



Research article

Depression and adherence to healthy lifestyle behaviors among patients with coronary artery diseases in Jordan

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ARTICLE INFO

Keywords:

Adherence
Depression
Coronary artery disease
Healthy lifestyle

ABSTRACT

Background: It is well-established in the literature that coronary artery disease (CAD) is a risk factor for depression and that depressive symptoms inversely affect the development and progression of CAD. No published studies have examined the relationship between depression and adherence to healthy lifestyle behaviors among patients with CAD in Jordan. Therefore, the purpose of this study is to investigate the impact of depression on adherence to healthy lifestyle behaviors among CAD patients in Jordan.

Methods: A correlational, cross-sectional study of convenience sample of 130 patients with CAD was conducted from out-patient cardiac clinics in a university-affiliated hospital and government-operated hospital in Northern Jordan. Data were collected using self-administered questionnaires on depression and adherence to healthy lifestyle behaviors among CAD patients.

Results: Our data showed that 41% of the participants were non-adherent to healthy lifestyle behaviors, especially in the areas of physical activity (6.2%), maintaining a healthy diet (24.6%), and weight loss (26.15%). Gender, smoking status, and number of cardiac catheterization procedures were found to be significant predictors of patient adherence to healthy lifestyle behaviors. Although depressive symptoms were present in 56.9 % of the participants, depression was not found to be a significant predictor of adherence to healthy lifestyle behaviors among our sample.

Conclusion: There was no significant relationship between depression and adherence to healthy lifestyle behaviors among CAD patients in Jordan. Physical activity, maintaining a healthy diet, and weight loss were the least lifestyle behaviors that were adopted, while quitting smoking and medication compliance were the most adopted behaviors among the patients. Our study provides valuable data regarding the levels and predictors of adherence to healthy lifestyle behaviors among CAD patients with CADs. Implications for future research and practice are addressed.

1. Introduction

The relationship between depression and heart disease has been well-established and documented. In fact, it has been found that over 30% of patients with coronary artery disease (CAD) also manifest depressive symptoms [1]. Experts agree that depression is a major risk factor for CAD development and progression [2, 3, 4, 5, 6]. Conversely, people with heart disease are also at a greater risk of developing depression, according to the National Heart, Lung, and Blood Institute [7]. This seemingly two-way relationship between heart disease and depression is considered a global concern. CAD is considered the leading cause of death worldwide [6, 8], and it is predicted to remain the leading cause of

death globally over the next decade. On the other hand, depression is a common illness worldwide, affecting more than 264 million people globally [9].

Poor quality of life has been documented in developing countries for patients with cardiac problems and depression [1, 10]. Depression influences patients' lifestyle habits, social life and work. Further, it may affect their productivity, increase burden on their families [10], readmission to hospital, and CHD mortality [11].

In the Kingdom of Jordan, CAD accounts for 18.61% of all annual deaths, which ranks Jordan the 42nd country in the world in terms of CAD deaths [12]. Meanwhile, depression is one of the most common mental illnesses in Jordan, with almost 25% of people who go to

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psychiatrists in the Kingdom suffering from depression [13]. In a study conducted by Hamdan-Mansour and colleagues [14], 27.5% of Jordanian patients with chronic diseases such as CAD reported that they had moderate to severe depressive symptoms, and about 31% of them had mild depression. Depression affects the adherence of patients to self-care practices [15] and healthy lifestyle behaviors, which predisposes them to developing CAD. Several studies have also demonstrated that patients who suffer from depression show less adherence to lifestyle changes and medication, which negatively impacts their health outcomes [16, 17, 18]. Moreover, depression is associated with increased rates of smoking and decreased chances of smoking cessation [5, 19], increased physical inactivity [5, 18, 19], increased alcohol intake [5], and increased dietary fat intake [19]. In comparison, patients who suffer from CAD but display positive affect have higher survival rates as a result of their increased physical activity [20, 21]. Furthermore, the increase in positive affect over time is associated with increased patient adherence to healthy lifestyle behaviors [21]. This inverse relationship between depression and healthy lifestyle indicates the importance of eliminating the symptoms of depression in order to foster adherence to healthy lifestyle habits and thereby could reduce the excessive cardiac risk associated with depression in CAD patients.

