



Research Paper:

Cardiac Function Modeling in Patients With Acute Myocardial Infarction Based on Type D Personality Considering the Mediating Role of Health-Promoting Lifestyle



Yarali Dousti¹ , Marzieh Mohammadi Pashaki^{1*} , Bahram Mirzaian¹

1. Faculty of Clinical Psychology, Sari Branch, Islamic Azad University, Sari, Iran.



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ABSTRACT

Background: The cardiac function of patients with acute myocardial infarction plays a vital role in disease prognosis. The risk of ischemic heart disease and death in people with type D personality is 4 times more than those with lower levels of negative affect and social inhibition. In this regard, lifestyle is the objective and quantifiable dimension of human personality.

Objectives: The research aimed to model the cardiac function based on type D personality with the mediating role of health-promoting lifestyle in patients with acute myocardial infarction.

Materials and Methods: The present research has employed a correlational method based on structural equation modeling, especially the regression equation. The statistical population of this research included all patients with acute myocardial infarction (ST-segment elevation MI) under primary percutaneous coronary intervention referred to Mazandaran Cardiac Center in Sari City, Iran, from 2017 to 2018. A total of 220 patients were selected through the Muller regression equation modeling formula, considering the ratio of the sample size to the free parameter, by the purposive sampling method. They responded to the D personality questionnaire and the health-promoting lifestyle questionnaire.

Results: Type D personality variable can directly predict the cardiac function of patients with acute myocardial infarction. This variable also predicts the cardiac function of these patients through the mediation of a health-promoting lifestyle.

Conclusion: Type D personality has a direct and indirect effect on the heart disease and prognosis of patients with myocardial infarction (because of the mediating role of health-promoting lifestyle), and screening for this personality type is necessary.

* Corresponding Author:

Marzieh Mohammadi Pashaki, PhD.

Address: Faculty of Clinical Psychology, Sari Branch, Islamic Azad University, Sari, Iran.

Tel: +98 (911) 33216733

E-mail: marzieh.mohammadi1351@gmail.com

1. Introduction

Cardiovascular disease is the most common cause of death in most countries of the world, including Iran. It will be the leading cause of mortality across the globe by 2020, according to the World Health Organization (WHO) [1, 2]. Myocardial infarction is one of the leading causes of infection, hospitalization, disability, and death in human societies and does not confine to a specific age group or gender [3, 4]. If a significant part of the myocardium suffers from ischemic injury, the pumping function of the left ventricle reduces. This disorder is the single essential predictor of mortality following ST-elevation myocardial infarction [5, 6]. Medical treatments, including thromboembolic drugs and angioplasty using balloon or spring, are used to limit myocardial infarction and prevent damage to the myocardium [7].

The known biological agents cannot fully explain the incidence of cardiovascular disease [8], but psychological and personality factors have a direct and indirect role in initiating and exacerbating cardiovascular disease [7, 9]. Personality is a set of relatively durable and unique features that may vary in response to different situations [10]. In the late 1990s and early 21 century, Denolt emphasized a new type of personality type called "Type D" by the typology of cardiovascular patients, which could predict heart disease with its characteristics [11].

The type D personality is defined as the interaction of two fixed and general personality traits, consisting of negative emotions and social inhibition. In negative emotions, the individual tends to experience negative feelings at different times and situations and feels more emotional, anxious, and irritable feelings. Social inhibition refers to people's desire to avoid negative emotions in social interactions, and individuals in this feature interact with others and feel distraction, stress, and insecurity [12-14]. The risk of ischemic heart disease and death in people with type D personality is 4 times more than those with lower levels of negative affect and social inhibition, and this is independent of the risk factors of traditional biomedicine [15-17].

The negative affections of type D personality in patients with myocardial infarction are the predictor of disability and low quality of life among them [16]. And the low quality of life predicts mortality in cardiovascular patients [15]. However, since there was no relationship between the behavior of type D personality and the risk of cardiovascular disease in all studies, this kind of personality type needs more research [18]. Although

extensive research in Western countries confirms the relationship between type D personality and the occurrence of cardiac problems, this study needs to be conducted in non-western countries, too [11].

