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Original Article

# Does fear of activity predict exercise capacity in patients with coronary artery disease in both sexes? A cross-sectional multicenter study

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*ABSTRACT*

**Objectives:** This study aimed to identify whether fear of activity predicts exercise capacity in patients with coronary artery disease (CAD) and whether there is a difference between sexes regarding this relationship.

**Patients and methods:** One hundred ninety-seven patients (145 males, 52 females; mean age: 56.3±10.8 years; range, 22 to 80 years) with a diagnosis of CAD or cardiac event in the previous one to 60 months were enrolled in this cross-sectional multicenter study between November 2015 and February 2017. Demographic and clinical features were recorded. Fear of activity was assessed by the fear of activity scale in patients with CAD (FactCAD). A 6-min walk test was used to assess exercise capacity.

**Results:** Female participants were older, less educated, and less employed (p=0.045, p=0.048, and p<0.001, respectively) than males. Prevalence of myocardial infarction was higher in males. Comorbidities were higher in females. Multiple linear regression predicted 6-min walk distance (6MWD) based on FactCAD, sex, and education level with an r-squared of 0.321 (p<0.001). Fear of activity had an effect on walking distance in males (each additional score of FactCAD predicts a decrease of 1.3 m in 6MWD), together with disease duration, presence of chronic pulmonary disease, and low back pain, whereas fear of activity was not a predicting factor on walking distance in females. Age, education, and presence of angina predicted 6MWD in females.

**Conclusion:** This study emphasizes that fear of activity is one of the predictors of 6MWD in males with CAD, and its assessment is recommended as a possible barrier to rehabilitation.

***Keywords:*** 6-min walk test, angina, coronary artery disease, exercise capacity, fear of activity, sex.

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Cardiac rehabilitation (CR) is a well-known management program for secondary prevention of heart diseases and reduces cardiovascular morbidity and mortality. Cardiac rehabilitation also enhances exercise capacity and quality of life, promotes healthy and active lifestyle, and reduces psychosocial stress and depressive symptoms in coronary artery disease (CAD).[1-3] Exercise training is the most important component of CR. The beneficial effects of exercise on cardiovascular disease are mediated by mechanisms such as reducing numerous risk factors, enhancing endothelial function, declining arterial inflammation and stiffness, improving diastolic function, remodeling of the left ventricle, and stabilization of electrical activity.[4-7]

Exercise capacity is a more powerful predictor of mortality than other established risk factors for cardiovascular disease.[8] Each 1-metabolic equivalent increase in exercise capacity is known to improve survival by 12%.[9] Regular training and physical activity increase exercise capacity; however, fear of activity might be an important barrier.

The prevalence of fear of activity in patients with CAD and heart failure was studied by several researchers with variable results.[10-12] Presence of cardiovascular disease is associated with higher levels of kinesiophobia.[13] It ranges from 70% in acute hospitalized CAD patients[10] to 20% in chronic patients in the community.[11] Muscle endurance, steps per day measured by a pedometer, and self-reported levels of physical activity were found to be lower in patients with a higher level of fear of activity.[11] However, exercise capacity was not objectively measured in these studies. Research investigating the effect of fear of activity on exercise capacity in patients with CAD is lacking. This study hypothesized that higher fear of activity predicts lower exercise capacity in CAD patients and aimed to identify whether fear of activity affects exercise capacity in CAD patients of either sex.

## PATIENTS AND METHODS

This cross-sectional multicenter study recruited patients from the outpatient clinics of 15 different physical medicine and rehabilitation departments from 10 different provinces in Türkiye between November 2015 and February 2017. The study population consisted of 197 CAD patients (145 males, 52 females; mean age: 56.3±10.8 years; range, 22 to 80 years). Inclusion criteria were *(i)* ≥18 years of age, *(ii)* diagnosis of CAD or cardiac event [myocardial infarction (MI), coronary artery bypass grafting (CABG), percutaneous coronary intervention (PCI)] in the previous one to 60 months, *(iii)* being medically stable, and *(iv)* having cognitive and physical ability to complete the required tests. Patients with a cardiac event in the last month, ongoing hospitalization, and musculoskeletal or neurologic issues that might prevent performing tests were excluded. The flowchart of the study participants is shown in Figure 1.

