

FACTORS ASSOCIATED WITH BARRIERS TO PHYSICAL ACTIVITY AMONG CARDIAC PATIENTS AT A TERTIARY CARE HOSPITAL, KARACHI, PAKISTAN: AN ANALYTICAL CROSS-SECTIONAL STUDY

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DOI: <https://doi.org/10.5281/zenodo.22659628>

Keywords

Physical activity, cardiac patients, prevalence, perceived facilitators, perceived barriers

Article History

Received: 01 June 2026

Accepted: 23 August 2026

Published: 08 September 2026

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Abstract

Background: Cardiac patients face numerous barriers that can restrict their ability to perform physical activity, making it of paramount importance to evaluate and address these barriers. However, no previous studies have been conducted in Pakistan regarding this phenomenon.

Purpose: This study aimed to determine the prevalence of physical inactivity, perceived barriers and facilitators to physical activity, and factors related to those barriers among cardiac patients at a tertiary care hospital in Karachi, Pakistan.

Methodology: An analytical cross-sectional quantitative study design was used on 344 cardiac patients from the Aga Khan University Hospital in Karachi, Pakistan. Data was collected by using the International Physical Activity Questionnaire (IPAQ), Exercise Benefits/Barriers Scale (EBBS), and the Barriers to Appropriate Physical Activity in Coronary Artery Disease (CAD) Patients (BAPAC) scale. Descriptive analysis was used to assess the prevalence of physical inactivity, perceived facilitators, and barriers to physical activity. Factors associated with barriers to physical activity were assessed by using the t-test for independent samples and one-way Analysis of Variance (ANOVA).

Results: The prevalence of physical inactivity among the cardiac patients was 46.2%. The overall mean facilitator score was 133.97 (SD $\pm$ 15.420). The overall mean barrier score by using EBBS was 57.62 (SD $\pm$ 8.720) and by using BAPAC was 41.53 (SD $\pm$ 6.528). There was a statistically significant association between prevalence rate, monthly income, educational status, previous episodes, and number of episodes of heart attack, substance abuse, and past medical history with the barriers to physical activity.

Conclusion: This study's findings shed light on the perceived barriers to physical activity among cardiac patients, emphasizing the need to assess physical activity levels and their barriers regularly. Implications should focus

on developing strategies that can maximize the patient's participation in physical activity and overcome those barriers to physical activity in cardiac patients.

Introduction

Cardiovascular disorders rank among the most common medical conditions throughout the world, including Pakistan. According to a study done in Bangladesh, 4.5% of the population aged 35 and older had at least one CVD (1). A study indicated the CVD burden in low- and middle-income countries as follows: Mexico (19.7%), Indonesia (8.8%), the Philippines (25.3%), Bangladesh (27.4%), China (6.6%), and India (15.4%) (2). A study on the incidence of cardiovascular disease in the native population of Punjab, Pakistan, investigated 5242 out of the 6351 healthy participants, and the rest of the samples, 17.5%, had cardiovascular disease (3). According to a study done in Lahore, Pakistan, 17% of people had ischemic heart disease (4).

Patients with cardiovascular diseases have increased mortality rates. As per the 2019 Global Burden of Disease study, age-standardized mortality was recorded at 357.88 per 100000 worldwide (239.85 per 100000), and the estimated age-standardized prevalence of CVD in Pakistan was 918.18 per 100000, 684.33 per 100000 globally (5). Memon Medical Institute Hospital in Pakistan has reported that in 2020, coronary heart disease killed 240,720 people in Pakistan, making up 16.49% of the total deaths. Pakistan has a death rate of 193.56 for every 100,000 individuals, ranking 30th globally (6). For those with coronary artery disease (CAD), maintaining a healthy lifestyle is crucial for minimizing mortality. This includes quitting smoking, exercising regularly, getting used to physical activity, eating a balanced diet, and taking prescribed medications (7).

Physical activity is significant for preventing and managing many noncommunicable diseases like CVD, diabetes, strokes, and other ailments. According to the World Health Organization, people with chronic illnesses, as well as those who are 18 to 64 years old, should perform 150-

300 minutes per week of moderate physical activity and 75-150 minutes per week of vigorous intensity physical exercise (8). Globally, it is anticipated that every 10% reduction in population-level physical inactivity will prevent 500,000 deaths yearly (9). The Canadian Physical Activity Guidelines recommend 150 minutes of moderate-to-intense physical exercise and two weekly activities that strengthen the bones and muscles can help to lower the risk of cardiovascular disease by 30%, osteoporosis by 25%, stroke by 25%, hypertension by 20%, diabetes by 20%, colon cancer by 20%, and breast cancer by 14%, along with reducing the risk of mortality from all causes by a minimum of 30% (10).

