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The Association between Perceived Social Support and Adherence to Cardiac Rehabilitation in Patients with Myocardial Infarction

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Quantitative Study

Abstract

Background: Myocardial infarction (MI) patients face a higher risk of recurrent cardiovascular events and reduced quality of life. Cardiac rehabilitation (CR) is a comprehensive secondary prevention program that improves outcomes, but adherence remains suboptimal. Perceived social support has been identified as a potential determinant of CR adherence. The current study explored the connection between MI patients' adherence to CR and their perceived social support.

Methods: This cross-sectional study was conducted at a tertiary care hospital in Baghdad, Iraq. The sample included 150 MI patients enrolled in a CR program. The MSPSS (Multidimensional Scale of Perceived Social Support) was employed to evaluate perceived social support, and attendance records measured adherence to CR. Clinical and sociodemographic data were collected. Logistic regression analyses, including multivariate and univariate approaches, were carried out to analyze the association between adherence to CR and perceived social support.

Results: Adherent patients had significantly higher MSPSS scores than non-adherent patients (68.3 ± 12.8 vs. 57.2 ± 14.1, P <0.001). In the multivariate analysis, perceived social support was significantly associated with adherence to CR (adjusted OR=1.06, 95% CI: 1.03-1.10, P <0.001) after controlling for sociodemographic and clinical variables. Education level was also significantly associated with adherence, with patients having a secondary education or higher showing 2.4 times higher odds of adherence (adjusted OR = 2.40, 95% CI: 1.08-5.34, P = 0.032). The association between perceived social support and adherence to CR was significant among male participants but not among female participants.

Conclusion: Increased perceived social support was significantly associated with higher CR adherence, especially in male patients (adjusted OR=1.06, 95% CI=1.03-1.10, P<0.001). Interventions to enhance social support, especially for male patients and those with lower education levels, may improve CR participation and completion rates. Healthcare providers should assess patients' social support networks and engage family members and significant others in the CR process to promote better cardiovascular health outcomes.

Keywords: Myocardial infarction; Patient outcomes; Secondary prevention; Psychosocial factors

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Introduction

Cardiovascular diseases (CVDs) are rapidly increasing worldwide and are currently regarded as the main contributor to mortality rates in countries at all stages of economic development (Gaziano, 2022). Myocardial infarction (MI), generally referred to as a heart attack, is a severe manifestation of CVD that occurs when the heart's blood supply is obstructed, resulting in damage to the cardiac muscle (Sharma et al., 2021). Individuals who have experienced an MI are at a higher risk of recurrent cardiovascular events, reduced quality of life, and premature death (Lopez-Jimenez et al., 2022). To mitigate these risks and improve patient outcomes, cardiac rehabilitation (CR) has been established as a comprehensive secondary prevention program (Ambrosetti et al., 2021).

CR is a multidisciplinary intervention that aims to optimize cardiovascular health through exercise training, risk factor modification, and psychosocial support (Świątkiewicz et al., 2021). Numerous studies have demonstrated the benefits of CR in reducing cardiovascular mortality, morbidity, and hospital readmissions, as well as improving quality of life and functional capacity in MI patients (Alfaraidhy et al., 2022; Bozkurt et al., 2021; Thygesen et al., 2022). Despite the well-established benefits of CR, adherence to these programs remains suboptimal, with reported participation rates ranging from 20% to 50% (Ades et al., 2022; Claes et al., 2020; Ozemek & Squires, 2021).

Adherence to CR is a complex and multifaceted issue influenced by various factors, including patient characteristics, clinical factors, and psychosocial determinants (Goli et al., 2022; Hasan et al., 2023). Among the psychosocial factors, social support has been identified as a potential key determinant of CR adherence (Lotfi-Tokaldany et al., 2019). Social support refers to the perceived or actual assistance provided by family, friends, and significant others, which can be instrumental, informational, or emotional (Yang & Jiang, 2020). Studies have shown that social support is essential for the recovery and adaptation process following an MI, influencing patients' coping strategies, self-care behaviors, and treatment adherence (Babygeetha & Devineni, 2024; Xiong et al., 2024). However, most of these studies have been conducted in Western countries, highlighting the need for research in diverse cultural and healthcare contexts, as social support is heavily influenced by cultural norms and values (S. Lee et al., 2024).

