

Associations of physical activity and mental well-being with resilience in patients with heart failure: a cross-sectional

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ABSTRACT

Introduction: Heart failure is a common chronic condition that significantly impairs the physical and mental well-being of individuals impacted. Resilience is a dynamic occurrence involving constructive responses to adversity. The researcher aims to investigate the relationship between physical activity and mental health on resilience in heart failure patients.

Methods: This study employed a quantitative, cross-sectional design. The population comprised 186 patients with heart failure at the cardiac outpatient department of Surakarta Regional General Hospital. A total of 140 participants were selected from this population using purposive sampling, based on specific criteria. The dependent variable is resilience, and the independent variables are physical activity and mental well-being. The data were gathered through the Adult Resilience Measure-Revised (ARM-R), the Mental Health Questionnaire incorporating the Depression, Anxiety, Stress Scale (DASS-42), and the Physical Activity Questionnaire derived from the International Physical Activity Questionnaire-Short Form (IPAQ-SF). The analyses used were the chi-square test and multiple linear regression analysis.

Results: This study found a weak, positive relationship between mental well-being, physical activity, and resilience, with a combined R-value of 0.355. The R² value of 0.126 indicates that mental well-being and physical activity together account for 12.6% of the variance in resilience. The remaining 87.4% of the variance is due to other undetermined factors.

Conclusions: Physical activity and mental well-being are positively, though weakly, related to resilience in heart failure patients. Both still contribute to improving resilience. Therefore, rehabilitation programs combining moderate physical activity and psychological support are recommended to enhance resilience and quality of life.

Keywords: heart failure, mental well-being, physical activity, resilience

Introduction

Heart failure (HF) is a common chronic ailment that considerably diminishes the physical and emotional health of those affected. Over 64 million individuals globally are estimated to suffer from heart failure, a condition characterized by elevated morbidity and mortality rates (Savarese and Lund, [2017](#)). The physical

limitations of HF often led to reduced physical activity, hence exacerbating Mental Well-Being problems such as depression and anxiety (Deka, Almenar, Pathak, Klompstra, López-Vilella, *et al.*, [2021](#)). Psychological conditions further impact physical functioning, creating a cycle of deteriorating health (LaMonte, [2020](#)). Situations or occurrences that pose a risk or cause disturbance may trigger an individual's stress response,



potentially coercing and obstructing their ability to manage it (Nurhayani and Wilda, [2021](#)). Good physical activity can reduce physical and psychological stress (Triastuti and Jayadiputra, [2024](#)). Individuals with heart failure may have a variety of physical and mental health challenges. Evidence suggests that resilience, defined as an individual's ability to recover and adapt to challenging situations, plays a significant role in supporting the well-being of these patients (Waugh and Sali, [2023](#)).

Resilience involves continuously adapting positively to adversity (Gatt *et al.*, [2020](#)). It refers to a person's ability to adapt to challenges such as conflict, confusion, and failure. Individuals with strong resilience typically demonstrate superior performance and self-assurance, whereas individuals with low resilience frequently endure self-reproach and elevated anxiety, resulting in melancholy (Lim *et al.*, [2020](#); Ploughman *et al.*, [2020](#)). Social support is an essential element in cultivating resilience, enabling individuals to feel pleasant emotions. Higher resilience correlates with a healthier lifestyle, enhanced physical performance, optimism, and general mental well-being (Liesto *et al.*, [2020](#); Ran *et al.*, [2020](#)).

Resilience, considered as the ability to adapt and recover from adversity, is crucial for the general well-being of patients with chronic illnesses (Moore, [2024](#)). It is associated with enhanced physical and mental well-being. Individuals with greater resilience demonstrate enhanced pleasant emotions, engage in greater physical exercise, and exhibit superior physical functioning (McGrath and Kovacs, [2019](#)). In heart failure patients, resilience protects against emotional and physical stress, resulting in improved Mental Well-Being and increased physical activity levels (Mulyani and Suryaningsih, [2023](#); Douma, Kop, and Kupper, [2024](#)). Psychological resilience exhibited an inverse correlation with anxiety and depression (Wang *et al.*, [2022](#)). Individuals with higher resilience may be better equipped to manage the psychological impact of their condition, leading to improved coping mechanisms and more consistent engagement in physical activities (Labrague, [2021](#)).