Lifestyle is the objective and quantifiable dimension of human personality. Adler introduced the concept of lifestyle in the early 1900s. Lifestyle is the most important factor, based on which everyone regulates his or her life; a healthy lifestyle includes behaviors that guarantee the physical and mental health of a person [19, 20].

The WHO considers lifestyle as personal and identifiable patterns of behavior that result from the interaction among personal characteristics, social relationships, environmental conditions, and socioeconomic situations [21]. Health-promoting lifestyle includes practices such as nutrition, physical activity, health responsibility, stress management, interpersonal relationships, and spiritual growth [22]. An inappropriate lifestyle is one of the factors affecting the development of chronic diseases and one of the most important causes of death in Iran [23].

Unhealthy eating habits, not exercising, and smoking are common behaviors that increase the risk of developing physical and chronic illnesses, especially hypertension and cardiovascular problems, in the long run [18, 24]. Having a healthy lifestyle can prevent many diseases [25]. Various studies show that lifestyle changes not only inhibit heart disease but also control its progress and reduce complications in patients with cardiovascular disease [26]. For example, quitting smoking after myocardial infarction reduces the relapse risk by up to 35% [25].

According to the first statement of the World Health Conference in Moscow, 60% of global mortality and 80% of deaths in developing countries are the result of unhealthy lifestyles, and figure 1 will reach 70% of global mortality by 2030 [27]. Urbinati showed that in spite of the strict adherence to drug therapy in patients with coronary heart disease and diabetes, they could not maintain their proper blood pressure and low-density lipoprotein without following a healthy lifestyle after the diagnosis [28]. Cardiovascular diseases are treatable, and the best prevention is to adopt a healthy lifestyle [29]. Shanshan Li et al. showed that a higher-quality diet in patients with post-myocardial infarction reduces mortality in all cases [30].

Several studies have examined the risk factors for cardiovascular diseases, but few studies have been conducted regarding the role of personality traits in life-

style, as well as the relationship between cardiovascular lifestyle and cardiovascular risk factors [19, 22]. Despite the high impact of psychological risk factors in coronary artery disease itself, its prevention, and treatment, this dimension is often overlooked [20]. Many studies have been conducted on the psychological factors and coronary heart disease through correlation, causality, and effectiveness methods. However, in this research, we tried to use the new method of Structural Equation Modeling (SEM) for type D personality on the cardiac function of myocardial infarction patients with the mediating role of lifestyle. The research in this field is necessary because of the importance of lifestyle and its significant effect on preventing diseases and protecting the health of individuals. Also, the increasing number of people suffering from chronic diseases will be another reason for such studies.

2. Materials and Methods

This research has employed a cross-sectional method to collect the required data. The obtained data were analyzed through the descriptive and correlational methods based on SEM. In particular, we used the regression equation (integration of path analysis and factor analysis of the second level), based on covariance approaches (CBSEM) done in AMOS software. This approach estimates path coefficients and factor loadings by minimizing the difference between a sample-based covariance matrix and a model-based covariance matrix. Also, Baron and Kenny's step approach was used to investigate the correlation between variables, exogenous and mediator, and mediator and endogenous. Finally, the mediating role of exogenous and endogenous variables was examined [31].

The statistical population of this study included all patients with acute myocardial infarction (ST-segment elevation MI) referred to the Emergency Ward of Mazandaran Cardiovascular Hospital from 2017 to 2018 under primary Percutaneous Coronary Intervention (PCI).

The inclusion criteria included patients 1. Aged 30 to 65 years old; 2. Diagnosed with acute myocardial infarction under primary Percutaneous Coronary Intervention (PCI) [5]; 3. Wanted to participate in the research voluntarily; 4. Could read and write to complete the study questionnaire. Individuals diagnosed with ST-segment elevation MI should have the following clinical features: ST-segment elevation, high levels of cardiac enzymes, and the clinical history of angina and coronary artery stenosis above 50%, confirmed by angiography.