Demographic characteristics of participants, such as age, height, weight, and body mass index, and clinical variables, including smoking status, comorbidities, type and duration of the CAD, medications, presence of complications, and ejection fraction, were recorded.

The fear of activity scale in patients with CAD (FactCAD) was used to assess fear of activity and exercise. The FactCAD is a novel scale developed for patients with heart disease. It consists of 21 items, scored using a 5-point Likert scale. The final score of the questionnaire ranges between 0 and 84. High scores indicate higher levels of fear regarding activity or exercise.[14] The time to complete this self-administered scale is 4 to 7 min.

Functional capacity was assessed by a 6-min walk test in all participants according to the American Thoracic Society guidelines in a 30-m corridor.[15] The subjects were asked to walk as long a distance as they could within 6 min. The six minute walking distance (6MWD) was recorded in meters.

### Statistical analysis

Statistical analysis was performed using IBM SPSS version 20.0 software (IBM Corp., Armonk, NY, USA). The normality of data was assessed using the Shapiro-Wilk test. Continuous variables were presented as either mean and standard deviation or median and interquartile range. Categorical variables were presented as percentages. Student's t-test or the chi-square test was performed to compare the demographic, clinical, and exercise variables between males and females with CAD. Multiple linear regression analysis was performed to assess the factors predicting fear of activity score. Parameters that showed correlation coefficients ≥0.3 with FactCAD and variables that did not show correlation ≥0.70 with each other were put in the regression analysis. Statistical significance was accepted as $p<0.05$.

A pilot study was performed with 20 CAD patients to determine the sample size. It was found that the correlation coefficient between FactCAD