Exercise training is an effective intervention for the management of heart failure patients. It markedly enhances exercise tolerance, quality of life, and clinical results (LaMonte and Eaton, [2021](#)). Ma ([2023](#)) found that resilience substantially correlates with physical activity among individuals with heart failure and partially mediates this association. Consequently, an all-encompassing strategy for heart failure care must incorporate exercise training (Laksono and Kusharsasmita, [2022](#)). Considering the complex challenges of heart failure, strategies aimed at enhancing resilience may function as effective interventions in clinical practice to foster psychological well-being and greater engagement in physical activities, thus addressing the interconnectedness of these health factors (Martín-Rodríguez *et al.*, [2024](#)). Resilience is essential for managing chronic diseases, as it affects patients' ability

to cope with the physical and mental burdens of their illness. This underscores the necessity for organized treatments to enhance resilience and augment psychosocial support and health management (Cui *et al.*, [2024](#)).

A patient with cardiovascular concerns may encounter mental well-being challenges stemming from inadequate self-care, insufficient social support, low understanding of the condition, tobacco use, and a prior history of depression. Mental well-being issues can exacerbate heart failure. Individuals with heart failure and mental well-being illnesses may find it challenging to preserve their quality of life and resilience (Yazew *et al.*, [2019](#)). This study examines the relationships among resilience, mental health, and physical activity in patients with heart failure. Assess whether resilience mediates the impact of physical activity on mental health, and identify the key factors that influence resilience in this population.

Materials and Methods

Design

This study employed a quantitative, cross-sectional design. Reporting adhered to the STROBE guidelines (Strengthening the Reporting of Observational Studies in Epidemiology). The correlational method was used to evaluate and clarify the relationship between the scores on the three instruments used in this study.

Setting and samples

This study was performed at the cardiac outpatient clinic of General Hospital Surakarta from February to July 2024. The study population comprised 186 patients. The sample size was 140 respondents, calculated using the Slovin formula with a 95% confidence level and a 0.05 margin of error (Khalaf *et al.*, [2019](#)). The sampling technique used was purposive sampling, based on established criteria. The inclusion criteria include heart failure patients categorised as New York Heart Association (NYHA) functional classes I, II, III, and IV, aged 18 to 69, diagnosed with heart failure. Exclusion criteria comprised psychological illnesses, defined for this study as clinically relevant psychosis or cognitive impairment, and refusal to provide informed consent.

Measurement

This study used three questionnaires: 1) The Adult Resilience Measure-Revised (ARM-R) was used to assess resilience (Resilience Research Centre, [2018](#)). The researcher used the original questionnaire, translated into Indonesian without changing the content. The Indonesian version was produced through a structured cross-cultural adaptation process. It consists of 17 statements with scale indicators, scored 1-5 (1 = not at all, 2 = a little, 3 = somewhat, 4 = moderately, 5 = a lot). The validity results showed strong potential for a measure of

adult resilience, with Cronbach's alpha values of 0.804-0.953 (Liebenberg and Moore, 2018). The ARM-R questionnaire is freely available for research and academic use. However, to access and download it, users must first complete a request form. 2) The Indonesian adaptation of the Depression, Anxiety, Stress Scale (DASS-42) was utilized for evaluating mental well-being and comprises 42 items addressing three dimensions: depression, anxiety, and stress, with indicators ranging from 0 to 3. The validity test indicated a positive correlation exceeding 0.532 across all items related to stress, anxiety, and depression, but the reliability test yielded findings of stress = 0.951, anxiety = 0.943, and depression = 0.952 (Marsidi, 2021). 3) The Indonesian adaptation of the International Physical Activity Questionnaire-Short Form (IPAQ-SF) assesses the intensity of physical activity and the duration of sedentary behavior in individuals' daily routines, estimating total physical activity in MET-min/week and sitting time through seven inquiries. The validity coefficient ($r=0.40$) and reliability are demonstrated by a significant Cronbach's Alpha ranging from 0.700 to 0.870 (Purnama and Suahda, 2019): access and permissions. The DASS-42 and IPAQ-SF are freely available and do not require authorization for research use.