The importance of conducting a study that explores the relationship between depression and adherence to healthy lifestyle behaviors among patients with CAD is needed to figure out the sophisticated relationship between depression and adherence to healthy lifestyle behaviors among those risky patients and their roles in the adverse outcomes of CAD. Therefore, the aim of this study is to bridge that gap in the literature by investigating the impact of depression on adherence to healthy lifestyle behaviors among CAD patients in Jordan. Specifically, the objectives of this study were as follows: 1) to assess the levels of depression and adherence to healthy lifestyle behaviors among patients with CADs, and 2) to determine the significant predictors of adherence to healthy lifestyle among patients with CAD using certain sociodemographic characteristics, clinical characteristics, and depression as predictors. This study hypothesizes that there is a negative relationship between levels of depression and adherence to healthy lifestyle behaviors among patients with CAD in Jordan.

2. Methods

2.1. Study design

This study is an analytical, cross-sectional study designed to assess the relationship between depression and adherence to healthy lifestyle behaviors among CAD patients in Jordan.

2.2. Setting and sampling

The study was conducted on a convenience sample recruited from outpatient cardiac clinics in a university-affiliated hospital and government-operated hospital in the north of Jordan. The sample size was determined using "Green" equation [22] for calculating sample size for multiple regression analysis. According to this equation, for medium effect size ($R^2 = .07$, $B = .20$), $N \geq 104 + k$ where k is the number of predictors in the study, accordingly, the minimum sample size needed for this study is 114 participants (i.e., $104 + 10$ predictors = 114). A 15% was added to the calculated sample size to ensure adequate sample with no many missing data (i.e., less than 10%), yielding a total of 130 participants. Participants were included in the study if they were diagnosed with CAD for at least 6 months, and aged over 18 years.

2.3. Data collection procedure and ethical considerations

Before data collection, institutional Review Board (IRB #2014/274) approval was obtained from Jordan University of Science and Technology (JUST) and the hospitals where the study was conducted.

Participants were selected based on their availability to participate in the study while visiting their physician. Patients who met the inclusion criteria were invited to participate in the study, and patients who agreed to participate were asked to sign an informed consent form. The informed consent contained the specific information about the study purpose, the potential minimal embarrassment that the questions could cause, and the public and participants involvement in the study results, as well as, the participant right to withdraw at any time. A sealed envelope containing the study survey was distributed to participants and was collected by hand once it was completed. The PI of this study was available on site to answer any question raised by study participants.

2.4. Instruments

Since the participants of this study are mainly speakers of Arabic, the language of the informed consent, demographics questionnaire, and study measurement tools was Arabic in which the participants can understand the questions clearly and to ensure there is no misunderstanding while answering the questions. We followed the procedure developed by Chapman and Carter [23] for the translation of the Cardiac Depression Scale (CDS) and the Adherence Scale from English into Arabic. At the beginning, a professional bilingual language editor translated the scales from English to Arabic. Another professional bilingual language editor translated the scales back into English. When discrepancies in the translation found, the two professional bilingual language editors worked together to reach consensus on the final version of the measure. Three experts also approved the scales for face validity and the questionnaire was pilot-tested among 10 participants. In the current study the Cronbach's alphas for the CDS and the Adherence Scale in our study were 0.90 and 0.71, respectively.

The questionnaire consisted of three parts: a) sociodemographic and health characteristics of the participants; b) the Cardiac Depression Scale (CDS) [24]; and c) the Adherence Scale [25], used to determine the levels of adherence to healthy lifestyle behaviors in patients with CAD. The sociodemographic and health-related data section included items related to age, gender, marital status, work status, income, health insurance, presence of chronic illnesses, previous cardiac catheterization procedures, smoking, number of cigarettes per day, number of years since CAD diagnosis, exercise habits, adherence to medication, health assessment, psychological health, previous diagnosis with depression and the impact of CAD on sexual activity.

