



# Does Type D Personality Inhibit Benefits of Cardiac Rehabilitation?

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## Abstract

**Introduction:** Cardiovascular diseases are major causes of mortality and morbidity in the world. D type personality is a poor prognostic factor in cardiovascular diseases. Cardiac rehabilitation is known to reduce mortality and morbidity in cardiovascular diseases. The present study aims to investigate whether type D personality inhibits the benefits of cardiac rehabilitation or not.

**Methods:** A single-center, retrospective cohort study was conducted with the evaluation of all CR participants at the University Hospital of Cardiovascular and Thoracic Surgery between 01.02.2017 and 01.02.2019. Study population was the patients who were 18 years and older and completed all 30 sessions of CR program and also completed both pre- and post-tests. Type D personality was assessed with DS14. Quality of life was assessed with SF 36. Functional capacity was assessed with a 6-minute walk test (6MWT). Submaximal cycle ergometer test was performed to evaluate maximum endurance watts. A special CR program was planned for each patient based on the cycle ergometer test peak workload. The primary endpoint was the observation of changes in the Beck Depression Scale, SF-36 scores and the secondary endpoint of the study was the observation of improvement in functional capacity and endurance according to patients' type D personality.

**Results:** 222 patients enrolled in this study. Among the patients, 37.4% of them were positive for D type personality. Functional capacity, endurance, quality of life, depression scores were all improved after cardiac rehabilitation ( $p < 0.01$ ). There was no statistically significant difference between D type positive and negative patient groups about the improvements of rehabilitation ( $p \geq 0.05$ ).

**Discussion and Conclusion:** D type personality is associated with inflammation and may increase mortality and morbidity in a cardiovascular disease. Cardiac rehabilitation may improve functional capacity, endurance, quality of life and depression scores independently from D Type personality.

**Keywords:** Cardiac rehabilitation; type D personality; quality of life.

Cardiovascular disease (CVD) is responsible for 17.7 million deaths in the world [1]. According to the European Society of Cardiology (ESC), total of 83.5 million people are living with CVD in Europe [2]. CVD has high mortality and morbidity [1, 2]. One of the most common comorbidi-

ties presented with CVD is depression [3]. Also depression is shown to increase mortality of the CVD [4]. Type D or Distressed personality means that a patient has high scores of negative affectivity (NA) and social inhibition (SI) in type D personality assessment [5]. Type D personality is associ-

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ated with inflammation and can predict mortality in CVD [6, 7]. Because Type D personality is linked to inflammation, ESC has included Type D personality as an independent risk factor of CVD [8]. Type D personality is also associated with low scores of health-related quality of life (HRQoL) in CVD populations [9].

Cardiac rehabilitation (CR) is a multi-component rehabilitation program for cardiac patients designed to decrease mortality and morbidity and also maximize secondary prevention from heart disease [10]. CR consists of internationally accepted core components which are nutritional counseling (NC), risk factor modification (RFM), psychosocial management (PM), patient education (PE) and exercise training (ET) [11]. A Cochrane review showed that CR reduces mortality and morbidity by 20% for CVD [12]. CR is also shown to decrease depression and increase HRQoL and functional capacity in CVD [13, 14].

Our study is focused on these benefits of CR on HRQoL, depression and functional capacity like most of the studies. The new highlight of this study to the literature is that these known benefits of CR are analysed for Type D personality positive and negative patients. The present study aims to investigate the potential effects of Type D personality on CR related improvement of HRQoL, depression and functional capacity of CVD patients.

## Materials and Methods

A single-center, retrospective cohort study was conducted with the evaluation of all CR participants at the University Hospital of Cardiovascular and Thoracic Surgery between 01.02.2017 and 01.02.2019. The study population was the patients who were 18 years and older and completed all 30 sessions of CR program and also completed both pre- and post-tests. Exclusion criteria were as follows: psychosis, cancer, untreated mental illness and systemic inflammatory disease. This study was approved by a local ethics committee and was performed in accordance with the Declaration of Helsinki. Informed consent was obtained from all the subjects. Patients' demographic data were collected. All patients were outpatient patients of the CR unit.