Data collection

The data were collected after respondents received a detailed explanation of how to complete the instrument. The researchers assisted the respondents in completing the instrument until they finished their responses. Previously, research assistants were trained to collect data from respondents to ensure consistency and to provide full informed consent. Before data collection, the researchers clarified the study's objectives, provided instructions for each questionnaire item, and ensured respondents' complete understanding. Assistance was offered in person at the cardiac outpatient clinic until each participant had completed the questionnaire, guaranteeing accuracy and completeness. Respondents were given adequate time to answer all questions based on their experiences and current health conditions. Throughout the process, confidentiality and voluntary participation were strictly maintained in accordance with the study's approved ethical standards. The informed consent form used had undergone ethical review and ensured the privacy of the respondent's data. Digital tools were also used to fill out questionnaires, and Google Forms was used to prevent errors and improve data collection efficiency.

Data analysis

The statistical analysis employed a computer software to utilize descriptive statistics for evaluating the respondents' characteristics, which encompassed frequency, percentage, standard deviation, mean,

minimum, and maximum values for variables including age, gender, education level, occupation, duration of heart failure, prior disease history, and classification of heart failure functional class (NYHA).

The relationship between respondent characteristics (age, gender, occupation, duration of illness, medical history, education level, NYHA score, and salary) and resilience levels was analyzed using the Chi-Square test, with a $p\text{-value} < 0.05$ indicating a statistically significant relationship, while a $p\text{-value} \geq 0.05$ indicates no statistically significant relationship.

Multivariate analysis was conducted to examine the influence of independent variables on resilience. Before regression analysis, the statistical assumptions of normality, multicollinearity, heteroscedasticity, and autocorrelation were tested. This study employed the Kolmogorov-Smirnov test to assess normality. The results revealed a normal distribution, $p > 0.05$ for mental well-being factors (including depression, anxiety, and stress) and physical activity variables associated with resilience ($p = 0.368$). Multicollinearity testing indicated no multicollinearity, with Tolerance > 0.1000 and VIF < 10.00 for all independent variables (depression: Tolerance = 0.338, VIF = 2.956; anxiety: Tolerance = 0.369, VIF = 2.711; stress: Tolerance = 0.365, VIF = 2.739; physical activity: Tolerance = 0.972, VIF = 1.029). The heteroscedasticity test utilizing scatterplots indicated the absence of heteroscedasticity; no discernible pattern (wavy, expanding, then contracting) was observed, and the data points were distributed both above and below zero on the Y-axis. The Durbin-Watson test demonstrated the absence of autocorrelation (Durbin-Watson = 1.764), which falls within the acceptable range ($Du = 1.758 < 1.764 < 4 - Du = 2.242$). This study employed multiple linear regression analysis to examine the simultaneous impact of independent factors (X) on dependent variables (Y) and to evaluate the individual effect of each independent variable on the dependent variable.

Ethical considerations

Before participants' involvement, the researchers obtained written informed consent and assured the confidentiality of the data. The study has received approval and ethical clearance from the Health Research Ethics Committee (KEPK) of the Health Polytechnic of the Ministry of Health Yogyakarta, under approval number DP.04.03/e-KEPK.1/456/2024.

Results

Table 1 summarizes the participants' characteristics. Of the 140 responders with heart failure, the predominant age group (64.3%) was between 41 and 65 years, with a mean age of 51 years. Most respondents were male (80 participants, 57.1%), and nearly half (63 participants, 45%) had attained Senior High School. Of

Table 1. Characteristics of Respondents (n=140)

Characteristics	Category	Frequency (n)	Percentage (%)	$\bar{X} \pm SD$
Age	18 – 40 years	31	22.1	51±12.885
	41 – 65 years	90	64.3	
	> 65 years	19	13.6	
Gender	Male	80	57.1	
	Female	60	42.9	
Education Level	Not in School	7	5.0	
	Elementary school	23	16.4	
	Junior high school	24	17.1	
	Senior high school	63	45.0	
	Diploma	7	5.0	
Employment	Bachelor	16	11.4	
	Unemployed	55	39.3	
Duration of suffering	Employed	85	60.7	
	≤ 5 years	108	77.1	
Disease history	6 – 10 years	21	15.0	
	>10 years	11	7.9	
	No comorbidity	78	55.7	
	Hypertension	24	17.1	
	Diabetes mellitus	17	12.1	
	Post-Stroke	1	0.7	
NYHA	Hyperlipidemia	8	5.7	
	Other	12	8.6	
	I	80	57.1	
	II	48	34.3	
Income	III	12	8.6	
	< Rp. 1.000.000	13	9.3	
	Rp. 1.000.000-Rp. 2.500.000	38	27.1	
	Rp. 2.500.000- Rp. 5.000.000	55	39.3	
	> Rp. 5.000.000	34	24.3	