The Cardiac Depression Scale (CDS), which is a 26-item self-rated questionnaire [24], was used to assess the levels of depression among the participants. The scale was developed by Hare and Davis in 1996 [24] and has been validated among the Jordanian population [3]. Responses are scored on a 7-point Likert scale, with higher scores indicating an increased number of depressive symptoms [24]. The Cronbach's alpha in the original study was 0.9. The correlation of CDS with Beck Depression Inventory (BDI) was 0.73, and with clinical assessment was 0.67 [24]. The original CDS was developed to have two dimensions and seven subscales, namely sleep, anhedonia, uncertainty, mood, cognition, hopelessness, and inactivity [24]. The participants were asked to rate how they felt regarding each question, and each item was then rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Seven of the 26 items are worded in a positive direction, and the total score is calculated by summing the scores of all of the items after reversing the positively worded items, with the total possible score ranging from 26 to 182.

The participants' levels of adherence to healthy lifestyle behaviors were assessed using the Adherence Scale, which is a 0–9 ordinal scale developed by Alm-Roijer, Stagmo, Ude'n, and Erhardt [25]. According to the scale, adherence to lifestyle changes and attainment of the treatment goals was defined as the patient's changes in self-reported dietary, smoking habits, and physical activity, reduction in weight, stress management and reduction in lipid, blood glucose, and blood pressure levels. Eleven items are used to measure adherence to lifestyle changes, whilst

lifestyle modification to achieve treatment goals is assessed using questions with responses ranging from 0 ("I have not made any lifestyle changes") to 9 ("I have made a lot of lifestyle changes"). The total score is obtained by summing the scores of all of the items. The total possible score ranges from 0-99, with higher scores indicating a higher degree of adherence to lifestyle modifications. The items were tested for internal consistency reliability using Cronbach's alpha coefficient, which has been reported to be around 0.73 in previous studies [25].

2.5. Data analysis

The Statistical Package for the Social Sciences (SPSS) for windows version 25.0 was used for data analysis. Descriptive statistics were used to describe the characteristics of the sample and the main study variables. Simultaneous regression analysis was used to determine the significant predictors of the participants' adherence to healthy lifestyle behaviors.

3. Results

A total of 130 patients with CAD participated in this study. The mean age of the participants was 56.15 years (SD = 10.83). The majority of the participants (55.4%) were male, 58 (44.6%) female, 81.5% were married, approximately 69.3% were educated to high school or below, and 31.5% were employed and had an average income of JOD 558.24 (SD = 437) (See Table 1).

As with regards to the clinical characteristics of our study sample, the majority of the participants (85.4%) had coexisting chronic conditions, and 65.4% had previously undergone cardiac catheterization. Meanwhile, 39.2% of the participants reported good general health, and 33.1% reported good psychological health.

The mean score for the CDS was 97.65 (SD = 23.72), ranging from 26-158. Shi, Stewart, and Hare [26] suggested a cut-off point for the CDS of >95 for participants to be considered depressed. Based on that, 56.9% of the participants in the present study were found to have depressive symptoms, while 43.1% were not depressed. Moreover, 9.2% of the sample in the current study had a previous diagnosis of depression (See Table 2).

Our data also showed that the average adherence to healthy lifestyle behaviors among the participants was (M = 58.98, SD = 1.75, range = 0–99). High adherence rates were associated with taking medications

Table 1. Participants' demographic characteristics (N = 130)

Variables	M(SD)	N	%
Age	56.15 (10.83)		
Gender			
Male		72	55.4
female		58	44.6
Marital status			
Married		106	81.5
Other (Single, widow, separated, and divorced)		24	18.5
Education level			
High school or less		90	69.3%
Diploma		13	10%
Baccalaureate		17	13.1%
Master or Ph.D		10	7.7%
Work status		130	
Working		41	31.5
Retired		34	26.2
Not working		55	42.3
Income JOD	558.25 (437.10)		
Health insurance			
Insured		116	89.2
Not insured		14	10.8

Note: M: Mean; SD: Standard deviation

Table 2. Participants' clinical characteristics (N = 130)

