditional healing practices, caregiving demands, and overexertion further complicate stroke recovery [6, 9, 10]. However, resilience and strong social support networks in Nigeria's religious society enhance HRQL of SSV, while economic stability improves healthcare access [8, 11].

Physical inactivity among SSV often stems from stroke-related factors such as fatigue, disabilities, and coordination problems, further compounded by personal factors [12]. Consequently, this sedentary lifestyle leads to physical deconditioning, an increased risk of falls, and heightened susceptibility to cardiovascular complications [13]. Regular exercise has been shown to significantly improve HRQL, reduce depressive symptoms, and alleviate social isolation among SSV [14]. Moreover, structured physical activity (PA), whether planned or spontaneous, positively impacts cardiovascular health and addresses pathophysiological changes that increase energy costs of walking and early fatigue [15]. Specifically, moderate- to high-intensity exercises are effective for achieving overall health benefits, while high-intensity exercises have the added potential to enhance neuroplasticity [16]. Despite these benefits, SSV are generally less active than their apparently healthy peers, even when they are capable of engaging in higher activity levels of PA.

Consequent to the aforementioned, stroke significantly impacts HRQL, with survivors experiencing poorer HRQL due to associated disabilities that impair PA, a key determinant of stroke recovery [17–19]. Regular physiotherapy often incorporates moderate intensity exercises into treatment plans [15], which positively influences HRQL and reduces post-stroke fatigue. However, sustaining these activities beyond clinic sessions remains challenging, particularly in resource-limited settings like LMIC with poor access to healthcare, thereby necessitating managing post-stroke fatigue and promoting long-term PA to improve HRQL of SSV [1].

The conceptual framework for physical activity in stroke rehabilitation, based on the American Heart Association/American Stroke Association's guidelines, emphasizes regular aerobic and resistance training (20–60 min of moderate- to high-intensity exercise, 3–7 days per week) to improve functional outcomes [15]. This multidisciplinary approach addresses the physical, cognitive, and emotional needs of SSV, helping them achieve better function, reduce stroke recurrence, enhance HRQL, and address fatigue [15]. However, the lack of a clear definition of PSF hinders its assessment, limits research, and complicates efforts to address its negative impact on recovery and functional outcomes [3, 5].

Existing studies on PA, fatigue, and HRQL among community-dwelling SSV have largely focused on isolated factors such as cardiorespiratory fitness, sleep quality, sleep time, functional capacity, or mortality [20–23]. Other researches have examined multiple factors including mobility, ambulatory activity, social support, and falls efficacy [24], post-stroke fatigue and associated factors [25], sleep and fatigue [26], fatigue and physical fitness [27], cardiorespiratory fitness and walking capacity [28], and barriers, fear of falling, and sedentary behavior [29]. These efforts left a notable gap in the comprehensive evaluation of the interrelationship among critical variables of PA, fatigue severity (FS), and HRQL among community-dwelling SSV. Therefore, the overarching aim of this study was to determine the combined relationship among PA, FS, and HRQL of community-dwelling SSV and predict the association with selected socio-demographic and clinical variables. It was hypothesized that there would be no significant correlation among PA, FS, and HRQL scores of respondents, and that PA levels, FS, and HRQL will not be associated significantly with the sociodemographic and clinical variables of respondents.

Methodology

Aim

This study was aimed at determining the relationships among PA, FS, and HRQL of community-dwelling SSV.

Design and setting

This was an analytical cross-sectional study conducted by assessing PA, FS, and HRQL of community-dwelling SSV. Respondents were purposively recruited from physiotherapy outpatient clinics of Obafemi Awolowo University Teaching Hospital, Ile-Ife, Osun State; Osun State University Teaching Hospital, Osogbo; State Hospital Asubiaro, Osogbo, Osun State; and Ring Road State Hospital Adeoyo, Ibadan, Oyo State, all in southwestern Nigeria. SSV aged 18 years and older; with stroke onset of at least 1 month, comorbidities such as hypertension, diabetes under control, or musculoskeletal impairment that is non-debilitating; and having cognitive ability to understand the items of the questionnaires and choose appropriate response options were included in the study. SSV on hospital admission and those with dysphasia and/or cognitive impairment that interfered with meaningful communication, the presence of any comorbidities that concurrently affect PA or HRQL such as severe heart failure, severe preexisting musculoskeletal disease, metastatic cancer, active psychiatric illness or dementia, other neurological conditions such as Parkinson's disease, and diagnosis of HIV infection were excluded from this study. Data was collected by two of the researchers, A. F. and O. M., using paper and pen at the outpatient clinics of each of the selected hospitals.

Sample size determination

The sample size for respondents in this study was calculated using the Cochran formula. $N = (Z^2pq)/e^2$ [30], where N = sample size, Z = statistic corresponding to the level of confidence, p = estimated proportion of the population with the attribute of interest, q = 1-p, and e = desired level of precision. Therefore, p = 5.9% [31], Z = 95%, e = 5% (0.05), and $N = (1.96 \times 1.96) \times 0.059 (1–0.059)/(0.05 \times 0.05) = 72$.