the respondents, 85 individuals (60.7%) were employed. Concerning their medical history, 108 respondents (77.1%) had been diagnosed with heart failure for five years or less, whereas 78 respondents (55.7%) had no history of comorbidities. Furthermore, 80 respondents (57.1%) were categorized as NYHA class I. The largest income group comprised 38 respondents (27.1%) earning between Rp1,000,000 and Rp2,500,000.

Table 2 shows that the Chi-Square test indicate that age ($p = 0.539$), gender ($p = 0.277$), occupation ($p = 0.135$), duration of illness ($p = 0.179$), medical history ($p = 0.203$), educational level ($p = 0.633$), and income ($p = 0.263$) were not significantly associated with resilience levels. In

contrast, NYHA scores ($p = 0.016$) were significantly associated with resilience levels.

Table 3 shows that among 140 heart failure respondents, the majority (92.1%) had high resilience, while a smaller number (7.9%) had low resilience. The resilience scores ranged from 47 to 85, with an average score of 74 ($SD = 9.388$). Table 2 shows that among the 140 heart failure respondents, 82.1% experienced normal Mental well-being (depression), 7.1% had mild depression, another 7.1% had moderate depression, 2.1% had severe depression, and 1.4% had very severe depression.

Mental well-being (anxiety) results indicated that 71 respondents (50.7%) experienced an average level of

Table 2. Relationship between Respondent Characteristics and Level of Resilience

Variable	Pearson Chi-Square (χ^2)	df	p-value	Description
Age	1,238	2	0,539	Not significant
Gender	1,184	1	0,277	Not significant
Occupation	2,229	1	0,135	Not significant
Duration of illness	3,444	2	0,179	Not significant
Medical history	7,247	5	0,203	Not significant
Level of education	3,434	5	0,633	Not significant
NYHA	8,320	2	0,016	Significant
Income	3,981	3	0,263	Not significant

Table 3. Resilience, Physical Activity, Mental Health, Depression

Resilience	n (%)	Min	Max	X̄± SD	
Low	11 (7.9)	47	85	74 ± 9.388	
High	129 (92.1)				
Physical Activity (In a week)					
Mild < 600 METs	18 (12.9)	3734.7 MET ± 4365.632			
Moderate ≥ 600 METs	66 (47.1)				
Heavy ≥ 3000 METs	56 (40.0)				
Mental Health Depression	Normal	Mild	Medium	Heavy	Very Heavy
	n (%)	n (%)	n (%)	n (%)	n (%)
Depression	115 (82.1)	10 (7.1)	10 (7.1)	3 (2.1)	2 (1.4)
Anxiety	71 (50.7)	23 (16.4)	26 (18.6)	10 (7.1)	10 (7.1)
Stress	119 (85.0)	12 (8.6)	6 (4.3)	3 (2.1)	0 (0.0)

Table 4. Results of the Simultaneous Determination Coefficient (R2) Test

Model	R	R Square (R ²)	Adjusted R Square
Resilience (Y) Mental Health (Depression (X1), Anxiety (X2), Stress (X3)), Physical Activity (X4)	0,355	0,126	0,100

Table 5. The Relationship of Mental Health and Physical Activity to Resilience Partially

	B	Std. Error	β	t	p-value
(Constant)	78.003	1.670		46.709	0.000*
Mental Health					
Depression (X1)	-0.481	0.222	-0.299	-2.164	0.032*
Anxiety (X2)	0.041	0.214	0.025	0.189	0.850*
Stress (X3)	-0.141	0.207	-0.091	-0.681	0.497*
Physical Activity (X4)	1.470	0.001	0.007	0.084	0.933*

*t-test

anxiety, 23 respondents (16.4%) reported mild anxiety, 26 respondents (18.6%) reported moderate anxiety, 10 respondents (7.1%) reported severe anxiety, and 10 respondents (7.1%) reported very severe anxiety. In terms of Mental well-being (stress), most respondents, 119 (85%), reported an average level of stress, 12 respondents (8.6%) reported mild stress, 6 respondents (4.3%) reported moderate stress, and 3 respondents (2.1%) reported severe stress. No respondents reported experiencing very severe stress.