Type D personality was assessed with DS14 which was also validated for the Turkish population [5, 15]. DS14 is based on subjective assessment of individuals; 14 substance scale contains questions that measure negative affectivity (NA) and social inhibition (SI) [5]. Patients who have high scores from NA subscale are inclined to experience negative emotions (e.g. anxiety and irritability) about situations and the

environment they are surrounded. SI score high patients have a tendency to consciously inhibit self-expression during social activities. Reason for this social inhibition is thought to be fear of being rejected and disapproval of society. Subscales' points can be maximum 28 points, and cut-off point for subscales is 10. Patients with high scores ( $\geq 10$ ) from both subscales NA and SI are classified as Type D personality positive [5].

Depression was assessed with the Beck Depression Inventory which was also validated for the Turkish population [16, 17]. Beck Depression Inventory is used to assess patients' depression symptom severity. Beck Depression Inventory contains 21 items, and each item consist of four statements which points to different classes of symptom severity. Patients were asked to answer the questions according to past one week time. A total score was calculated, which shows bigger scores for more depressive symptoms [16].

Quality of life was assessed using SF 36, which is also validated for the Turkish population for various illnesses [18–20]. SF 36 can be summarized with two dimensions which are physical health and mental health of 36 items for measuring eight health concepts: physical functioning, role limitations due to physical health problems, pain, general health perception, vitality, social functioning, role limitations due to emotional problems and general mental health [18].

Functional capacity was assessed using a 6-minute walk test (6MWT). Patients were asked to walk back and forth as much as possible around cones in six minutes on a 30-foot path. They were allowed to slow down or stop if necessary. Talking to the patients while they take the 6MWT was prohibited. Submaximal cycle ergometer test was performed to evaluate endurance. During the test for every 2-minute, watt was increased by 25 watts and the Borg scale was asked to the patient. Assessing the situation of the patient for breath and muscle fatigue according to the patient, the Borg scale was asked during the test. Arterial blood pressure (ABP) was measured at the beginning of the test and every two minutes afterwards, and at the end of the test automatically by the computer system. Electrocardiogram, heart rate and saturation of oxygen were monitored continuously right before, during the test and recovery period. If any lightheadedness, angina, cyanosis, dyspnea, hypoxia, confusion, significant muscle pain (patient declares Borg Scale  $\geq 5$ ) occurred, ABP exceeded 180/100 or submaximal heart rate is reached according to Karvonen formula (for patients who does not use beta-blockers), the test was

ended and the maximum watt was calculated according to the time of the taken test.

A special CR program was planned for each patient based on the cycle ergometer test peak workload. Low-intensity interval training was prescribed for patients with low initial test performance. Exercise program for patients using beta-blockers was given independent of heart rate. All core components of CR were administered according to patients' specific needs. Each patient's CR program was evaluated after 10 sessions and was updated by the physiatrist according to Borg scales assessed by the rehabilitation nurse during the exercise sessions. Each exercise program started with a warm-up and ended with a recovery period, which is also monitored continuously for heart rate, oxygen saturation, ABP and electrocardiogram. All of the patients who attend CR program received NC from the dietician, PC from the psychologist, and patient education according to their special health conditions (e.g. diabetes) from CR nurse. Smokers were guided to the tobacco cessation outpatient clinic. In one week of completion of CR sessions, all the tests were repeated.

The primary endpoint was the observation of changes in Beck Depression Inventory, SF-36 scores and the secondary endpoint of this study was the observation of improvement in functional capacity and endurance according to patients' type D personality.

### Statistical Analysis

NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. Descriptive statistical methods (mean, standard deviation, median, frequency, percentage, minimum, maximum) were used when evaluating the study data. The Mann-Whitney U test was used in comparisons between two groups of quantitative variables that did not show Normal distribution. The T-test was used in the in-Group comparisons of quantitative variables with Normal distribution. Wilcoxon signed-ranks test was used for in-Group comparisons of quantitative variables that did not show Normal distribution. Statistical significance was considered  $p < 0.05$ .