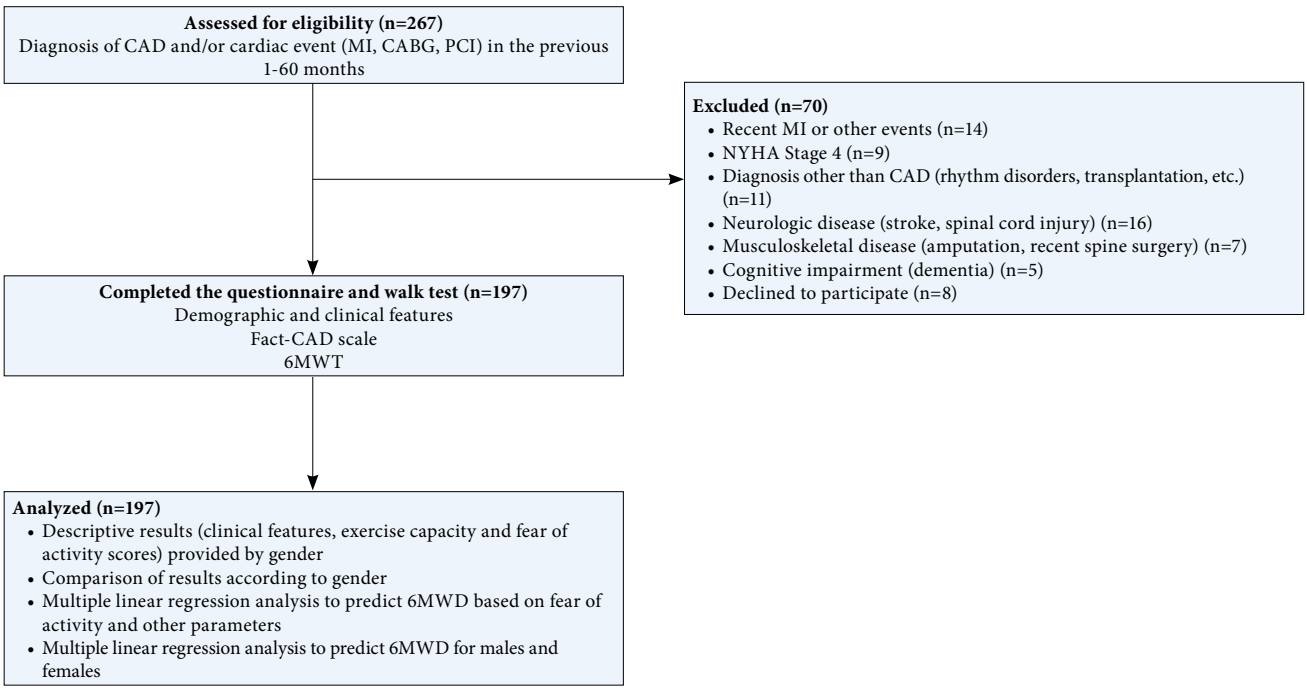


**Figure 1.** The schematic flow chart of the study.

CAD: Coronary artery disease; MI: Myocardial infarction; CABG: Coronary artery bypass grafting; PCI: Percutaneous coronary intervention; 6MWT: Six-minute walk test; 6MWD: Six minute walking distance; NYHA: New York Heart Association.

**TABLE 1**
Demographic variables of the participants

| | Males (n=145) | | | Females (n=52) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variables | n | % | Mean±SD | n | % | Mean±SD | Mean difference | 95% CI | *p* |
| Age (year) | | | 55.4±10.5 | | | 58.9±11.0 | 3.486 | 0.084-6.888 | **0.045** |
| Body mass index (kg/m$^2$) | | | 28.4±3.7 | | | 29.2±5.0 | 0.786 | −0.748-2.319 | 0.310 |
| Education | | | | | | | | 0.027-0.036 | **0.048** |
| ≤8 years | 79 | 55 | | 37 | 71 | | | | |
| >8 years | 66 | 45 | | 15 | 29 | | | | |
| Employment | | | | | | | | −0.305-0.000 | **<0.001** |
| Employed | 62 | 43 | | 5 | 10 | | | | |
| Not employed | 83 | 57 | | 47 | 90 | | | | |
| Perceived economical state | | | | | | | | 0.782-0.803 | 1.000 |
| Moderate to excellent | 135 | 93 | | 48 | 92 | | | | |
| Poor to very poor | 10 | 7 | | 4 | 8 | | | | |
| Marital status | | | | | | | | 0.014-0.021 | **0.015** |
| Married | 128 | 88 | | 38 | 73 | | | | |
| Not married | 17 | 12 | | 14 | 27 | | | | |
| Living with | | | | | | | | 0.420-0.446 | 0.549 |
| A family member | 135 | 93 | | 47 | 90 | | | | |
| Alone or else | 10 | 7 | | 5 | 10 | | | | |

SD: Standard deviation; CI: Confidence interval.

and 6MWD was −0.20. Based on this result, the sample size was calculated using MedCalc version 19.1 (MedCalc Software bv, Ostend, Belgium; https://www.medcalc.org; 2019), which concluded that at least 193 participants would be required, with a type 1 error of 0.05 and power of 0.80.

## RESULTS

Demographic and clinical characteristics of the study participants are demonstrated in Tables 1 and 2, respectively. Female participants were older, less educated, and less employed (p=0.045, p=0.048, and p<0.001, respectively), and the time since the first cardiac event was longer in females than males (p=0.025). Rate of complications after a cardiac event did not differ between males and females. The prevalence of CABG or PCI following an MI was higher in males, whereas the prevalence of CABG or PCI without an MI was higher in females. More females reported angina than males. Complications and medications were similar, except for greater use of angiotensin-converting enzyme inhibitors and nitrate in females. Coexisting diseases, such as hypertension, diabetes mellitus, low back pain, osteoarthritis, and psychiatric diseases, were higher in females. Prevalence of smoking was higher in males (Table 2).