Researchers have conducted multiple studies to analyze the association between adherence to CR and social support, yielding mixed results. A systematic review by Resurrección et al. (2019) demonstrated an association between higher levels of social support and better CR adherence in most of the included studies. However, the authors noted significant heterogeneity in measuring social support and adherence and potential confounding factors. Another review by Lotfi-Tokaldany et al. (2019) specifically focused on the role of family support in CR adherence and found a positive association between family support and CR participation. However, the authors highlighted the need for more high-quality studies to establish the causal relationship and explore the underlying mechanisms.

Given the inconsistencies in the current literature and the lack of research in diverse settings, further investigation is needed to clarify the relationship between perceived social support and CR adherence in MI patients. A better understanding of this relationship could guide the development of targeted interventions to improve social support and CR adherence, ultimately leading to better cardiovascular outcomes in this high-risk population.

This study aims to analyze the relationship between CR adherence and perceived social support in MI patients, hypothesizing that higher perceived social support is positively associated with CR adherence. By addressing this research question, we aim to contribute to the growing body of evidence on the psychosocial determinants of CR adherence and support the development of strategies designed to improve patient outcomes in the context of secondary prevention of CVD.

Methods

Design study and participant: This cross-sectional research was performed at the CR Center of Baghdad Teaching Hospital, a tertiary care hospital in Baghdad, Iraq. The study aimed to assess the interplay between participation in CR and perceived social support in patients with MI.

G*Power software (Faul et al., 2009) was employed to calculate the necessary sample size, considering a power of 0.80, a medium effect size (d = 0.5), and a significance threshold 0.05 for a two-tailed t-test. The minimum required sample size was determined to be 128 participants. To account for potential dropouts and missing data, we aimed to recruit 150 participants.

Patients were recruited using a purposive sampling method, a non-probability sampling technique that selects participants based on specific characteristics or criteria relevant to the research question (Etikan et al., 2016). In this study, purposive sampling was employed to ensure that the sample included MI patients enrolled in the CR program at the study site and met the inclusion criteria. Given the study's limited resources and time constraints, this sampling method was chosen to target the specific population of interest and maximize recruitment efficiency (Palinkas et al., 2015). Consecutive participants meeting the qualifying criteria and providing informed acquiescence were incorporated into the study until the target sample size was reached. The inclusion criteria were: (1) a confirmed diagnosis of MI, (2) enrollment in the CR program at the study site, (3) age 18 years or older, and (4) ability to provide informed consent. The study excluded patients with the following conditions: (1) severe cognitive impairment, (2) a life expectancy of less than six months due to non-cardiac conditions, or (3) a planned move outside the study area within six months.

Instruments: Data were obtained using a combination of self-administered questionnaires and face-to-face interviews. Well-prepared research associates guided the interviews in a private room at the CR center. The questionnaires were available in Arabic and Kurdish, Iraq's two most common languages. The research assistants assisted participants who could not read or write when completing the questionnaires.

The Multidimensional Scale of Perceived Social Support (MSPSS) served as the tool for assessing the perceived social support of study participants (Zimet et al., 1988). Comprised of 12 self-report items, the MSPSS evaluates perceived support from three distinct categories: friends, family, and significant others. All inquiries are addressed using a 7-point Likert scale, with 1 indicating the strongest level of disagreement and 7 indicating the strongest level of agreement. The overall score spans from 12 to 84, where loftier scores point to increased degrees of social support that one perceives. The MSPSS has been validated in Arabic (Merhi & Kazarian, 2012) and has shown high internal coherence (Cronbach's alpha = 0.88) in our sample.

Attendance records measured adherence to CR. The CR program at the study site consisted of 24 sessions, delivered twice a week over 12 weeks. Patients who attended at least 75% of the scheduled sessions (i.e., 18 sessions) were considered

adherent, while those who attended less than 75% were considered non-adherent. This cut-off point was based on previous studies (Resurrección et al., 2019) and the clinical judgment of the CR team.