To accommodate for attrition and considering the fact that this was a cross-sectional study, 50% of SSV was added to the sample [30], giving a total sample of 108 respondents. A total of 102 respondents were involved in the study.

Instrument

1. Stroke Physical Activity Questionnaire (SPAQ) [32]: SPAQ developed and validated by Phusuttatam et al. [32] contains 12 items in 3 main components which cover low (7 items), moderate (3 items), and vigorous (2 items) PA arranged based on the intensity, duration, and frequency of PA. The SPAQ had a content validity index of 0.93, Spearman's correlation coefficient for SPAQ vs. IPAQ-SF was 0.53 ($p < 0.001$), and for convergent validity, the SPAQ had a moderate correlation with the 6-min walk test, National Institute of Health Stroke Scale, Functional Ambulatory Category scale, Timed Up and Go test, and modified Rankin Scale ($p < 0.05$). Scoring of SPAQ was based on IPAQ using two forms of output as three categories (low activity levels, moderate activity levels, or high activity levels) or as a continuous variable (metabolic equivalents (MET) minutes a week). MET minutes represent the amount of energy expended carrying out PA. To get a continuous variable score from the IPAQ (MET in minute a week), walking or light activity is considered as 3.3 METS, moderate PA to be 4 METS, and vigorous activity to be 8 METS.
2. Fatigue Severity Scale (FSS): FSS was developed by Krupp et al. [33]. It contains nine statements, and each is scored from 0 to 7. The mean score of the nine items is used as the FSS score. The scoring algorithm defines scores ≤ 4 points as indicating no fatigue, 4.1–4.9 as indicating medium fatigue, and ≥ 5.0 as indicating serious fatigue [34]. Item analysis of the scale showed excellent internal consistency and reliability (Cronbach $\alpha = 0.93$). Test–retest variability showed stable values over time (2.94 ± 0.90 vs. 2.90 ± 0.74; $p = 0.27$) [34].
3. Stroke-Specific Quality-of-Life (SS-QoL) scale 2.0: This is a patient-reported measure of HRQL of SSV [35]. It consists of 49 items in 12 domains. Items are rated on a 5-point Likert scale (1 to 5). Total score ranges from 49 to 245 with higher scores indicating better function. The SS-QoL 2.0 has adequate to excellent internal consistency (Cronbach's $\alpha > 0.73$) across the 12 domains with most domains moderately correlated (r^2 range = 0.3 to 0.5) with similar domains of established outcome measures such as Barthel Index and General Health Survey Short Form (SF-36). This was used to assess the HRQL of SSV in this study. The Yoruba version of SS-QoL was administered to SSV who are not literate in the English language. It demonstrated moderate-to-high construct validity ($r = 0.54$ to 0. 89) with the English version, strong test–retest reliability with intra-class correlation coefficient (ICC) for the domain and overall

score ($r = 0.47$ to 0.81), and moderate-to-high internal consistency (Cronbach's alpha = 0.61 to 0.82) for the domain scores [36, 37].

Procedure

This study was approved by the appropriate ethics and research committee with protocol number ERC/2021/07/03. Respondents were SSV who attended physiotherapy outpatient clinics one to four times monthly and receive 30–60 min of physiotherapy per session. The SSV in this study were not sedendary as they were attending outpatient physiotherapy sessions that comprised active and passive range of motion exercises; aerobic exercises, core and trunk strengthening exercises, repetitive task training, flexibility, balance, and coordination exercises for the upper and lower limbs; and breathing exercises and gait retraining among others. There were also prescribed home exercise programs in verbal or written instructtions or demonstrated to primary caregivers of the SSV to maintain clinical and functional gains. The purpose of the research was explained to the respondents, and their written informed consent was obtained before the commencement of the study. Socio-demographic data (age, sex, marital status, level of education, and occupation before stroke) and clinical data (onset of stroke, type of stroke, side of affectation) were obtained through interviews and from hospital files of respondents. All questionnaires were researcher administered face to face on SSV with paper and pen at the purposively selectec clinics. The researchers read the items to the SSV and allowed them to choose response options appropriate to them without interference from the caregivers. The responses were recorded by the researchers in the presence of the SSV and the caregivers. The SS-QoL questionnaire [37] and FSS (in print) are available in Yoruba validated versions. SPAQ was taken through forward and back-translation for consistency between English and Yoruba languages. These were administered on SSV who were not literate in English language. Data was collected over a period of 3 months, from April to July, 2021.

Data analysis

Socio-demographic variables and participants' scores were summarized using mean, standard deviation, frequencies, and percentages. Inferential statistics of Pearson's correlation was used to compare scores on SPAQ, FSS, and SS-QoL. The Chi-square test was used to determine the association between each socio-demographic/clinical factor (gender, age, level of education, marital status, stroke type, time since stroke, and affected side) and each of PA, FS, and HRQL. Pearson's correlation was used to determine the relationship among PA, FS, and HRQL and linear regression analysis to test the strength of the relationship. Association between HRQL and each of the socio-demographic/clinical factors was predicted using binary regression. Multiple regression analysis was conducted to predict the effects of various socio-demographic/clinical variables of respondents on each of PA and FS. The level of significance was set at $p < 0.05$. Data were analyzed using IBM Statistical Package for Social Sciences version 25.