### Results

This study was enrolled in a University Hospital of Cardiovascular and Thoracic Surgery between 01.02.2017 and 01.02.2019. There were a total of 222 patients enrolled in this study. 37.4% of the 222 patients had Type D personality other demographics and Type D personality charac-

**Table 1.** Demographics and type D personality characteristics of the patients

Age	
Min-Max (Median)	21-81 (57)
Mean±SD	56.44±10.31
Gender	
Female	120 (54.1)
Male	102 (45.9)
Diagnosis	
Hypertension	99 (44.8)
Heart failure	23 (10.4)
Coronary artery disease	89 (40.3)
Arrhythmia	10 (4.5)
DS 14	
Negative affectivity	
Min-Max (Median)	0-26 (11)
Mean±SD	11.09±6.87
Negative affectivity	
<10	98 (42.2)
≥10	134 (57.8)
Social inhibition	
Min-Max (Median)	1-23 (10)
Mean±SD	10.24±4.91
Social inhibition	
<10	112 (48.3)
≥10	120 (51.7)
Type D personality	
Type D (+)	83 (37.4)
Type D (-)	139 (62.6)

teristics of the patients are in Table 1. Patients lost weight after 30 sessions of CR. Before rehabilitation average body mass and body mass index of patients were  $80.99 \pm 13.63$  kg,  $29.80 \pm 4.92$  and after CR, it was  $79.79 \pm 13.31$  kg and  $29.35 \pm 4.60$  respectively ( $p \leq 0.01$ ). Functional capacity (6MWT) and endurance (Cycle Ergometer Test Maximum Watts) of the patients statistically significantly increased after CR sessions (Table 2). The decrease in the Beck Depression scores was statistically significant after CR (Table 3). Also, the quality of life measures was increased after CR for both physical health and mental health subscales of SF-36 (Table 3). These statistically significant benefits which are body mass, BMI, functional status, endurance, Beck Depression scores and HRQoL are investigated for Type D positive patients, and there was no statistically significant difference between the Type D positive and negative patients for these benefits (Table 4).

**Table 2.** Evaluation of weight, BMI, endurance and physical function before and after cardiac rehabilitation

	Before CR	After CR	Difference	Test value; p
Weight (kg)				
Min-Max (Median)	50-133 (78)	-1.21±3.34	t: -5.381	0.001
Mean±SD	79.79±13.31		<sup>a</sup> 0.001**	
BMI (kg/m <sup>2</sup> )				
Min-Max (Median)	18.4-43 (28.95)	-0.46±1.54	t: -4.407	0.001
Mean±SD	29.35±4.60		<sup>a</sup> 0.001**	
Cycle ergometer test max WATT				
Min-Max (Median)	25-150 (75)	15.41±19.37	Z: -9.361	0.001
Mean±SD	75.70±25.00		<sup>b</sup> 0.001**	
6MWT (meters)				
Min-Max (Median)	234-650 (387)	16.72±45.42	t: 5.486	0.001
Mean±SD	392.64±64.47		<sup>a</sup> 0.001**	

<sup>a</sup>Paired Samples Test; <sup>b</sup>Wilcoxon Signed Ranks Test; \*\*p<0.01.

**Table 3.** Evaluation of depression and SF-36 HRQoL subscales before and after cardiac rehabilitation

	Before CR	After CR	Difference	Test value; p
BECK depression				
Min-Max (Median)	0-38 (9)	0-37 (7)	-3.15±8.02	Z: -5.612
Mean±SD	11.20±7.93	8.05±6.25		<sup>b</sup> 0.001**
Physical health				
Min-Max (Median)	13-99.25 (63)	12.5-98 (73.88)	8.08±20.10	t: 5.986
Mean±SD	61.67±20.68	69.75±17.93		<sup>a</sup> 0.001**
Mental health				
Min-Max (Median)	15.5-95 (62.46)	25.25-99 (74.44)	9.27±19.68	t: 7.017
Mean±SD	60.88±19.34	70.15±17.29		<sup>a</sup> 0.001**

<sup>a</sup>Paired Samples Test; <sup>b</sup>Wilcoxon Signed Ranks Test; \*\*p<0.01.