The exclusion criteria included failure to complete the questionnaire, withdrawal from continuing research activities, developing physical, psychological, and emotional problems during the study. To determine the sample size, we used the Muller regression equation modeling formula considering the ratio of the sample size to the free parameters [32]. Regarding the number of free parameters, 220 samples were obtained according to the average in the targeted sampling method.

The implementation method initially reviewed the records of hospitalized patients in the special wards of the hospital, who were aged 30 to 65 years old with the diagnosis of acute myocardial infarction under primary PCI. We used the D personality (DS14) and the Health-Promoting Lifestyle (HPLP II) questionnaires in this research. In the first step, the demographic information was obtained by taking the biographies of the patients and studying their records and the severity of coronary artery involvement through the angiographic report sheet considering the inclusion criteria. The questionnaires were then given to the patients, and they were asked to answer all the questions by explaining how to complete the questionnaire. Cardiac function was recorded with the Ejection Fraction index recorded in the echocardiographic artery.

Study instruments

D personality Questionnaire

Denolt designed the D Personality Questionnaire (DS14). It has 14 questions and two subscales of negative emotions and social inhibition [12]. This scale is at a desirable level in terms of reliability with as much as 81% obtaining through the test-retest method in Belgium. Based on the Cronbach alpha method, the reliability of this scale is 0.86 [33]. The validity of this scale is also at a desirable level so that the subscale of negative emotions with neuroticism has a correlation of 0.74, which is significant at the level of 0.001. There is a positive correlation between social inhibition and extroversion ($r=-0.61$) and a negative relationship between social inhibition and the level of consciousness ($r=-0.40$). There is also a positive correlation between social inhibition and neuroticism ($r=0.50$). These coefficients are all significant at 0.001 [12].

Zoljanahi et al. in Iran obtained the internal reliability of the negative emotion and social inhibition scale as 0.77 and 0.69, respectively [34]. Fakhari et al. calculated the Cronbach alpha for the negative emotion and social in-

Table 1. Questions of the questionnaire and the dimension

Dimension	Related Questions
Nutrition	1-11
Sport	12-24
Health responsibility	25-32
Stress management	33-38
Interpersonal support	39-46
Self-actualization	47-54

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hibition scale as much as 0.79 and 0.56, respectively. The alpha value for the total reliability of DS14 was 0.83 [35].

The questionnaire was rated based on a 5-point Likert scale from 0, 1, 2, 3, and 4 (indicating incorrect, somewhat incorrect, I do not have any idea, somewhat correct, and correct). Higher scores (closer to 56) shows the presence of the Type D personality.

Health-Promoting Lifestyle Questionnaire

Health-Promoting Lifestyle (HPLP II) questionnaire is a modified version of HPLP presented by Walker et al. It measures the health-promoting lifestyle by focusing on innovative work and individual perceptions that maintain or increase the level of well-being, self-actualization, and individual satisfaction.

This tool has 52 items and measures health-promoting behaviors in 6 dimensions. The measurable dimensions include nutrition (having a food pattern and choosing food), sports (pursuit of regular sport patterns), health accountability, stress management (identifying stress sources and stress management practices), interpersonal relationships and support (maintaining relationships with the feeling of proximity), spiritual growth, and self-actualization (having a sense of purposefulness, seeking to advance individuality and experience of self-awareness and satisfaction). Regarding the scoring, the respondent was asked to specify how much he or she performs health promotion behaviors on the 4-point Likert scale (never, sometimes, often, and normally). Generally, the health-promoting lifestyle score and behavioral dimension scores are calculated using average responses for 52 questions and each subcategory (8-9 items).

Hill-Polerecky and Walker reported the alpha value of 0.94 for the HPLP II tool and 0.79 to 0.94 for the sub-

categories. The reliability of the 3-week test-retest for the whole questionnaire was 0.89 [36]. In the study of Zaidi et al. the Cronbach alpha for the entire tool was 0.82. Also, the Cronbach alpha for the subcategories, including nutrition, physical activity, health responsibility, stress management, interpersonal relationships, spiritual growth, and the whole questionnaire was 0.81, 0.79, 0.86, 0.91, 0.75, 0.64, and 0.82, respectively [36]. SPSS 18 and AMOS software were used to analyze the data. Table 1 presents the questions of the questionnaire for each dimension.