Table 3 indicates that among the 140 heart failure patients who participated in physical activity over a week, the predominant group engaged in moderate-intensity exercise (66 respondents, 47.1%), followed by those involved in vigorous activity (56 respondents, 40%), while a smaller segment partook in light activity (18 respondents, 12.9%). The weekly physical activity averaged 3734.7 MET-min/week (SD = 4365.6). The multiple linear regression analysis findings indicate a significant association between Mental Well-Being and physical exercise on resilience, with a p-value of less than 0.05 ($0.001 < 0.05$). This signifies a substantial correlation among Mental Well-Being, physical activity, and resilience in heart failure patients at General Hospital Surakarta.

The multiple correlation test in Table 4 yielded an R-value of 0.355, indicating a weak relationship among Mental Well-Being, physical activity, and resilience. The positive R-value suggests a positive or unidirectional relationship. The R² value of 0.126 (12.6%) indicates a significant combined contribution of Mental Well-Being and physical activity to resilience, with the remaining 0.874 (87.4%) attributable to other variables not tested in this study.

The results of the T-test research in Table 5 showed a significance value of $p < 0.05$ when testing depression

(X1) on resilience (Y) ($0.032 < 0.05$). This indicates that depression affects resilience. Additionally, the obtained significance values of $p > 0.05$ when testing anxiety on resilience ($0.850 > 0.05$), stress on resilience ($0.497 > 0.05$), and physical activity on resilience ($0.933 > 0.05$) indicate that anxiety, stress, and physical activity do not affect resilience.

Based on the coefficient values, we can conclude the following relationships: 1) The negative coefficients for X1 (-0.481) and X3 (-0.141) indicate that if depression (X1) increases, resilience (Y) will decrease, and vice versa. Similarly, if stress (X3) increases, resilience (Y) will decrease, and vice versa. 2) The positive coefficients for X2 (+0.041) and X4 (+1.470) suggest that if anxiety (X2) increases, resilience (Y) will increase, and vice versa. Likewise, if physical activity (X4) increases, resilience (Y) will increase, and vice versa.

The results of Table 6 show that the Effective Contribution (SE) values for depression (X1) are 10.47%, anxiety (X2) is -0.67%, stress (X3) is 2.73%, and physical activity is 0.04%. The Relative Contribution (SR) values for the same variables are 83.1% for depression (X1), -5.3% for anxiety (X2), 21.9% for stress (X3), and 0.3% for physical activity. This study concludes that the variable with the highest practical and relative contribution to the relationship between Mental Well-Being and physical activity on resilience is depression (X1).

Discussions

This study found that among the examined demographic and clinical variables, only the New York Heart Association (NYHA) functional class showed a significant association with resilience in patients with HF. This result is clinically plausible, as NYHA classification reflects the symptomatic and functional burden of HF—limitations in physical activity, dyspnea,

Table 6. Partial Determination Coefficient (R2) Test Result

	Beta (β)	Correlation coefficient	R Square	EC (%)	RC (%)
Mental Health					
Depression (X1)	-0.299	-0.350	0.126	10.47	83.1
Anxiety (X2)	0.025	-0.268		-0.67	-5.3
Stress (X3)	-0.091	-0.300		2.73	21.9
Physical Activity (X4)	0.007	0.061		0.04	0.3
Total				12.6	100

*EC = Effective Contribution; RC: Relative Contribution

and fatigue—which directly strain psychological coping mechanisms (Yang *et al.*, 2024). As symptom burden increases from NYHA I to IV, patients face progressive losses in role functioning and autonomy, which can erode adaptive capacity. Previous studies similarly demonstrate that worsening NYHA class correlates with poorer health-related quality of life (HRQoL) and psychological adjustment, reinforcing its role as an integrated marker of disease burden and functional stress (Greene *et al.*, 2021).

Beyond the NYHA classification, this study revealed weak but positive correlations between mental well-being, physical activity, and resilience. These findings align with existing research suggesting that while psychological and physical health contribute to resilience, their influence is often modest and mediated by broader psychosocial factors (Xu *et al.*, 2023; Elliott *et al.*, 2024). Depression, anxiety, and stress are highly prevalent in HF and may diminish individuals' ability to adapt to chronic illness (Poletti *et al.*, 2022). Psychological resilience supports emotional regulation, adherence to treatment, and engagement in self-care, all of which are essential for managing HF (Min *et al.*, 2013). Thus, even minor improvements in mental well-being may foster better coping and self-management.