## Discussion

Cardiovascular diseases are responsible for 17.7 million deaths in the world and much more people are living with CVD worldwide which end up CVD to be one of the most mortality and morbidity related diseases [1, 2]. Type D personality is associated with inflammation and poor prognosis in CVD, so it is accepted as a psychosocial risk factor for CVD [8]. Type D personality is found to be different percentages in different cardiac patient populations. To our knowledge, this is the first study from Turkey, which investigates Type D personality prevalence for cardiac rehabilitation patients and Type D personality of CR patients found to be 37.4% in this population. Cross-cultural analysis of Type D personality in 6222 patients worldwide with ischemic heart disease it is found to be between 19 and 44%, and they concluded this prevalence was lower in Northern (24%), and Western European and English-speaking (both 27%) countries as compared to Southern (37%) and Eastern (35%) European countries [21]. Our findings are concurrent

with the literature.

Well planned comprehensive CR is known to increase functional status, HRQoL and decrease mortality and depression scores in CVD [12–14]. In one study, Type D personality has been linked to poor HRQoL for patients who had CR for CVD before and after CR [22].

In our study, all patients HRQoL increased in both physical health and mental health subgroups after CR (p≤0.01). There was no difference in the increase in HRQoL in Type D patient group and non-Type D group (p≥0.05). Type D patients are more prone to heal with social interaction like group therapies, in our comprehensive CR program all exercise sessions are in groups and most of the patients come same day, same hour; thus, it can affect the increase in the HRQoL in our Type D study group.

In one study which focused on Type D personality positive coronary artery disease patients, they compared expended cardiac rehabilitation (increased physical training, stress management, stay at 'Patient Hotel' and cooking sessions)

**Table 4.** Evaluation of changes before and after rehabilitation according to the presence of type D personality

	Type D		Test value p
	Type D (+) (n=83)	Type D (-) (n=139)	
Weight (kg)			
Min-Max (Median)	-10-13 (-1)	-15-8 (0)	Z: -0.518
Mean±SD	-1.04±3.44	-1.31±3.29	<sup>c</sup> 0.605
BMI (kg/m <sup>2</sup> )			
Min-Maks (Median)	-8.1-4.4 (-0.4)	-4,9-6,8 (0)	Z: -0.682
Mean±SD	-0.53±1.69	-0.41±1.45	<sup>c</sup> 0.496
Cycle ergometer test max (WATT)			
Min-Maks (Median)	-25-75 (25)	-75-75 (25)	Z: -0,753
Mean±SD	17.07±17.88	14.42±20.19	<sup>c</sup> 0.451
6MWT (Meters)			
Min-Maks (Median)	-118-144 (16)	-86-159 (18)	Z: -0.812
Mean±SD	13.69±45.16	18.53±45.63	<sup>c</sup> 0.417
BECK depresyon			
Min-Maks (Median)	-33-17 (-2)	-23-20 (-2)	Z: -0.687
Mean±SD	-4.01±10.13	-2.64±6.43	<sup>c</sup> 0.492
Physical health			
Min-Maks (Median)	-44.5-52.25 (8.75)	-65-55.5 (5.75)	Z: -0.236
Mean±SD	7.68±21.19	8.31±19.5	<sup>c</sup> 0.813
Mental health			
Min-Maks (Median)	-55-64.5 (10.5)	-55.5-58.88 (7.66)	Z: -0.949
Mean±SD	10.72±20.54	8.4±19.18	<sup>c</sup> 0.343

<sup>c</sup>Mann Whitney U Test.

to routine CR and concluded that no significant changes were seen in depression in routine CR group in Type D patients [23]. Our study shows that a comprehensive CR program improves HRQoL, functional status, endurance, and decreases self-estimated Beck Depression scores no matter patients have Type D personality or not. Because the Type D personality is known to be responsible for poor clinical prognosis, impaired psychological and physical health and decreased HRQoL among cardiac patients, these achievements of comprehensive CR on Type D personality patients is really important. More studies can be carried out about this topic which is focused on change in mortality related inflammatory markers with CR on Type D personality positive CAD patients as Type D personality is known to be an inflammatory risk factor. A recent computer tomography study showed that Type D personality is associated with in-stent neoatherosclerosis in coronary patients with the percutaneous coronary intervention [24].

To sum up, our study shows that no matter patients have Type D personality or not, a comprehensive CR program can increase functional status, endurance, HRQoL outcomes and decrease Beck Depression Inventory scores of the CR patients.

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**Conflict of Interest:** None declared.

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