Results

One-hundred and two community-dwelling stroke survivors (48 males and 54 females) participated in the study. Their mean age was 59.98 ± 11.59 years (range 35 to 90 years). The majority were aged 56–75 years (47.6%), married (93.2%), and in self/private employment (60.8%), and equal proportions had secondary and tertiary level education (34.3%) (Fig. 1). Clinical variables presented in Fig. 2 indicated that the majority of the respondents had an ischemic stroke (72%), with right-side weakness (54%) for over 6 months (80%). Respondents' mean scores on SPAQ, FSS, and SS-QoL scales are 1867.47 ± 1817.93 MET minutes/week, 31.94 ± 11.29, and 156.47 ± 26.62, respectively. Results of the Chi-square association between socio-demographic/clinical variables of respondents and their levels of physical activities are presented in Table 1. There was no significant association except in gender ($\chi^2 = 6.737$; $p = 0.034$). In Table 2, the association between socio-demographic/clinical variables of respondents and FS is presented, and results showed that there were no significant associations except on the side of affectation ($\chi^2 = 5.839$; $p = 0.054$). No significant association was also found between the socio-demographic/clinical variables of respondents and HRQL except in the level of the education ($\chi^2 = 23.497$; $p = 0.001$) and side of affectation ($\chi^2 = 7.389$; $p = 0.007$) (Table 3).

Correlations between PA, FS, and HRQL of SSV indicated that FSS scores correlated negatively with SPAQ (MET total) scores and negatively significantly ($p = 0.020$) with HRQL scores. SPAQ scores correlated positively and significantly with HRQL scores ($p = 0.001$) (Table 4). Linear regression analysis revealed a moderate correlation value $R = 0.426$. R^2 indicated that 18.2% of the total variation in the dependent variable (HRQL) can be explained by the independent variables (FS and PA). The regression model was statistically significant ($p < 0.001$) and predicted the outcome variables (HRQL) (Table 5). There was a negative correlation between fatigue severity and HRQL. Both FS ($p = 0.020$) and PA ($p = 0.001$) contribute statistically significantly HRQL. The regression equation is presented as follows:

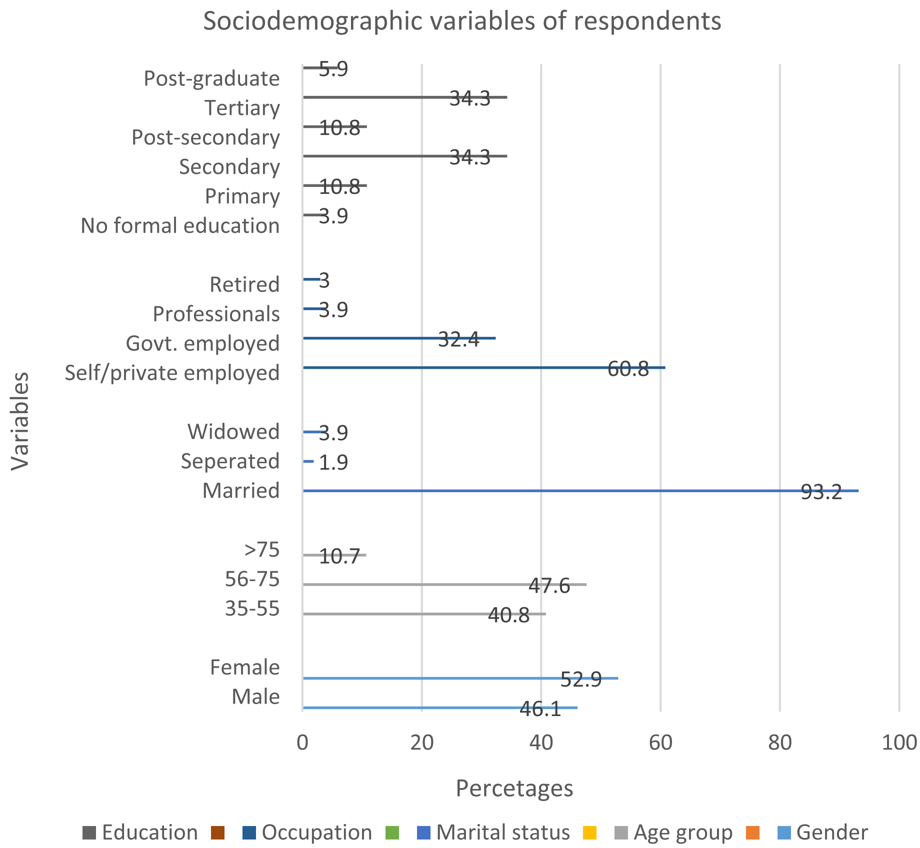

Fig. 1 Socio-demographic variables of respondents

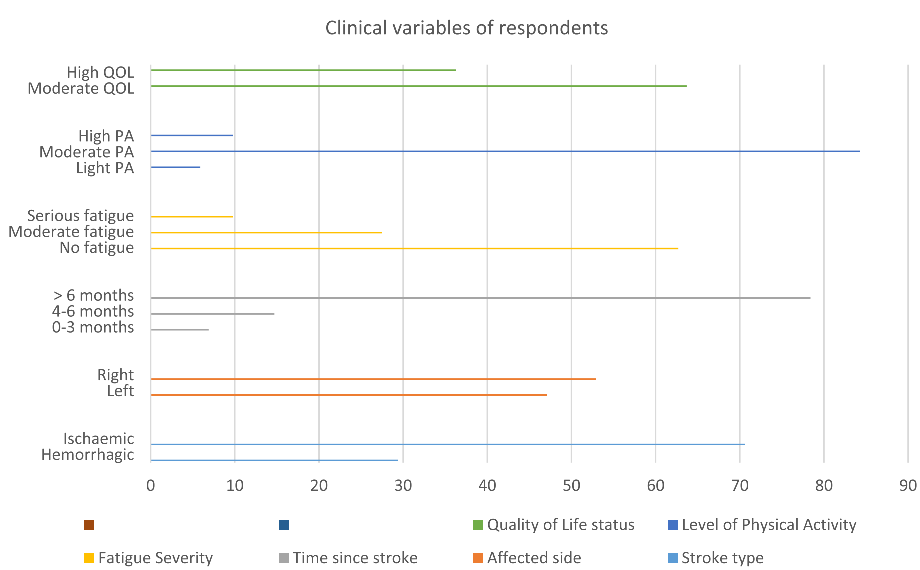

Fig. 2 Clinical variables of respondents. PA, physical activity

Table 1 Association between respondents physical activity level and socio-demographic/clinical variables

Variables	Level of physical activity					
	Light	Moderate	Strenuous	Total ($N=102$)	χ^2	*p*-value
Gender						
Female	2 (2.0)	43 (42.2)	9 (8.8)	54 (52.9)	6.737	0.034*
Male	4 (3.9)	43 (42.2)	1 (1.0)	48 (47.1)		
Age group (years)						
35–55	4 (3.9)	32 (31.4)	6 (5.9)	42 (41.2)	5.00	0.287
56–75	1 (1.0)	44 (43.1)	4 (3.9)	49 (48.0)		
≥ 76	1 (1.0)	10 (9.8)	0	11 (10.8)		
Level of education						
No formal education	0	3 (2.9)	1 (1.0)	96 (94.1)	8.643	0.733
Primary	0	10 (9.8)	1 (1.0)	2 (2.0)		
Secondary	3 (2.9)	27 (26.5)	5 (4.9)	4 (3.9)		
Post-secondary	1 (1.0)	10 (9.8)	0			
Tertiary	2 (2.0)	30 (29.4)	3 (2.9)	4 (14.7)		
Postgrad	0	6 (5.9)	0	11 (10.8)		
Marital status				35 (34.3)		
Married	6 (5.9)	81 (79.4)	9 (8.8)	11 (10.8)	1.631	0.803
Seperated	0	2 (2.0)	0	35 (34.3)		
Widowed	0	3 (2.9)	1 (1.0)	6 (5.9)		
Occupation						
Self/private employed	4 (3.9)	52 (51.0)	6 (5.9)	33 (32.4)	4.152	0.843
Govt. employed	1 (1.0)	28 (27.5)	4 (3.9)	3 (3)		
Retired	0	3 (2.9)	0	4 (3.9)		
Professionals	1 (1.0)	3 (2.9)	0	33 (32.4)		
Stroke type						
Hemorrhage	0	26 (25.5)	4 (3.9)	30 (29.4)	3.068a	0.216
Ischemic	6 (5.9)	60 (58.8)	6 (5.9)	72 (70.6)		
Affected side						
Left	4 (3.9)	39 (38.2)	5 (4.9)	48 (47.1)	1.062	0.588
Right	2 (2.0)	47 (46.1)	5 (4.9)	54 (52.9)		
Time since stroke						
0–3 months	1 (1.0)	5 (4.9)	1 (1.0)	7 (6.9)	1.411	0.842
4–6 months	1 (1.0)	13 (12.7)	1 (1.0)	15 (14.7)		
Over 6 months	4 (3.9)	68 (66.7)	8 (7.8)	80 (78.4)		

* Significant at $p < 0.05$

$$HRQL = 66 + 0.002(\text{MET TOTAL}) + (-0.208)\text{FSS score}$$

The logistic regression did not statistically significantly ($\chi^2=12.713$, $p>0.05$) predict the effects of socio-demographic/clinical variables on HRQL. The model explained 16% of the variance in HRQL and correctly classified 81.5% of cases as moderate QOL. Females were 1.95 times more likely to exhibit moderate HRQL than males. With increasing age and time since stroke, the HRQL is likely to be lower. The affected side is the only significant predictor of moderate HRQL (Table 6). In Table 7, the results of multiple regression run to predict PA from socio-demographic/clinical variables are presented. A multiple correlation coefficient *R*-value of 0.223 indicated a low level of prediction. The socio-demographic and clinical variables explained only 5% of the variability and did not statistically significantly predict PA (F (8, 93) $=0.607$; $p>0.05$). The unstandardized coefficient B indicated that for each 1-month increase in time since stroke onset, there is an increase of 15.1 times in PA, and for each 1-year increase in age at stroke onset, there is a decrease of 15.3 times in PA.