Variables	M(SD)	N	%
Chronic illness			
Has chronic illness		111	85.4
Does not have chronic illness		14	10.8
Unknown		5	3.8
Cardiac catheterization			
Yes		85	65.4
No		45	34.6
Num cath. procedure		85	65.4
1-2		66	50.8
3-4		13	10
5-6		5	3.8
More than six		1	.8
Smoking status			
Smoker		33	25.4
Not smoker		60	46.1
ex-smoker		37	28.5
Number of cigarettes per day	10.84 (17.43)		
Years with CAD diagnosis			
6m-1y		28	21.5
1-5 y		43	33.1
10 y		32	24.6
More than 10 y		27	20.8
Regular physical activity			
Yes		28	21.5
No		102	78.5
Previous diagnosis of depression			
Yes		12	9.2
No		118	90.8
General health assessment			
Excellent		9	6.9
Very good		25	19.2
Good		51	39.2
Fair		37	28.5
weak		8	6.2
Psychological health			
Excellent		14	10.8
Very good		33	25.4
Good		43	33.1
Fair		36	27.7
Weak		4	3.1
Impact of CAD on sexual activity			
Positive effect		3	2.3
Negative effect		45	34.6
No effect		66	50.8
Not involved in any sexual activities		10	7.7
I don't know		6	4.6
Depression (CDS)	97.66 (23.73)		
Yes		74	56.9
No		56	43.1

Note. CDS = Cardiac Depression Scale; M: Mean; SD: Standard deviation.

(68.5%) and quitting smoking (47.7%), while low adherence was attributed to physical activity (6.2%), followed by healthy nutrition (24.6%), and weight loss (26.15%).

A simultaneous regression analysis was conducted to predict the participants' levels of adherence to healthy lifestyle behaviors. Missing data were treated using the expectation-maximization algorithm, and data were missing completely at random. The tests for multicollinearity using bivariate correlation table and VIF values indicated no

multicollinearity between the variables (see Table 3). The P-P plot of regression standardized residuals showed linearity of the residuals (Figure 1) Independence and homoscedasticity were also tested. The scatterplot for the dependent variable showed that the values fell between 2 and 3 for the regression standardized predicted value and regression standardized residuals (Figure 2). Normality of the continuous variables was tested using the Kolmogorov-Smirnov test, and the variables were normally distributed ($p > .05$).

The predictors of adherence to healthy lifestyle were as follows: (a) sociodemographic variables (including gender, age, income, and level of education), (b) clinical variables (including presence of co-existing chronic illnesses, previous cardiac catheterization procedures, smoking status, and previous depression diagnosis), and (c) depression variable of the CDS.

The results indicated a significant regression equation $F(11, 118) = 4.19, p < .001, R^2 = .28$. Adjusted $R^2 = .21$, which indicates that 21% of the variance in the participants' adherence to healthy lifestyle behaviors was explained by all of the predictors. Being a current smoker $t(118) = -4.23, p < .001$, an ex-smoker $t(118) = -2.30, p = .02$, gender $t(118) = 2.88, p = .005$, and number of cardiac catheterization procedures $t(118) = 2.29, p = .02$ were the only significant predictors of adherence to healthy lifestyle behaviors among the participants. More specifically, being a current smoker and being an ex-smoker reduced adherence by .45 units ($\beta = -.45, p < .001$) and .22 units ($\beta = -.22, p = .02$), respectively. Being male increased adherence by .28 units compared to being female ($\beta = .28, p = .005$), and having undergone a high number of cardiac catheterization procedures enhanced adherence to healthy lifestyle behaviors by .28 units ($\beta = .28, p = .02$) (See Table 3).