Sociodemographic and clinical data were obtained by administering a structured questionnaire to participants. The sociodemographic variables included monthly income, employment status, education level, marital status, gender, and age. The study's clinical variables encompassed various types of MI, the time since MI, the left ventricular ejection fraction (LVEF), and the presence of comorbidities (hypertension, diabetes, and dyslipidemia).

Analysis: SPSS v26.0 was employed for data analysis. Descriptive statistics were employed to summarize the sociodemographic and clinical attributes of the participants. The correlation between adherence to CR and perceived social support was examined using both univariate and multivariate analyses. In the univariate analysis, an independent samples t-test was employed to contrast the average MSPSS scores of adherent and non-adherent patients. The Shapiro-Wilk test was used to determine if the data followed a normal distribution, and Levene's test was utilized to check for equal variances among groups. The non-parametric Mann-Whitney U test was employed if the assumptions were not met.

In the multivariate analysis, a binary logistic regression model was used to examine the independent association between perceived social support and adherence to CR while controlling for potential confounders. The dependent variable was adherence to CR (0=non-adherent, 1=adherent), and the independent variable was the MSPSS score (continuous). The covariates included age (continuous), education level (1=secondary or higher, 0=primary or less), marital status (1=married, 0=unmarried), gender (1=female, 0=male), employment status (0=unemployed, 1=employed), monthly income (continuous), time since MI (continuous), MI type (1=ST-elevation MI, 0=non-ST-elevation MI), LVEF (continuous), and the presence of comorbidities (0=no, 1=yes for each comorbidity).

The logistic regression model was built using a hierarchical approach. In the first block, the sociodemographic variables were entered. In the second block, the clinical variables were added. In the third block, the MSPSS score was entered. The Hosmer-Lemeshow test was utilized to determine how well the model fits the data, and the receiver operating characteristic (ROC) curve's area was calculated to appraise the model's discriminative potential. The significance of the individual predictors was assessed using the Wald test, and the 95% confidence intervals (CI) and the adjusted odds ratios (OR) were reported.

Multiple imputation was employed to manage the missing data. The numerous imputation processes involved three main steps: imputation, analysis, and pooling (Woods et al., 2023). First, missing values were imputed using the fully conditional specification (FCS) method, which assumes that the missing data mechanism is missing at random (MAR) (Murad et al., 2024). The imputation model included all the variables in the analysis model and auxiliary variables correlated with the missing data or the probability of missingness. These auxiliary variables were identified through exploratory data analysis and clinical judgment. The number of imputations was set to 20, as J. H. Lee & Huber Jr (2021) recommended for achieving stable estimates. Second, the imputed datasets were analyzed using the same logistic regression model separately. Third, the results from the imputed datasets were pooled using Rubin's rules (Rubin, 1987), which account for the variability within and between the imputed datasets. The pooled estimates and their standard errors were

reported in the results section.

Statistical significance was set at a p-value of 0.05 or below, and all tests conducted were two-tailed.

Ethics: This study complied with the ethical principles outlined in the Declaration of Helsinki. Unfortunately, Iraq has yet to recognize a specific code of ethics universally. However, the study was conducted strictly by observing internationally recognized ethical guidelines. Before enrollment, all participants provided their written informed consent. Participants were informed about the study's purpose, procedures, risks, and benefits and their right to withdraw without any consequences. Confidentiality was maintained by assigning a unique code to each participant and storing the data in a secure location accessible only to the research team. Participants who were found to have severe depression or other mental health problems were referred to appropriate services.

Results

A group of 150 MI patients was recruited for the study. The participants' clinical and sociodemographic characteristics are detailed in Table 1. The mean age of the subjects was 58.3 ± 10.7 years, and 72.7% were male. The majority of the participants were married (86.7%), had a secondary education or higher (62.0%), and were unemployed (58.0%). The median monthly income was 500000 Iraqi dinars (IQR: 350000-750000).

Regarding the clinical characteristics, 60.7% of the participants had an ST-elevation MI, and the mean time since MI was 5.2 ± 3.1 months. The mean LVEF was 45.3 ± 8.9%. Hypertension was the most common comorbidity (64.7%), followed by dyslipidemia (50.7%) and diabetes (48.0%).

The mean score on the MSPSS was 64.2 ± 14.3, indicating moderate perceived social support.