Multiple regression run to predict FS from socio-demographic/variables revealed coefficient *R*-value of 0.326 which indicated a fair level of prediction. The independent

Table 2 Association between fatigue severity and socio-demographic/clinical variables of respondents

Variables	Fatigue severity			Total ($N=102$)	χ^2	*p*-value
	No fatigue	Moderate fatigue	Serious fatigue			
Gender						
Female	34 (33.3)	16 (15.7)	4 (3.9)	54 (52.9)	872	0.647
Male	30 (29.4)	12 (11.8)	6 (5.9)	48 (47.1)		
Age group (years)						
35–55	28 (27.5)	13 (12.7)	1 (1.0)	42 (41.2)	7.898	0.095
56–75	32 (31.4)	10 (9.8)	7 (6.9)	49 (48.0)		
≥ 76	4 (3.9)	5 (4.9)	2 (2.0)	11 (10.8)		
Marital status						
Married	60 (58.8)	27 (26.5)	9 (8.8)	96 (94.1)	4.428	0.351
Separated	1 (1.0)	0	1 (1.0)	2 (2.0)		
Widowed	0	3 (2.9)	1 (1.0)	4 (3.9)		
Level of education						
No formal	1 (1.0)	2 (2.0)	1 (1.0)	4 (14.7)	12.505	0.406
Primary	9 (8.8)	1 (1.0)	1 (1.0)	11 (10.8)		
Secondary	24 (23.5)	7 (6.9)	4 (3.9)	35(34.3)		
Post-secondary	8 (7.8)	2 (2.0)	1 (1.0)	11 (10.8)		
Tertiary	18 (17.6)	14 (13.7)	3 (2.9)	35 (34.3)		
Postgraduate	4 (3.9)	2 (2.0)	0	6 (5.9)		
Occupation						
Self/private employed	39 (38.2)	15 (14.7)	8 (7.8)	33 (32.4)	4.692	0.790
Govt. employed	19 (18.6)	12 (11.8)	2 (2.0)	3 (3)		
Retired	3 (2.9)	0	0	4 (3.9)		
Professionals	3 (2.9)	1 (1.0)	0	33 (32.4)		
Stroke type						
Haemorrhagic	23 (22.5)	6 (5.9)	1 (1.0)	30 (29.4)	3.987	0.136
Ischemic	41 (40.2)	22 (21.6)	9 (8.8)	72 (70.6)		
Affected side						
Left	36 (35.3)	9 (8.8)	3 (2.9)	48 (47.1)	5.839	0.054*
Right	28 (27.5)	19 (18.6)	7 (6.9)	54 (52.9)		
Time since stroke						
0–3 months	6 (5.9)	1 (1.0)	0	7 (6.9)	6.077	0.194
4–6 months	12 (11.8)	1 (1.0)	2 (2.0)	15 (14.7)		
Over 6 months	46 (45.1)	26 (25.5)	8 (7.8)	80 (78.4)		

* Significant at $p=0.05$

variables explained 10.7% of the variability of FS. The socio-demographic and clinical variables did not statistically significantly predict FS (F (8, 93) = 1.386; $p > 0.05$). The coefficient B indicates that for each 1-month increase in stroke onset, there is a decrease of 0.45 times in FS, and for each 1-year increase in age at stroke onset, there is an increase of 0.149 times in FS (Table 8).

Discussion

This study assessed the relationships of PA, FS, and HRQL among community-dwelling stroke survivors (SSV). The strengths of this study are in the critical and underexplored area of how the triad interact in real-world conditions, making the findings more applicable to outpatient and community-based stroke rehabilitation. Effects of socio-demographic and clinical variables on each outcome were also predicted, revealing the need to explore additional unmeasured factors. The gender distribution of respondents in this study suggested a relatively balanced one with a diverse age range. A significant proportion of respondents were in the age group of middle-aged to older adults. Respondents were majorly in marital relationships which indicated spousal or family support in addition to being in a relatively active workforce before

Table 3 Association between health-related quality of life and socio-demographic/clinical variables of respondents