To ensure that type II error was not committed, Pearson correlation test was conducted to explore the relationship between adherence to healthy lifestyle and the variables of age, income, number of Cath procedures performed, and CDS. Significant and non-significant results were similar to those reported in the regression analysis (see Table 4). Furthermore, t-test and One-way ANOVA analyses were performed to depict whether differences in adherence exist according to the variables of gender, educational level, the presence of chronic illness, whether Cath procedure was performed, smoking status, and depression diagnosis. The significant and non-significant results of the t-test and ANOVA were similar to those of the regression analysis, except for gender (see Table 5). T-test showed no significant differences in adherence to health lifestyle between male and female participants, while the regression analysis revealed that gender was a significant predictor with males being more adherent than females. This relates to the fact that regression

Normal P-P Plot of Regression Standardized Residual

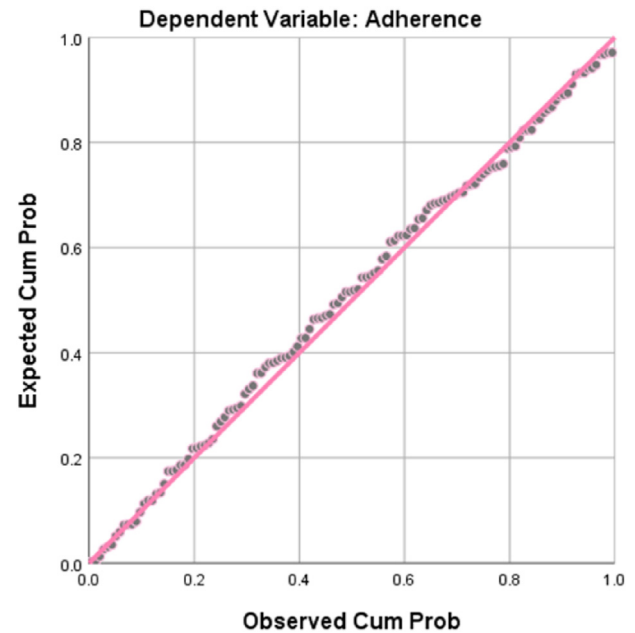


Figure 1. P-P Plot of Regression Standardized Residual. Note. This figure demonstrates linearity of the regression standardized residuals.

analysis controls for other sources of variability in the dependent variable, whereas the t-test has lower power to detect the effect.

4. Discussion

The majority of the participants in the current study were male, married, and unemployed. Most of the participants suffered from co-existing chronic illnesses and had been diagnosed with CAD for at least one year, and nearly half of the participants had undergone at least one to two catheterization procedures in the past. As for the participants' healthy lifestyle practices, most of the participants were either current smokers or ex-smokers, and the majority exercised rarely. These descriptive statistics are partially in concordance with a recent research about the predictors of adherence to treatment in a similar target population [27]. They found

Table 3. Simultaneous regression analysis of sociodemographic data, clinical data, and depression on adherence to healthy lifestyle (N = 130).

Predictor	DF	SE	t Value	B	β	P Value	95% CI	Collinearity Statistics	
								Tolerance	VIF
Gender (Male)	11	3.93	2.88	11.36	.282	.005**	3.56–19.16	.678	1.474
Age	11	.160	.282	.045	.024	.779	-.271–.361	.817	1.224
Income	11	.004	.927	.044	.088	.356	-.005–.013	.680	1.471
Education	11	1.58	.204	.323	.204	.839	-2.80–3.45	.601	1.663
Chronic illness (yes)	11	5.17	1.45	7.51	.133	.150	-2.74–17.76	.765	1.307
Cath (yes)	11	5.60	.177	.659	.016	.907	-10.44–11.75	.348	2.874
Number of Cath	11	3.16	2.25	7.14	.289	.026*	.88–13.41	.378	2.647
Smoking (yes)	11	4.86	-4.23	-20.61	-.451	.000***	-30.24–-10.98	.602	1.660
Smoking (ex)	11	4.31	-2.30	-9.94	-.226	.023*	-18.49 - - 1.39	.602	1.660
Depression (yes)	11	6.02	-1.29	-7.81	-.114	.197	-19.74–4.10	.823	1.215
CDS	11	.079	.198	.016	.019	.843	-.14–17	.720	1.389
R^2		.28							
Adj R^2		.21							
F		4.19***							

Note. Gender, having a chronic illness, underwent catheterization, smoking status, and having depression diagnosis, were dummy coded. CDS = Cardiac Depression Scale.

* $p < .05$, ** $p < .01$, *** $p < .001$.