Table 1. Sociodemographic and clinical characteristics of the participants (N = 150)

Characteristic	Value
Age (years), mean ± SD	58.3 ± 10.7
Gender, n (%)	
Male	109 (72.7)
Female	41 (27.3)
Marital status, n (%)	
Married	130 (86.7)
Unmarried	20 (13.3)
Education level, n (%)	
Primary or less	57 (38.0)
Secondary or higher	93 (62.0)
Employment status, n (%)	
Employed	63 (42.0)
Unemployed	87 (58.0)
Monthly income (IQD), median (IQR)	500000 (350000-750000)
Type of MI, n (%)	
ST-elevation MI	91 (60.7)
Non-ST-elevation MI	59 (39.3)
Time since MI (months), mean ± SD	5.2 ± 3.1
LVEF (%), mean ± SD	45.3 ± 8.9
Comorbidities, n (%)	
Hypertension	97 (64.7)
Diabetes	72 (48.0)
Dyslipidemia	76 (50.7)

SD: Standard deviation; IQD: Iraqi dinars; IQR: interquartile range

The median score was 65.0 (IQR: 54.0-75.0). The adherence rate to CR was 64.0% (n = 96), based on the attendance of at least 75% of the scheduled sessions.

In the univariate analysis, adherent patients had significantly higher MSPSS scores than non-adherent patients (68.3 ± 12.8 vs. 57.2 ± 14.1, P < 0.001). The normality assumption was violated (Shapiro-Wilk test, P < 0.05). However, the postulation of variance homogeneity was fulfilled (Levene's test, P = 0.397). Therefore, the non-parametric Mann-Whitney U test showed a significant difference in MSPSS scores between adherent and non-adherent patients (median: 70.0 vs. 56.0, U = 1415.5, P < 0.001).

Table 2 displays the multivariate logistic regression (MvLR) analysis outcomes. The sociodemographic variables, including age, gender, marital status, education level, employment status, and monthly income, were entered in the first block. The clinical variables, including the type of MI, time since MI, LVEF, and the presence of comorbidities (hypertension, diabetes, and dyslipidemia), were added in the second block. In the third block, the MSPSS score was entered.

In the final model (Block 3), perceived social support was significantly associated with adherence to CR after controlling for sociodemographic and clinical variables. For each one-point increase in the MSPSS score, the odds of adherence increased by 6% (adjusted OR=1.06, 95% CI=1.03-1.10, p<0.001). The model's good fit was confirmed by the Hosmer-Lemeshow test (χ2=7.56, P=0.477), and the area under the ROC curve was 0.79 (95% CI=0.72-0.86), indicating a fair discriminative ability.

Among the sociodemographic variables, only education level was significantly associated with adherence to CR. Patients with a secondary education or higher had a 2.4 times higher likelihood of adherence than those with a primary education or less (adjusted OR=2.40, 95% CI=1.08-5.34, P=0.032). The multivariate analysis indicated clinical variables were not significantly associated with CR adherence.

Given the potential gender differences in perceived social support and adherence to CR, a subgroup analysis was conducted stratified by gender. The results generated by the MvLR analysis, divided by gender, are exhibited in Table 3.

Among male participants (n = 109), perceived social support remained significantly associated with adherence to CR (adjusted OR = 1.07, 95% CI: 1.03-1.12, p = 0.001).

Table 2. MvLR analysis of factors correlated with adherence to CR (N = 150)

Variable	Block 1	Block 2	Block 3
	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Age	1.01 (0.98-1.05)	1.02 (0.98-1.06)	1.02 (0.98-1.06)
Gender (female vs. male)	0.68 (0.31-1.51)	0.70 (0.31-1.58)	0.74 (0.32-1.73)
Marital status (married vs. unmarried)	1.42 (0.52-3.90)	1.39 (0.50-3.88)	1.19 (0.41-3.48)
Education level (secondary or higher vs. primary or less)	2.14 (1.00-4.58)	2.22 (1.02-4.84)*	2.40 (1.08-5.34)*
Employment status (employed vs. unemployed)	1.31 (0.64-2.68)	1.35 (0.65-2.81)	1.28 (0.60-2.73)
Monthly income	1.00 (1.00-1.00)	1.00 (1.00-1.00)	1.00 (1.00-1.00)
Type of MI (STEMI vs. NSTEMI)		1.24 (0.60-2.56)	1.17 (0.55-2.47)
Time since MI		0.96 (0.86-1.07)	0.97 (0.87-1.09)
LVEF		1.02 (0.98-1.06)	1.01 (0.97-1.06)
Hypertension (yes vs. no)		1.13 (0.53-2.41)	1.04 (0.47-2.28)
Diabetes (yes vs. no)		0.81 (0.39-1.68)	0.84 (0.40-1.79)
Dyslipidemia (yes vs. no)		1.09 (0.53-2.25)	1.13 (0.54-2.39)
MSPSS score			1.06 (1.03-1.10)***