3. Results

Initially, By reviewing statistical defaults, Outliers data were identified by examining statistical using box, tensile and skewness tests, Kolmogorov-Smirnov tests then were eliminated by Mahalanobis test and It was finalized with 201 samples, and the final data were extracted with 201 samples. Also, after evaluating the data normalized distribution, the measured model of two variables of research was assessed and confirmed. Besides, the average extraction variances show that all subscales of character type D variables and health-promoting lifestyle are greater than 0.5. The measured standards in the model, representing convergent validity and compound value (construct validity), indicate that the values obtained from the components are greater than 0.07 i.e., the measured standards. Therefore, the subject of average extraction variances and construct reliability for questionnaires are verified.

The results presented in Table 2 show a significant correlation between type D personality, lifestyle, and health promotion with heart function ($P=0.01$). According to Table 3, the value of RMSEA is 0.444, which indicates the model is acceptable. Also, the Chi-square to the degree of freedom is 2.795. The GFI, CFI, and NFI

Table 2. Mean±SD and correlation of type D personality, lifestyle, and promotion of health with heart function

Variable	Mean±SD	1	2	3	4	5	6	7	8
Nutrition	22.91±7.24	1							
Exercise	20.89±7.64	39*	1						
Responsibility of health	20.42±7.25	24*	34*	1					
Stress management	13.27±3.65	48*	51*	44	1				
Interpersonal support	17.27±5.75	46*	57*	52*	38*	1			
Self-actualization	20.70±6.45	68*	46*	46*	62*	58*	1*		
Type D personality	24.67±4.91	55*	48*	30*	25*	21*	20	1	
Ejection fraction heart function	42.33±8.45	66*	58*	23*	24*	20*	34*	27*	1

* P<0.05

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Table 3. Fit indicators obtained from data analysis and variables after two correction steps

Test	Description	Acceptable Values	The amount Obtained Before the Correction	The Amount Obtained After the Correction
χ^2/df	Relative normed Chi-square	> 3	3.20	2.795
X ²	Chi-square		220.467	198.457
df	Degrees of freedom		73	71
RMSEA	Root mean square error of approximation	>0.1	.052	0.044
GFI	goodness of fit index	<0.9	0.918	0.938
NFI	Normed fit index	<0.9	0.904	0.931
CFI	Comparison fitness index	<0.9	0.899	0.914

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indices approximately equal to 0.9 and show that the model is appropriate for measuring variables. According to Table 4, type D personality and health-promoting lifestyle have a direct effect on heart function.

Based on the Table 4, From the indirect path considered according to standardized values (β), not standardized (b) and (R^2) obtained, the path of type D personality with medi-

ating the life-style of promoting health on heart function has significant effects with respect to the obtained values and is confirmed by the Bootstrap estimation method. the path of type D personality with mediating the life-style of promoting health on heart function has significant effects with respect to the obtained values and is confirmed by the Bootstrap estimation method Table 5.

Table 4. The direct estimation of the model with the maximum-likelihood estimation