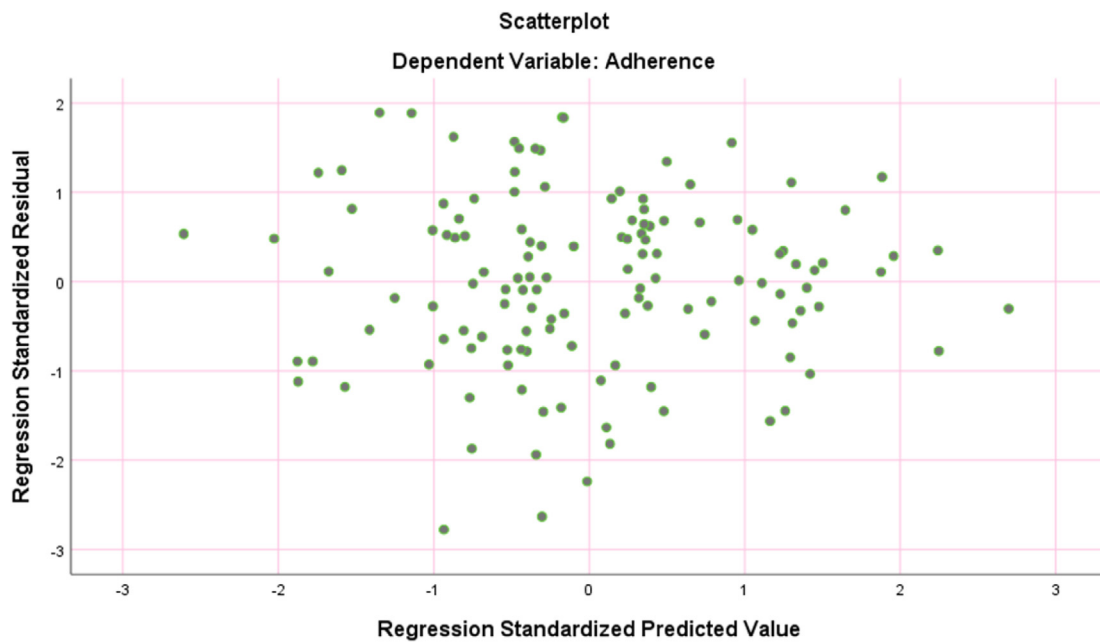


Figure 2. Homoscedasticity Assumption of the Regression Model. *Note.* The scatterplot for the dependent variable (i.e., adherence to healthy lifestyle) shows that the values fell between 2 and 3 for the regression standardized predicted value and regression standardized residual, demonstrating meeting the assumption of homoscedasticity.

Table 4. Pearson correlations between adherence, age, income, number of Cath procedure, and CDS (N = 130).

Variables	1	2	3	4	5
1. Adherence	-				
2. Age	.15	-			
3. Income	.008	-.101	-		
4. Num Cath. Procedure	.248**	.048	-.147	-	
5. CDS	.067	.074	-.193*	.252**	-

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

being male, having close personal relationship, long education period, having moderate-to-high physical activity, consuming more vegetables, LDL cholesterol, and diagnosed with coronary heart disease for long time without previous percutaneous coronary intervention.

Approximately one third of the sample described their psychological health as being "good", and depressive symptoms were present in 56.9% of the participants. This is in concordance with what a recent comprehensive review supported [28]. The review found that depression is coexisted with coronary artery disease through bidirectional relationship, contributing to sudden cardiac death, cardiac mortality, and poor adherence to lifestyle and treatment.

Our data also indicated that many of the participants were non-adherent to healthy lifestyle behaviors, especially in the areas of physical activity, maintaining a healthy diet, and weight loss. The two most commonly adopted lifestyle changes were quitting smoking and medication compliance. Meanwhile, the lifestyle change that was the least commonly adopted and least adhered to was physical activity.

The findings of our study also revealed that smoking status, gender, and number of previous catheterization procedures were the only predictors of adherence to healthy lifestyle behaviors. Being male, having undergone a high number of catheterization procedures, and being a non-smoker were found to predict the participants' adherence to healthy lifestyle behaviors. Interestingly, even though depressive symptoms were present in more than 50% of our sample, this variable was found to be an insignificant predictor of adherence.