FactCAD scores were higher in females (38.4±17.1) than in males and (33.1±15.2, p=0.022). Females had a shorter 6MWD than males (350.1±116.6 and 468.1±92.3, respectively; p<0.001).

Correlation analysis between 6MWD and several variables is demonstrated in Table 3. Correlation coefficients of 6MWD with FactCAD, age, education level, and duration of disease were significant in the study population (all p<0.001). By sex, it was found to

**TABLE 2**
Clinical features of the participants

| | Males (n=145) | | | Females (n=52) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Variables | n | % | Mean±SD | n | % | Mean±SD | Mean difference | 95% CI | *p* |
| Time since first CAD event (month) | | | 15.5±14.8 | | | 21.1±16.8 | 5.627 | 0.722-10.532 | **0.025** |
| Ejection fraction (%) | | | 54.7±10.1 | | | 56.5±7.1 | 1.502 | –2.220-5.224 | 0.426 |
| Type of CAD event | | | | | | | | 0.017-0.024 | **0.025** |
| CABG/PCI with MI | 84 | 58 | | 19 | 37 | | | | |
| CABG/PCI without MI | 37 | 26 | | 22 | 42 | | | | |
| CAD without MI/CABG/PCI | 24 | 16 | | 11 | 21 | | | | |
| Presence of angina | 39 | 27 | | 26 | 50 | | | 0.077-0.091 | **0.003** |
| Complications | | | | | | | | | |
| Atrial fibrillation | 7 | 5 | | 3 | 6 | | | 1.000-1.000 | 0.725 |
| Ventricular arrhythmia | 15 | 10 | | 4 | 8 | | | 0.429-0.455 | 0.785 |
| Arrest | 4 | 3 | | 1 | 2 | | | 0.671-0.694 | 1.000 |
| Mechanical ventilation | 1 | 1 | | 1 | 2 | | | 1.000-1.000 | 0.459 |
| Medications | | | | | | | | | |
| Beta blocker | 112 | 79 | | 37 | 71 | | | 0.017-0.024 | 0.257 |
| ACEI | 82 | 58 | | 40 | 77 | | | 0.243-0.266 | **0.018** |
| Antiarrhythmic | 6 | 4 | | 3 | 6 | | | 1.000-1.000 | 0.703 |
| Nitrates | 2 | 1 | | 5 | 10 | | | 0.025-0.034 | **0.016** |
| Diuretic | 52 | 37 | | 18 | 35 | | | 0.459-0.485 | 0.867 |
| Lipid lowering | 86 | 61 | | 28 | 54 | | | 0.060-0.073 | 0.415 |
| Aspirin | 96 | 68 | | 37 | 71 | | | 0.243-0.265 | 0.728 |
| Clopidogrel | 53 | 37 | | 18 | 35 | | | 0.229-0.251 | 0.867 |
| Coexisting diseases | | | | | | | | | |
| HT | 74 | 51 | | 37 | 71 | | | 0.049-0.061 | **0.014** |
| DM | 36 | 25 | | 30 | 58 | | | 0.001-0.003 | **<0.001** |
| HPL | 76 | 52 | | 35 | 67 | | | 0.195-0.216 | 0.074 |
| LBP | 37 | 26 | | 30 | 58 | | | 0.000-0.000 | **<0.001** |
| OA | 11 | 8 | | 25 | 48 | | | 0.000-0.000 | **<0.001** |
| COPD | 10 | 7 | | 1 | 2 | | | 0.166-0.185 | 0.294 |
| Psychiatric dis | 2 | 1 | | 6 | 12 | | | 0.001-0.003 | **0.005** |
| Smoking | 63 | 43 | | 9 | 17 | | | 0.053-0.066 | **<0.001** |

SD: Standard deviation; CI: Confidence interval; CAD: Coronary artery disease; CABG: Coronary artery bypass grafting; PCI: Percutaneous coronary intervention; MI: Myocardial infarction; ACEI: Angiotension converting enzyme inhibitor; HT: Hypertension; DM: Diabetes mellitus; HPL: Hyperlipidemia; LBP: Low back pain; OA: Osteoarthritis; COPD: Chronic obstructive pulmonary disease.