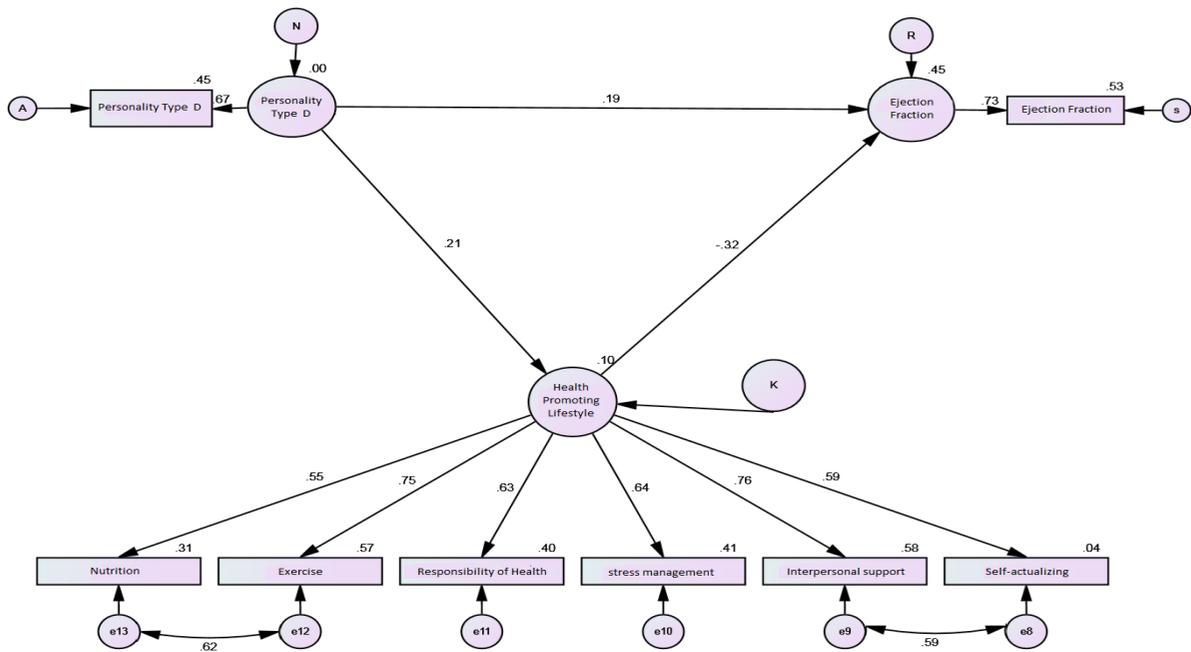
Variable	B	B	R ²	Sig.
Personality type D on heart function	0.21	0.19	0.039	0.034
Health-promoting lifestyle on heart function	-0.54	0.34	0.183	0.01

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Table 5. Indirect estimation of the model using the Bootstrap method

Variable	B	Lower Boundary	Upper Boundary	Sig.
Type D personality on heart function by mediating lifestyle	0.318	0.296	0.423	0.001

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Figure 1. The final model of predicting the heart function in the indirect pathway by the type D character variable with mediating lifestyle

It is worth noting that in the final model for creating latent variables, it is necessary to have multiple markers of each of the variables. We usually use the subscales of the measurements as separate indicators of the construct, but in some cases, there is no specific design of a particular structure. In this case, the item packets described by Russell et al. are used. In this study, this method was also used to analyze the type D personality and the heart function according to the single variables to improve the overall variance of the model based on Russell et al. method in the hidden variable [37].

4. Discussion

The present research aimed to model the structural relationships of type D personality with the cardiac function of patients with acute myocardial infarction with the mediating role of a health-promoting lifestyle. According to the final model of the research, the Type D personality variable can predict cardiac function in patients with acute myocardial infarction. Investigating the predictive role of type D personality and health-promoting lifestyle in predicting cardiac function in patients with acute myocardial infarction also showed a correlation coefficient of 0.039 and 0.18 in patients with acute myocardial infarction. In addition, the indirect effect of type D personality variable on the cardiac function of patients with acute myocardial infarction with mediating the health-promoting lifestyle explained variance (R^2) as much as 0.37, indicating an indirect effect on the cardiac function

of patients with acute myocardial infarction. These results are consistent with the studies of Urbinati et al. Shanshan Li et al. Hemati Pak Maslak et al. and Mazloumi et al. They reported that a health-promoting lifestyle affects cardiovascular patients, especially those with myocardial infarction. This lifestyle helps patients to control their blood pressure, cholesterol, diabetes, cardiac function better, and to reduce the death rate [26-28, 30]. In addition, this research is in line with the research done by Mohseni Pouya et al. Saber Moghaddam Ranjbar et al. Besharat et al. Aminpour et al. and Etemad on the effect of lifestyle in the development of coronary heart disease [20, 22, 23, 38, 39]. The results were also consistent with the Sedaghat et al. Stein et al. and Mirzaie et al. study results which reported that following a promoting lifestyle, especially in cardiac patients, is not only being aware of a healthy lifestyle but is also being influenced by psychological factors such as personality type and motivation [19, 24, 29]. These findings emphasize the importance of psychological issues in the health area of cardiac patients.