Table 5. The effect of sociodemographic characteristics on adherence to healthy lifestyle.

Variable	Mean (SD)	t/F-value	p-value
Gender		1.75	0.08
Male	61.71 (20.26)		
Female	55.58 (19.20)		
Education level		1.50	.20
Secondary education or less	59.68 (17.96)		
High school	58.73 (18.55)		
Diploma	53.92 (27.20)		
Baccalaureate	54.10 (25.01)		
Master or Ph.D.	71.60 (9.69)		
Chronic illness		1.54	0.12
Yes	59.77 (19.06)		
No	51.12 (24.76)		
Performed Cath		1.85	.06
Yes	61.32 (20.37)		
No	54.55 (18.57)		
Smoking status		7.06	.001
Current smoker	48.26 (19.42)		
Ex-smoker	62.24 (20.41)		
Not smoker	62.89 (18.02)		
Depression diagnosis		-2.84	.07
Yes	46.46 (13.44)		
No	53.34 (20.05)		

Note: N = 130, SD = standard deviation, t = t-test, F = F test.

These findings on the levels of adherence among our sample are similar to the findings reported by studies conducted in other Eastern countries [29, 30, 31]. For example, Ghaddar and colleagues [30] reported that patients with CAD had low adherence to physical activity (10.8%–14.7%) and weight loss (33.3%–61.3%) but had satisfactory adherence to taking medications (83%–89.9%). On the contrary, high adherence rates to healthy lifestyle behaviors have been reported by studies conducted in Western countries. For example, in the study of

Griffo and colleagues [32], 89.9% of the patients showed good adherence to treatment, 72% to maintaining a healthy diet, 51% to following exercise recommendations, and 74% to quitting smoking. These differences between the findings of Eastern studies and the findings of Western studies may be attributed to the influence of culture on patients' attitudes towards adopting healthy lifestyle behaviors. For example, studies conducted in Eastern countries have found that non-adherence to healthy lifestyle behaviors may be due to patients having busy schedules, an unwillingness to adopt healthy lifestyle behaviors, the presence of comorbidities, and patients placing more emphasis on attending social gatherings than on adhering to a healthy lifestyle [29, 31].

Our findings on the gender-based differences in the participants' adherence to healthy lifestyle behaviors are consistent with other studies conducted in Jordan, which have found that men are more adherent to healthy lifestyle behaviors than are women [33, 34, 35, 36]. For example, in the study of Ammouri and colleagues [33], Jordanian men were found to be significantly more physically active than Jordanian women. Maintaining a healthy lifestyle may be challenging for women in Jordan due to several factors, which include problems in transportation, low social status, low self-efficacy, and lack of spousal support [37]. Vari and colleagues [38] also explained that gender behaviors, including the adoption of healthy lifestyle behaviors, are defined by sociocultural expectations.

In Jordan, women are expected to place great emphasis on family-oriented tasks and caring for the family, which may mean that they pay insufficient attention to adopting healthy lifestyle behaviors such as physical activity. Future studies are needed to further investigate the other factors which may contribute to gender-based differences in adherence to healthy lifestyle behaviors in the Middle Eastern context. It is noteworthy that in the present study, no gender-based differences in adherence to healthy lifestyle behaviors were identified by the t-tests; however, the regression models indicated that males had higher adherence than did females. The difference between the findings of the two statistical models may be attributed to the fact that regression analysis estimates the significance of a variable on an outcome after controlling for the effect of other variables, while t-test does not control for such an effect [39]. Therefore, estimates based on regression models can be more reliable than the estimates of t-tests.

A positive association was found between adherence to healthy lifestyle behaviors and the number of previous cardiac catheterization procedures, indicating that the participants are aware of the importance of adopting healthy lifestyle behaviors in order to prevent further CAD episodes or complications. Kayaniyil and colleagues [40] explained that knowledge of diagnostic tests and interventional procedures allows patients to clearly understand their condition and enables them to make educated decisions regarding their health.