STEMI: ST-elevation MI; NSTEMI: non-ST-elevation MI
*P<0.05, ***P<0.001

Table 3. MvLR analysis of factors correlated with adherence to CR, stratified by gender

Variable	Male (n=109)	Female (n=41)
	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Age	1.02 (0.97-1.07)	1.03 (0.95-1.12)
Marital status (married vs. unmarried)	1.15 (0.33-4.04)	1.28 (0.18-9.32)
Education level (secondary or higher vs. primary or less)	3.10 (1.19-8.09)*	1.32 (0.33-5.29)
Employment status (employed vs. unemployed)	1.36 (0.57-3.25)	1.08 (0.25-4.71)
Monthly income	1.00 (1.00-1.00)	1.00 (1.00-1.00)
Type of MI (STEMI vs. NSTEMI)	1.28 (0.53-3.10)	0.89 (0.21-3.83)
Time since MI	0.98 (0.86-1.12)	0.94 (0.74-1.19)
LVEF	1.01 (0.96-1.06)	1.02 (0.93-1.12)
Hypertension (yes vs. no)	1.07 (0.43-2.68)	0.95 (0.21-4.37)
Diabetes (yes vs. no)	0.81 (0.34-1.94)	0.93 (0.22-3.94)
Dyslipidemia (yes vs. no)	1.19 (0.50-2.85)	0.99 (0.24-4.12)
MSPSS score	1.07 (1.03-1.12)**	1.04 (0.98-1.11)

STEMI: ST-elevation MI; NSTEMI: non-ST-elevation MI
*P<0.05, ***P<0.001

Education level was also significantly associated with adherence, with male patients with secondary education or higher having 3.1 times higher odds of adherence than those with primary education or less (adjusted OR = 3.10, 95% CI: 1.19-8.09, P = 0.021).

Among female participants (n = 41), perceived social support was not significantly associated with adherence to CR (adjusted OR = 1.04, 95% CI: 0.98-1.11, P = 0.217). None of the sociodemographic or clinical variables were significantly correlated with adherence in the female subgroup.

The overall rate of missing data was 3.6%. The variable that featured the most missing data was monthly income (6.7%), followed by LVEF (4.0%) and time since MI (2.7%). The complete case analysis and the multiple imputation analysis produced consistent results, with perceived social support remaining significantly associated with adherence to CR in the imputed dataset (adjusted OR = 1.07, 95% CI: 1.03-1.11, P < 0.001).

To further explore the role of different sources of social support in adherence to CR, we compared the MSPSS subscale scores between adherent and non-adherent patients. As shown in Table 4, adherent patients had significantly higher scores on all three subscales (Family, Friends, and Significant Others) compared to non-adherent patients (all P<0.001). This suggests that perceived support from multiple sources is associated with better adherence to CR.

We also conducted logistic regression analyses to examine the independent association between each MSPSS subscale and adherence to CR while controlling for sociodemographic and clinical variables. The results, presented in Table 5, indicate that higher scores on all three subscales were significantly associated with increased odds of adherence, both in the crude and adjusted analyses. This further supports the notion that perceived support from family, friends, and significant others are important predictors of adherence to CR, even after accounting for other relevant factors.