**TABLE 3**
Correlation coefficients of 6MWD with several variables

| | Fact-CAD | Age | Educational level | Duration of disease |
|---|---|---|---|---|
| All participants (n=197) | | | | |
| r | −0.349 | −0.284 | 0.368 | −0.297 |
| *p* | <0.001 | <0.001 | <0.001 | <0.001 |
| Females (n=52) | | | | |
| r | −0.247 | −0.405 | 0.549 | −0.064 |
| *p* | 0.091 | 0.004 | <0.001 | 0.665 |
| Males (n=145) | | | | |
| r | −0.324 | −0.115 | 0.149 | −0.317 |
| *p* | <0.001 | 0.197 | 0.094 | <0.001 |

6MWT: Six-minute walk test; CAD: Coronary artery disease.

**TABLE 4**
Regression equations predicting 6MWD for the whole study population, females and males

| | Regression equations | F | *p* | $R^2$ |
|---|---|---|---|---|
| All (n=197) | 277.3 + (99.0 × Sex) − (1.8 × Fact-CAD) + (38.2 × Education) | F(3,171)= 26947 | <0.001 | 0.321 |
| Females (n=52) | 380.7 − (1.3 × Age) − (44.6 × Angina) + (23.0 × Education) | F(3,44)= 11506 | <0.001 | 0.274 |
| Males (n=145) | 558.2 − (1.3 × Fact-CAD) − (1.7 × Dis duration) − (95.3 × COPD) − (49.0 × LBP) | F(4,122)= 7580 | <0.001 | 0.341 |

6MWT: Six-minute walk test; CAD: Coronary artery disease; COPD: Chronic obstructive pulmonary disease; LBP: Low back pain; Codes for gender; female=1, male=2, Codes for education level; illiterate=1, literate=2, primary school (5 years)=3, secondary school (8 years)=4, college (11 years)=5, university (15 years)=6, and master/doctorate (>15 years)=7; Codes for stable angina, COPD, LBP; absent=0, present=1; Disease duration; in months.

be significant in females according to age (r= −0.405, p=0.004) and education (r=0.549, p<0.001) and in males according to FactCAD (r= −0.324, p<0.001) and duration of disease (r= −0.317, p<0.001).

The results of a multiple linear regression calculated to predict 6MWD based on FactCAD, sex, education level, and other parameters are given in Table 4. Sex, FactCAD score, and education were found to predict 6MWD with an r-squared of 0.321 (p<0.001). Age, education, and the presence of angina were found to predict 6MWD with an r-squared of 0.274 (p<0.001) in females. The FactCAD score, disease duration, COPD, and low back pain were found to predict 6MWD with an r-squared of 0.341 (p<0.001) in males.

## DISCUSSION

This study demonstrated the disparities of fear of activity on functionality between sexes in patients with CAD. It was observed that fear of activity had an effect on walking distance in males, together with disease duration and presence of COPD and low back pain, whereas fear of activity was not a predicting factor on walking distance in females. Age, education, and presence of angina were found to predict 6MWD in females.

Exercise capacity is lower in patients with CAD compared to healthy subjects.[18] Physical activity and exercise training are important in the management of CAD. However, nearly half of the subjects reduce their physical activity following the diagnosis of CAD.[19-22] Following a cardiac event, decreased physical activity was not totally explained by cardiovascular symptoms.[19] Dysfunctional beliefs and attitudes about physical activity and exercise contribute to physical inactivity.[22-25]

Fear of activity, also termed as kinesiophobia, is a dysfunctional feeling and an important barrier to physical activity.[26] Fear of activity might affect self-efficacy immediately after a cardiac event. Self-efficacy was found to be an important variable related to changes in physical activity in the first six months after discharge.[27] It may interfere with returning to occupation, leisure time, and even household activities in CAD patients.[28] Tampa Scale for Kinesiophobia, developed to measure fear of

activity in chronic pain,[29] was adapted for CAD.[30] In this study, FactCAD, which was recently developed for patients with CAD and found to be valid and reliable for this study population, was used.[14] To our knowledge, this is the first study to evaluate the predictive effect of fear of activity for 6MWD in CAD.