Variables	Health-related quality of life				
	Moderate f (%)	**High f (%)**	**Total (N = 102) f (%)**	χ^2	***p*-value**
Gender					
Female	38 (37.3)	16 (15.7)	54 (52.9)	2.192	0.139
Male	27 (26.5)	21 (20.6)	48 (47.1)		
Age group (years)					
35–55	26 (25.5)	16 (15.7)	42 (41.2)	0.450	0.798
56–75	31 (30.4)	18 (17.6)	49 (48.0)		
≥ 76	8 (7.8)	3 (2.9)	11 (10.8)		
Marital status					
Married	60 (58.8)	36 (35.3)	96 (94.1)	2.502	0.286
Separated	1 (1.0)	1 (1.0)	2 (2.0)		
Widowed	4 (3.9)	0	4 (3.9)		
Level of education					
No formal education	1 (1.0)	3 (2.9)	4 (14.7)	23.497	0.001*
Primary	10 (9.8)	1 (1.0)	11 (10.8)		
Secondary	19 (18.6)	16 (15.7)	35 (34.3)		
Post-secondary	10 (9.8)	1 (1.0	11 (10.8)		
Tertiary	25 (24.5)	10 (9.8)	35 (34.3)		
Postgrad	0	6 (5.9)	6 (5.9)		
Occupation					
Self/private employed	36 (35.3)	26 (25.5)	33 (32.4)	8.376	0.079
Govt. employed	24 (23.5)	9 (8.8)	3 (3)		
Retired	0	3 (2.9)	4 (3.9)		
Professionals	4 (3.9)	0	33 (32.4)		
Stroke type					
Haemorrhagic	20 (19.6)	10 (9.8)	30 (29.4)	0.159	0.690
Ischemic	45 (44.1)	27 (26.5)	72 (70.6)		
Affected side					
Left	24 (23.5)	24 (23.5)	48 (47.1)	7.389	0.007*
Right	41 (40.2)	13 (12.7)	54 (52.9)		
Time since stroke					
0–3 months	3 (2.9)	4 (3.9)	7 (6.9)	1.629	0.443
4–6 months	9 (8.8)	6 (5.9)	15(14.7)		
Over 6 months	53 (52.0)	27 (26.5)	80 (78.4)		

* Significant at $p < 0.05$

stroke occurrence. About equal proportions of participants had secondary and tertiary education, suggesting a balanced educational distribution. This diverse distribution of SSV in terms of demographic characteristics is consistent with an earlier study by Rexrode et al. [38], who also reported a diverse age range and balanced gender distribution among their sample of SSV. Clinical characteristics of respondents in this study also indicated the prevalence of ischemic stroke and right-side weakness, which could reflect the side of the dominant hemisphere of motor control. Respondents comprised SSV with a mix of acute and chronic SSV which aligned with Boehme et al. [39], who reported a similar prevalence of ischemic stroke and variations in affected side and time since stroke among their study participants.The absence of significant associations between PA level and most socio-demographic and clinical variables, except gender, is consistent with an early finding [40]. It was reported that gender could influence PA levels among SSV. Gender-based differences in perceived barriers, motivation, and access to PA resources could contribute to this variation. The lack of significant associations between

Table 4 Correlations between physical activity, fatigue severity, and health-related quality of life of stroke survivors

Variables		FS score	MET TOTAL	HRQL score
Fatigue severity score	Pearson correlation (r)	1	−.040	−0.230
	p-value		0.690	.020*
MET TOTAL	Pearson correlation (r)	−.040	1	0.368
	p-value	0.690		.001*
HRQL score	Pearson correlation (r)	−0.230*	0.368	1
	p-value	.020	.001	

FS fatigue severity

HRQL health-related quality of life

MET TOTAL total metabolic equivalents for physical activity

* Significant correlation at $p < 0.05$

Table 5 Linear regression analysis of relationship among physical activity, fatigue severity, and health-related quality-of-life of stroke survivors

Variables	B	95% CI Lower bound	Upper bound	t-value	p-value
HRQL (constant)	**66.488**	**60.197**	**72.780**	**20.969**	**0.001***
Fatigue severity	−0.208	−0.381	−0.034	−2.370	0.020*
Physical activity	0.002	0.001	0.003	3.945	0.001*

* Significant at $p < 0.05$

HRQL (dependent variable), health-related quality of life

fatigue severity and most socio-demographic and clinical variables, except for the side of affectation, corresponds with a previous study [41]. However, the side of affectation was linked to varying levels of fatigue severity among SSV possibly due to the neural pathways involved in motor control [42]. The absence of significant associations between HRQL and most socio-demographic and clinical variables, except for education level and the side of affectation, is comparable with the submission that lower education level is associated with lower HRQL [43]. The level of education and the side of affectation of stroke possibly influenced the quality-of-life outcomes due to their impact on functional ability and coping mechanisms. The lack of significant associations between PA level, fatigue severity, quality of life, and most socio-demographic and clinical variables of SSV in this study highlighted the complex nature of post-stroke outcomes. These are in line with existing literature, which emphasized that stroke recovery is influenced by numerous factors, some of which might not have been captured in this study [44]. The few associations that were identified, such as the influence of gender and side of affectation on PA and fatigue respectively, highlight the importance of considering these factors in stroke rehabilitation strategies [45]. These factors should thus be considered as important within the broader context of stroke research and the multifaceted determinants of post-stroke outcomes.