Resilience is often conceptualized as the ability to adapt and recover from adversity (Sisto *et al.*, 2019). It encompasses cognitive, emotional, and behavioural processes that enable individuals to cope with stressors and maintain psychological stability (Liu and Boyatzis, 2021). Mental well-being, on the other hand, is a broader construct encompassing life satisfaction, positive emotions, and overall psychological functioning (Gautam *et al.*, 2024). Although resilience may enhance coping, the limited link identified in this study suggests that other psychosocial factors, including social support, personality traits, and coping mechanisms, may substantially affect mental well-being (Nwaogu and Chan, 2022). This reciprocal relationship suggests that interventions targeting both resilience and well-being holistically may yield more effective results in improving psychological health.

These factors can foster greater resilience by equipping individuals with more effective coping mechanisms to deal with adversity. Nevertheless, resilience is a multifaceted construct influenced by personal attributes such as optimism, cognitive flexibility, and emotional regulation, and may not depend solely on physical activity (Azam, Muhamad, and Syazwan Ab Talib, 2024). Socially, participation in physical activities, especially in group settings, provides opportunities for social support and community engagement. Social support has been recognized as a crucial protective factor for resilience, helping individuals navigate challenges and recover from adversity more effectively (Liu *et al.*, 2021; Fahamsya, Anggraini, and Faizin, 2022). However, the weak correlation found in

this study suggests that social interactions through physical activity might not be strong enough to serve as the primary factor for developing resilience.

Cardiac rehabilitation has evolved into a multidimensional program that integrates physical, psychological, and social components, aimed at optimizing recovery following a cardiac event or managing chronic cardiovascular disease. Mental Well-Being disorders, including depression, anxiety, and stress, are common in patients with heart failure and are associated with adverse health outcomes, such as reduced medication adherence, compromised physical function, and increased hospital readmission rates (Celano *et al.*, 2018). Structured physical activity is fundamental to cardiac rehabilitation, enhancing cardiovascular fitness, boosting endothelial function, and diminishing systemic inflammation, therefore fostering overall health and resilience (Lavie *et al.*, 2015).

In this study, we observed a weak yet positive association among physical activity, mental well-being, and resilience in patients with heart failure. Although directionally consistent with theory and prior evidence, several methodological and clinical considerations likely attenuated the magnitude of the correlations. Disease severity and hemodynamic burden are likely confounders and effect modifiers. Activity levels decrease with worsening NYHA functional class, and device-based activity tracks with invasive hemodynamics (Tinggaard *et al.*, 2025). Frailty—a prevalent, multisystem syndrome in HF further reduces capacity and dampens response to exercise, thereby weakening the observable link between physical activity, mental well-being, and resilience. If not fully adjusted, these clinical factors can obscure stronger underlying relationships (Omar *et al.*, 2021). Psychological comorbidity, especially depression and anxiety, both confound and mediate the physical activity-resilience pathway. Depression is common in HF and is associated with lower activity, poorer self-care, and worse outcomes (Deka, Almenar, Pathak, Klompstra, López-Vilella, *et al.*, 2021). While exercise training can reduce depressive symptoms, the presence and variability of mood symptoms can introduce noise in cross-sectional associations between PA, mental well-being, and resilience, particularly when mood is transient, or treatment is changing (Smith and Merwin, 2021). Social determinants and contextual resources—such as social support, socioeconomic status, and healthcare access—shape both physical and psychological adaptation to HF. International comparisons highlight that quality of life and related psychosocial outcomes vary by structural and cultural context, independent of clinical factors (Roy *et al.*, 2020). Unmeasured or imperfectly measured contextual variables, therefore, plausibly attenuate direct PA-resilience correlations (Mygind *et al.*, 2021).