Smoking status was also found to predict adherence among the participants in this study. Participants who had never smoked had better adherence to healthy lifestyle behaviors than current smokers or ex-smokers. This might be explained by the study of Sharma and Agrawal [41], in which knowledge of the harmful effects of smoking on CAD was found to increase patients' adherence to healthy lifestyle behaviors. Another interesting explanation is provided by Masiero, Lucchiari, and Pravettoni [42], who reported that smokers and ex-smokers might have a cognitive distortion called "optimistic bias". This group of patients tend to overestimate the impact of their decisions and are too optimistic towards their future and their capacity to monitor their health consequences.

Studies in the literature have reported contradictory findings regarding the impact of depressive symptoms on adherence to healthy lifestyle behaviors among CAD patients. Although the majority of studies have reported that depressive symptoms predict poor adherence to healthy lifestyle behaviors among CAD patients [43, 44, 45], one study [46] suggested no such relationship, which is consistent with our findings. Although many of the participants in the present study reported having depressive symptoms, this does not necessarily mean that they are clinically depressed. According to Fogel [47], depression had the most significant impact on adherence among cardiac patients during

hospitalization. Therefore, the fact that our participants were recruited from outpatient cardiac clinics may justify the weak relationship between depressive symptoms and adherence to healthy lifestyle behaviors indicated by our results. This is in concordance with the impact of the lifestyle and healthy lifestyle adherence on CAD and depression through considering the adherence to healthy lifestyle as an independent associated factor for having low risk of adverse outcomes in CAD patients. Similarly, this relationship plays an ultimate role in secondary prevention, supporting the practices of interventional cardiology [48].

4.1. Limitations of the study

One of the limitations of the present study is that the use of a self-report questions for data collection may have led to social desirability bias. Future research needs to employ more reliable and valid methods of assessment including those related to depression, reporting of changes in diet, lipids level, blood glucose and reporting of education. Further, the participants were recruited from two outpatient cardiac clinics, which may limit the generalizability of our findings to other CAD patients in other care settings. Finally, this study was unable to assess the causal relationships between depression and the factors that contribute to adherence to healthy lifestyle behaviors among CAD patients in Jordan.

4.2. Implications and recommendations

Our study has shown that CAD patients in Jordan have low adherence to certain healthy lifestyle behaviors, including physical activity, maintaining a healthy diet, and weight loss. Significant gender-based differences in adherence were identified, whereby females were found to be less adherent than males to healthy lifestyle behaviors. Our findings also showed that being a smoker negatively impacts adherence to healthy lifestyle behaviors among CAD patients. As a result, education and training programs should be created and tailored to patients with low adherence to physical activity, healthy diet, and weight control as well as those who are smoker. These programs might be provided to hospitalized patients during and after discharge from the hospital.

The findings of the current study calls for implications for future research including: a) the need to investigate the factors which contribute to low adherence to healthy lifestyle behaviors among CAD patients in Jordan and to determine whether gender-based differences in adherence exist among larger samples, b) explore the barriers to adopting and adhering to healthy lifestyle practices among female CAD patients in Jordan, and c) examine the effect of depressive symptoms on adherence to healthy lifestyle behaviors among Jordanian CAD patients using more specific measures of depression and taking into account any differences between patients in inpatient and outpatient cardiac settings.

5. Conclusion

Effective and flexible strategies are needed to help patients with CAD adjust their lifestyle behaviors in order to improve their overall health and reduce the risk factors of CAD. Nurses play a major role in assessing CAD patients' lifestyle practices on a regular basis and spreading awareness among patients regarding the importance of adopting healthy lifestyle behaviors. Nurses can support patients in making healthy choices and adhering to them.

Declarations

Author contribution statement

Ibtisam M. Al-Zaru RN, PhD: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Ghada Shahrouf, Ph. D., PMHCNS, RN; Dina Masha'al Ph.D., MSN, RN & Audai A. Hayajneh, RN, PhD, CNS, CPT: Performed the experiments;

Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data included in article/supp. material/referenced in article.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Acknowledgements

Thanks for Jordan University of Science and Technology.

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