Moderate positive and significant correlation among fatigue severity, PA, and quality of life suggests that there is an evident connection between these variables. A study by Chen et al. [46] reported a significant correlation between fatigue severity and quality of life, while Pedersen et al. [45] reported an inverse and significant correlation between fatigue and PA in stroke

Table 6 Binary regression analysis of predictors of health-related quality-of-life of stroke survivors

Variables	OR	95% CI		p-value
		Lower	Upper	
Gender (ref. = female)	1.947	0.782	4.848	0.153
Age (ref. = ≤ 50 years)	0.705	0.229	2.172	0.543
Level of education (ref. = secondary and below)	0.735	0.306	1.766	0.492
Marital status (ref. = married)	0.308	0.031	3.084	0.317
Stroke type (ref. = Haemorrhagic)	0.761	0.283	2.045	0.588
Months since stroke (ref. = < 6 months	0.505	0.143	1.785	0.289
Affected side (ref. = left)	0.341	0.142	0.820	0.016*

* Significant at $p < 0.05$

Table 7 Regression analysis of predictors of level of physical activities among stroke survivors

Variables	*B*	95% CI		*t*-value	*p*-value
		Lower	Upper		
Gender	−294.26	−1057.367	468.846	−0.766	0.446
Age	−15.31	−50.116	19.482	−0.874	0.384
Level of education	95.26	−184.590	375.118	0.676	0.501
Marital status	45.743	−864.587	956.072	0.100	0.921
Occupation	−108.345	−575.814	359.124	−0.460	0.646
Stroke type	−467.813	−1285.426	349.801	−1.136	0.259
Months since stroke	15.07	−11.760	41.905	1.115	0.268
Affected side	−21.903	−809.875	766.069	−0.055	0.956

Table 8 Regression analysis of predictors of fatigue severity among stroke survivors

Variables	*B*	95% CI		*t*-value	*p*-value
		Lower	Upper		
Gender	3.878	−0.717	8.473	1.676	0.097
Age	0.149	−0.061	0.358	1.410	0.162
Level of education	0.826	−0.860	2.511	−0.860	2.511
Marital status	−0.274	−5.755	5.208	−5.755	5.208
Occupation	−1.475	−4.290	1.340	−4.290	1.340
Stroke type	3.431	−1.492	8.355	1.384	0.170
Months since stroke	−0.045	−0.206	0.117	−0.551	0.583
Affected side	3.591	−1.154	8.336	1.503	0.136

survivors. The negative correlation between fatigue severity and quality of life in our study suggests that higher levels of fatigue are associated with lower quality of life, similar to Pedersen et al. [45]. This is consistent with the understanding that fatigue can negatively impact various aspects of well-being. About 18.2% of the variation in quality of life which can be attributed to the variation in fatigue severity and PA suggests that while these variables have a noticeable impact on quality of life, a significant portion of the variation was left unexplained, possibly due to other factors that are not accounted for in the model. This is in line with an earlier study [47] with the submission that the measurable impact of fatigue severity and PA on quality of life only explained a moderate portion of the variance. However, the fact that the regression model is statistically significant implies that the model as a whole effectively predicts quality of life. This indicates that FS [46] and PA [12] significantly contribute to the prediction of and are important determinants of HRQL in SSV.

The relationships between the predictors (gender, age, education level, marital status, stroke type, time since stroke, and affected side) and the likelihood of respondents having a moderate HRQL after a stroke imply that these predictors collectively did not have a significant impact on the likelihood of moderate HRQL and, therefore, failed to find strong evidence of a relationship. This is evident in the report that stroke severity, post-stroke disability, depression, social support, and coping strategies significantly predicted HRQL outcomes [47, 48]. The model's ability to explain 16% of the variance in QOL suggests that there is some relationship between the predictors and HRQL outcomes. However, this percentage indicates that a substantial portion of HRQL variation remains unaccounted for. This may be attributed to unexplained variance in the current study in which implicated factors like stroke severity and depression were not considered. The model of this study correctly classified 81.5% of cases, and this classification accuracy alone does not indicate the model's overall effectiveness, as statistical significance is not established. Finding that females were 1.95 times more likely to exhibit moderate HRQL than males is in contrast to the conclusion of worse HRQL outcomes in female stroke survivors [43]. Increasing age and time since stroke might lead to lower HRQL which is consistent with the study of Bártlová et al. [49], which highlighted the challenges of stroke recovery in older patients and improved HRQL over time since stroke. The significance of the affected side as a predictor aligns with findings from studies of Braadt et al. [43], emphasizing that stroke impact on specific brain regions can lead to varying levels of impairment.

The predictors (gender, age, education level, marital status, stroke type, time since stroke, and affected side) collectively do not significantly predict PA after a stroke. The weak positive correlation between the predictors and PA aligned with findings from a previous study [40] which reported a similar weak correlation between age, gender, and PA levels post-stroke. The limited explained variability of 5% is also in line with an earlier study [40] which reported that socio-demographic variables explained only a small portion of the variance in PA outcomes. It also reflects that socio-demographic variables were not significant predictors of PA after stroke, which underscores the complex interaction of individual and contextual factors. Thilarajah et al. [12] opined that age, sex, physical function, depression, fatigue, self-efficacy, and HRQL significantly influence PA post-stroke, supporting this study in similar areas. Overall, the results of this study are in line with similar research that underscored the challenge of predicting PA after stroke solely based on socio-demographic and clinical variables. The nuanced nature of post-stroke recovery and PA engagement suggests that other factors, such as psychological aspects (motivation, self-efficacy), environmental influences, and individual preferences, play substantial roles in determining post-stroke PA levels.