The findings indicate that while Mental Well-Being and physical activity contribute to resilience, their

simultaneous effect is weak. This implies that other factors may play a more significant role in enhancing resilience, such as social support, coping strategies, or personality traits (Fletcher and Sarkar, 2013). The positive link between Mental Well-Being, physical activity, and resilience aligns with previous research indicating that those who engage in physical activity tend to have better mental well-being, which, in turn, fosters resilience (Wang *et al.*, 2023). These results hold several practical implications. First, interventions aimed at improving resilience should not focus solely on physical activity and Mental Well-Being, but should also incorporate other psychological and social determinants. Second, healthcare providers and policymakers should consider a more holistic approach in designing resilience-building programs, integrating Mental Well-Being services with lifestyle interventions that promote physical activity. Finally, educators and workplace wellness programs may leverage these findings to develop strategies that enhance resilience among students and employees by combining Mental Well-Being support with physical activity promotion.

Although the simultaneous analysis demonstrates a statistically significant but modest association among mental health, physical activity, and resilience, the partial analyses indicate that only depression exerts a considerable effect. The relatively weak association may be attributable to characteristics of the study sample or the psychometric properties of the measurement instruments utilized. Moreover, the cross-sectional design limits the ability to establish causal inferences; therefore, future investigations employing longitudinal or experimental approaches are warranted to elucidate the causal mechanisms linking mental health, physical activity, and resilience. Notably, the analysis also revealed a significant correlation between the demographic factor of New York Heart Association (NYHA) classification and resilience, suggesting that disease severity may play an essential role in shaping patients' adaptive capacity. Subsequent research should further examine whether these associations are stronger across different populations, such as distinct age cohorts or occupational groups.

This study shows a weak relationship between physical activity and mental well-being, but stresses its importance for heart failure patients. It suggests moving beyond medical treatments to include both physical and psychological support. Healthcare providers and policymakers should create programs that combine physical rehabilitation with mental health support, like counselling or mindfulness. This approach can help patients better manage their condition and improve their quality of life. Despite the weak connection, it highlights an important area for holistic cardiovascular care.

This study has several limitations. First, its cross-sectional design precludes causal inference; although

physical activity and mental well-being were positively associated with resilience, we cannot determine the direction of causality. Second, the study relied on self-reported questionnaires (e.g., DASS-42 and IPAQ-SF), which are susceptible to recall and social-desirability bias and may attenuate or inflate observed associations. Third, the low R^2 observed in the multivariable models indicates that a substantial proportion of variance in resilience remains unexplained, suggesting the presence of unmeasured or residual confounders (e.g., social support, socioeconomic hardship, disease severity indices, medication adherence). Fourth, the single-centre, purposively sampled cohort limits generalisability to broader populations and other healthcare settings. Future research should employ longitudinal and multicentre designs, incorporate objective measures where feasible (e.g., accelerometry for physical activity), and include additional psychosocial and clinical covariates to improve model fit and clarify mechanisms. Interventional trials targeting modifiable factors (e.g., structured physical activity programs and mental health interventions) are warranted to establish causal effects on resilience and to inform stronger clinical recommendations.

Conclusion

Research findings consistently confirm that psychological factors influence resilience in heart failure patients more than demographic or socio-economic factors. Depression has been shown to have a significant impact on resilience levels, so managing depressive symptoms should be an integral component of outpatient cardiology care, particularly for patients with NYHA functional classification I-IV. This highlights the urgency of psychological interventions and proactive screening within nursing clinical practice.

On the other hand, demographic variables such as age, gender, education level, occupation, or income are not significantly associated with resilience and therefore cannot be used as primary indicators. The severity of the disease, as indicated by NYHA classes, is closely linked to patient resilience, highlighting the importance of physical condition in psychological adaptation. The severity of the disease, as indicated by NYHA classes, is linked to patient resilience, highlighting the role of physical condition in psychological adaptation. While physical activity doesn't show a significant partial effect, it still demonstrates value in promoting and preventing issues related to patient resilience. Integrated rehabilitation programs that combine moderate physical activity with psychological support should be implemented to enhance resilience and quality of life for heart failure patients.

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Availability of data and materials

The author states that the data and materials in this research are available and accessible.

Authors' contributions

BK contributed to developing the research concept. Following this, BK, NFA, IRNL, and RAP participated in initial discussions on the research proposal and methodological framework. NFA, IRNL, and RAP were responsible for drafting and revising the manuscript under BK's supervision. The writing and review of the manuscript were carried out collaboratively by all authors. Each author contributed equally to this manuscript, irrespective of their specific roles.

Declaration of Interest

No conflict of interest was observed whilst the research was being conducted and concluded.

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