Personality can be considered the distinct patterns of thinking, emotion, and behavior that interact with each individual's physical and social environment [40]. Not many aspects of human action can reflect its personality [41]. Whatever human beings have gained or will bring, including their general health status, is influenced by their personality and those with which they are interacting [10]. Personality types are a model, by which the real person can be evaluated. Each type has certain

reserves of attitudes and skills to overcome problems and environmental tasks [42]. The theoretical basis for the personality type D was the study of heart patients in Belgium, in which the role of personality traits was examined in the outcomes of heart disease [12].

Type D personality affects the biological causes (e.g. blood pressure, blood lipids, and tobacco use) of coronary heart disease [22, 23, 29]. In the present research, the mean scores of stress control and interpersonal relationships and support were 13.27 and 17.27, respectively, which gained lower scores compared with the mean scores of the other dimensions of health-promoting lifestyle. The type D personality is defined as the interaction of two fixed and general personality traits, consisting of negative emotions and social inhibition. Regarding the negative emotions, the individual tends to experience negative emotions in different times and situations, and regarding social inhibition, people tend to avoid negative emotions in social interactions. In this feature, individuals feel distraction, stress, and insecurity while interacting with others [12-14].

People with negative emotions and social inhibition often suffer from chronic stress, low social support, and a low level of well-being [11]. The results of this study can support the notion that personality is an important and significant component in explaining the lifestyle as an internal and interpersonal factor. Establishing social relationships can promote physical mobility, and this activity leads to physical and mental health [19]. According to the social-cognitive theory of Bandura, most of the information is obtained through mutual interaction with others [43]. Therefore, having social relationships provides a learning and modeling opportunity for other people's positive behaviors on issues such as stress management, proper nutrition, and quality. Moreover, having social relationships will lead to social support, spiritual growth, and self-actualization. Studies have shown that heart patients with social support are more likely to recover and have lower death rates [7].

Type D personality with social inhibition can interfere with interpersonal and social relationships, which is one of the essential components of lifestyle. In most of the mentioned studies, analytical-descriptive or interventional methods have been used; moreover, the effect of lifestyle in the development of cardiovascular diseases or the impact of education on lifestyle and achievement of therapeutic goals in cardiovascular patients were examined. However, the SEM has been used in this research, which investigated the effect of personality type D on the cardiac function that determines prognosis in

patients with myocardial infarction through the mediating role of lifestyle. Therefore, this study is different from other studies in terms of methodology.

The results of this research will be proposed to general health specialties, health psychologists, cardiologists, and intensive care unit nurses. Interventions can be considered for improving cardiac function and better prognosis in acute myocardial infarction by identifying factors that affect coronary heart disease and cardiac function. Lifestyle is regarded as the quantitative dimension of personality, which is an essential factor in the development of chronic diseases, including coronary heart disease. Therefore, the timely identification of coronary heart disease in patients with type D personality and psychological interventions can influence their lifestyle.

As a result, the clinicians can achieve therapeutic goals, including the proper cardiac function in patients with myocardial infarction. The research method can be mentioned as one of the limitations because of using self-report tools, which were sometimes lengthy and tedious and out of the patient's physical condition. Therefore, it is suggested to conduct the present study prospectively and after the recovery of the disease. According to the studies conducted in the field of positive psychology and health psychology, we recommend that the effects of other variables such as mindfulness, self-efficacy, optimism, and coping styles on the cardiac function of myocardial infarction patients should be investigated.

Ethical Considerations

Compliance with ethical guidelines

All the participants were given information about the goal of the study. They were aware that taking part in this study was voluntary and had the right to refuse participation or leave the study whenever they wish. The Ethical Code is IR.IAU.SARI.REC.1397.027.

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Authors' contributions

All authors contributed to preparing this article.

Conflict of interest

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