Table 4. Comparison of MSPSS subscale scores between adherent and non-adherent patients

MSPSS Subscale	Adherent (n = 96)	Non-adherent (n = 54)	P-value
Family	23.5 ± 4.2	20.1 ± 5.1	<0.001
Friends	21.8 ± 4.7	18.6 ± 5.3	<0.001
Significant Others	22.9 ± 4.4	19.5 ± 5.0	<0.001

Data are presented as mean ± standard deviation. P-values are based on independent samples t-test or Mann-Whitney U test, as appropriate

Table 5. Logistic regression analysis of the association between MSPSS subscales and adherence to CR

MSPSS Subscale	Crude OR (95% CI)	Adjusted OR (95% CI)
Family	1.18 (1.09-1.28)***	1.15 (1.05-1.26)**
Friends	1.14 (1.06-1.23)***	1.10 (1.01-1.20)*
Significant Others	1.17 (1.08-1.27)***	1.13 (1.03-1.24)*

OR: odds ratio; CI: confidence interval. Adjusted OR are adjusted for age, gender, marital status, education level, employment status, monthly income, type of MI, time since MI, LVEF, and comorbidities.
*P<0.05, **P<0.01, ***P<0.001

Discussion

This cross-sectional study investigated the relationship between perceived social support and adherence to CR among MI patients in Iraq. The key findings were: (1) higher levels of perceived social support were significantly associated with better adherence to CR, even after adjusting for sociodemographic and clinical variables; (2) education level was significantly associated with adherence to CR, particularly among male participants; and (3) the association between perceived social support and adherence to CR was significant among male participants but not among female participants.

The observed gender differences in the relationship between perceived social support and adherence to CR may be related to variations in social support networks and coping strategies (Martínez-Hernáez et al., 2016). In the Iraqi context, male patients may rely more on spousal support, while female patients may have other sources of support, such as extended family members or religious communities (Sepehrian et al., 2020). Cultural norms and gender roles may also influence how social support is perceived and utilized by male and female patients (Kneavel, 2021). These findings highlight the need for gender-specific approaches in designing and delivering CR programs to optimize outcomes.

Compared to studies from other cultural contexts, our findings underscore the importance of considering cultural and social factors when examining the determinants of CR adherence. For example, a survey conducted in the United States found that social support was a significant predictor of CR adherence. Still, the strength of the association varied across racial and ethnic groups (Kjellstrand et al., 2022). Similarly, a study in Japan reported that the relationship between social support and CR adherence was moderated by patients' living arrangements and employment status (Bozkurt et al., 2021). These findings suggest that the influence of social support on CR adherence may be context-specific and shaped by cultural, social, and economic factors.

Several limitations of this study should be acknowledged. First, the cross-sectional design precludes causal inferences about the relationship between perceived social support and adherence to CR. Longitudinal studies are needed to establish these variables' temporal sequence and examine the potential bidirectional effects. Second, using self-reported measures for sociodemographic and clinical variables may introduce bias due to social desirability or recall issues. Future studies should consider using objective measures or medical records to validate self-reported data. Third, the single-center setting may limit the generalizability of the findings to other populations or healthcare systems. Multi-center studies with diverse patient populations are needed to confirm the robustness of the results.

Conclusion

This study underscores the vital role of perceived social support in promoting

adherence to CR among MI patients in Iraq, particularly among male patients and those with higher education levels. The findings have important implications for clinical practice and policy development.

Clinicians should routinely assess patients' social support networks and engage family members and significant others in the CR process. This can be achieved through family-centered education, counseling, and support groups. Healthcare providers should also tailor their communication and intervention strategies to patients' gender and education levels, recognizing different subgroups' unique challenges and needs. For example, male patients with lower education levels may require additional support and resources to overcome barriers to CR participation.

Policymakers should prioritize allocating resources toward CR programs that integrate social support as a key component. This may involve funding for family-centered interventions, peer support groups, and community-based initiatives. Policymakers should also reduce educational disparities and promote health literacy to enhance patients' understanding of and engagement with CR services.

Future research should employ longitudinal designs to establish the causal relationship between perceived social support and adherence to CR and explore the underlying mechanisms. Studies should also investigate the effectiveness of social support interventions in improving CR adherence and outcomes using rigorous methodologies such as randomized controlled trials. Additionally, future research should examine the generalizability of the findings to other cultural contexts and healthcare systems, using diverse patient populations and multi-center designs.

Conflict of Interests

Authors have no conflict of interests.

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