Positive correlation between the independent variables (gender, age, education level, marital status, stroke type, time since stroke, affected side) and FS suggests that there is a connection between these variables and FS levels, though the correlation is moderate at best. A previous study reported similar moderate correlation between socio-demographic variables and FS among SSV [25]. The combined independent variables accounting for approximately 10.7% of the variability in FS are an indication that while the predictors contribute to explaining FS to some extent, there are numerous other factors not considered in the model that also play a significant role in determining fatigue. This aligns with Kjeverud et al. [42] who also found that socio-demographic variables explained only a relatively small portion of the variance in FS among SSV. The lack of statistical significance suggests that the model, as a whole, is not a good fit for predicting FS. This implies that the included socio-demographic and clinical variables do not effectively predict FS among stroke survivors. This is similar to the submission that post-stroke fatigue is strongly associated with emotional and attentional disturbances which implies that socio-demographic variables alone were not significantly predictive of FS post-stroke [50]. An increase of 1 month in the time since stroke onset corresponds to a decrease of 0.45 times in FS, while a 1-year increase in age at stroke onset corresponds to an increase of 0.149 times in FS. These coefficients provide insights into the relationships between these predictors and FS, which is similar to previous reports that a longer time since stroke was linked to decreased FS, and older age at stroke onset was associated with increased FS [40]. Generally, these findings aligned with similar research in the literature, emphasizing that the socio-demographic and clinical variables considered have a limited ability to predict FS among stroke survivors. FS is a complex phenomenon influenced by a multitude of factors, including psychological, physiological, and contextual variables.

The findings of this study highlighted the significant influence of Nigerian cultural and socioeconomic factors on stroke recovery outcomes. Gender-specific roles explain the association with PA, whereas caregiving responsibilities and societal expectations amplify FS, while strong link of education to HRQL reflects the impact of socioeconomic status on healthcare access. However, Nigeria's resilience and strong social support networks partially mitigate these effects, fostering better HRQL despite limited resources. These findings emphasize the need for culturally sensitive interventions addressing economic constraints, traditional beliefs, and caregiving demands to enhance stroke recovery outcomes.

Clinical implications

Integrating fatigue assessment and management, tailored PA through safe personalized exercise regimens, holistic quality-of-life assessments, and proactive monitoring of secondary complications such as deconditioning, cardiovascular issues, or depression into stroke rehabilitation can optimize recovery, prevent complications, and enhance patient well-being. Educating and empowering patients and caregivers to manage fatigue and engage in PA can enhance recovery outcomes and quality of life. These findings provided a guide for future research into interventions that address this triad and inform policy development for comprehensive stroke care, prioritizing fatigue management and PA enhancement.

Limitations of the study

This study has some limitations that may need to be considered in interpreting and generalizing its findings. Socio-demographic/clinical variables (gender, age, level of education, marital status, stroke type, time since stroke, and affected side) considered in this study were not significant predictors of PA, FS, and HRQL, which emphasizes the complex interaction of individual and contextual factors including psychological, physiological, and contextual variables that were not considered in this study. Therefore, future research should aim to incorporate these factors to create a more comprehensive model to better capture the complexity of PA, FS, and HRQL in SSV.

Conclusion

Moderately significant correlations among PA, FS, and HRQL of SSV indicated that improvements in one domain could positively affect others. Limited ability of selected socio-demographic and clinical variables (gender, age, level of education, marital status, stroke type, time since stroke, affected side) to predict FS, PA, and HRQL highlighted the complex nature of post-stroke outcomes and emphasized importance of other potentially relevant factors, such as cultural or psychological factors in playing a remarkable role.

Abbreviations

FS	Fatigue severity
FSS	Fatigue Severity Scale
HRQL	Health-related quality of life
PA	Physical activity
SPAQ	Stroke Physical Activities Questionnaire
SS-QoL	Stroke-Specific Quality-of-Life scale
SSV	Stroke survivors

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Authors' contributions
MO conceptualized the study, was involved in research design, prepared the manuscript, and took part in data analysis and interpretation. AF was involved in the conceptualization of the study, was involved in research design, and was involved in data collection, collation, data entry, and proofreading of the manuscript. OM was involved in study design, editing, data collection, and collation and proofreading of the manuscript. CE, FN, and FF were involved in editing, proofreading, and intellectual contributions. All authors read and approved the final manuscript.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The research protocol was approved by the Ethics and Research Committee of Obafemi Awolowo University Teaching Hospital, Ile-Ife, Nigeria, with protocol number ERC/2021/07/03. Informed consent was obtained from all participants included in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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