Kinesiophobia can be found in subjects hospitalized for acute cardiovascular disease[31] and may decrease over time after an acute cardiac event.[32] However, in our study, duration of disease was found as a predictor of lower exercise capacity in males. This might be a result of a lifestyle change towards reduced physical activity following acute cardiovascular disease or a result of a disease progression. As our study population consisted of patients with stable CAD, we believe that the possibility of deterioration of cardiovascular functions, such as reduced ejection fraction, is not highly expected.

In males, each additional score of FactCAD corresponds to a higher level of fear and predicts a decrease of 1.3 m in 6MWD. Experiencing acute MI, a life-threatening event, might lead to fear of reinfarction and deterioration of health, particularly in the immediate period following the event,[33] and consequent fear avoidance behaviors. Higher rates of MI in males compared to females might also have played a role in the impact on fear of physical activity in our study.

Grande and Romppel[34] demonstrated the impact of gender roles and social living conditions on the recovery goals of patients after an acute MI. Female participants prioritized "performance of household duties," "independence in activities of daily living," and "emotional balance," whereas for male participants, "physical endurance" and "reducing strain at the workplace" were of higher importance. The authors recommend investigating recovery goals while planning individual intervention programs. In our study, males were younger and more employed compared to females. Returning to work after a cardiac event would require more physical labor and psychosocial stress, such as sustaining productivity and financial worries. We suppose that this could also explain the predictor role of activity fear on exercise capacity in males.

Bäck et al.[32] reported that females had higher levels of kinesiophobia, similar to our study. However, we believe that the only reason for higher levels of fear of activity in females cannot be attributed exclusively to cardiovascular disease since female participants were older and had a higher number of coexisting diseases compared to males in our study. Furthermore, fear of activity was not a predictor for exercise capacity in females, contrary to that of males, which was an interesting finding. Exercise capacity was associated with age, level of education, and presence of angina rather than fear of activity in the females of our study population. Additionally, multiple comorbidities may have affected exercise capacity in females to some degree, although not reaching statistical significance. Although females had higher levels of activity fear and lower exercise capacity compared to males, the correlation was not statistically meaningful. Lower level of awareness in females may be a reason. Health expectations might differ in females compared to males. Moore and Kramer[35] reported that females experience more pain and fatigue than males when exercising during a CR program, and their concerns may need to be addressed.

This study has some limitations. One of the limitations is the small number of female participants, which may have obscured the interpretations regarding fear of activity and exercise capacity. Second, information regarding the level of physical activity of patients was lacking. Objective measures, such as pedometers or an accelerometer, or subjective measures, such as the international physical activity questionnaire, would provide valuable data about the relationship between actual exercise capacity, activity in daily life, and patients' perception of exercise safety or fear.

In conclusion, fear of activity was shown to be one of the predictors of 6MWD in males with CAD but not in females. This finding helps to evaluate sex-specific differences and needs in assessing and improving exercise capacity in future studies. Fear of activity is recommended to be assessed as a possible barrier to rehabilitation in CAD.

**Ethics Committee Approval:** The study protocol was approved by the Gazi University Faculty of Medicine Ethics Committee (date: 27.11.2013, no: 25901600/7587). This study was registered in the ClinicalTrials.gov database (NCT number: NCT04335760). The study was conducted in accordance with the principles of the Declaration of Helsinki.

**Patient Consent for Publication:** A written informed consent was obtained from each patient.

**Data Sharing Statement:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

**Author Contributions:** Idea/concept, control/supervision: N.D.; Design: N.D., Ö.Ö.T., B.S.T.; Analysis and/or interpretation, literature review, writing the aticle:

N.D., Ö.Ö.T., T.A.; Data collection and/or processing, critical review, references: All authors.

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