Regular physical activity has many health benefits; it lowers the likelihood of developing chronic illnesses, including cardiac diseases. It also reduces the mortality and morbidity rates of cardiovascular diseases. A study has shown that, as compared to established treatment procedures, physical exercise is more effective in treating disease and decreasing the mortality risk (11). Physical activity is one of the critical components of lifestyle modifications that may lower the risk of mortality from heart-related conditions. A critical intervention for preventing CVD involves maintaining a healthy lifestyle with regular physical activity (12). The American Heart Association reports that the highest quartile (more active behavior) of light to moderate to intense physical activity has been associated with a lower death risk from all causes than the lowest (least active behavior) (13). The research demonstrates that avoiding a sedentary lifestyle and exercising within one's tolerance level protects against cardiovascular disease in people of all ages (14). It has been reported that regular to moderate exercise is beneficial for both primary and secondary prevention of cardiovascular disease in both males and females (15).

Physical inactivity is among the significant risk factors that contribute to several chronic disorders, including cardiac disorders. Researchers estimate there will be 0.686 million deaths overall and 0.397 million cardiovascular deaths as a result of insufficient physical activity (16). Inadequate physical activity is responsible for up to 10% of the worldwide burden of disease caused by coronary artery disease (17). As per the study conducted in Indonesia, physical inactivity has been linked to an increased incidence of overweight, obesity, hypertension, diabetes, and the likelihood of developing cardiovascular diseases (18).

Physical activity is one modifiable factor that can reduce cardiovascular disease mortality and morbidity rates. Cardiac patients face many barriers and challenges that can restrict them from performing physical activity. In the Pakistani context, these challenges and barriers to physical activity have yet to be explored. It revealed that there is a need to conduct research in Pakistan. This study may identify factors that can lead to physical inactivity in cardiac patients in Pakistan. The results of this study enable nurses to identify these factors in their cardiac patients and address them on time, thereby providing care that facilitates patients' engagement in physical activity after discharge from the hospital and reduces the risk of mortality. Moreover, this study may prepare the nurses to arrange teaching sessions for their patients regarding lifestyle modifications, especially the advantages or significance of physical activity, and cardiac rehabilitation after having cardiac events, so that patients can be motivated. Finally, this study may provide opportunities for further studies that can identify interventions to overcome the barriers to physical activity in cardiac patients and identify strategies for self-care management. Therefore, the purpose of the current study was to determine the prevalence of physical inactivity, assess the perceived barriers and facilitators to physical activity, and examine the factors associated with barriers to physical activity among cardiac

patients in one of the tertiary care hospitals in Karachi, Pakistan.

Objectives of the Study

1. To determine the prevalence of physical inactivity among cardiac patients attending a tertiary care hospital in Karachi, Pakistan.
2. To assess and analyze the perceived barriers hindering physical activity and the perceived facilitators among cardiac patients at a tertiary care hospital in Karachi, Pakistan.
3. To investigate the factors associated with barriers to physical activity in cardiac patients at a tertiary care hospital in Karachi, Pakistan.

Methodology

Study Design and Setting

The quantitative analytical cross-sectional study design was conducted at the inpatient and outpatient cardiac units of the Aga Khan University Hospital in Karachi, Pakistan.

Study Population

The targeted study's population was cardiac patients who were admitted to the cardiac inpatient units and visited the cardiac outpatient unit at the Aga Khan University Hospital in Karachi, Pakistan. The inclusion criteria were cardiac patients aged 30 years and above, the ability to understand and communicate in English or Urdu, cardiac patients with no serious or life-threatening conditions, cardiac patients with no communicable diseases as co-morbidities, and cardiac patients who were able to give their consent for the study. The exclusion criteria were patients with unclear diagnosis and cardiac patients with psychological disorders or cognitive impairments (hearing problems) as a co-morbidity.

Sampling Strategy and Sample Size

A non-probability purposive sampling technique was used to recruit samples. OpenEpi software was used to calculate the sample size. From the previous study, the prevalence of physical inactivity was taken to be 33.7% and with 5% absolute precision and a 95% confidence level,

the sample size was 344 cardiac patients to assess the prevalence of physical inactivity. Sample size was also calculated for the factors associated with barriers to physical activity in cardiac patients by using Open Epi software which turned out to be 296 cardiac patients, but as it is less than for the first objective of the prevalence of physical inactivity, a sample size of 344 was selected as a final sample size.

Recruitment of Samples

The samples were recruited from the cardiac outpatient and inpatient departments at the Aga Khan University Hospital in Karachi, Pakistan, based on the study's objectives, and those who met the inclusion criteria. Data were collected from the patients admitted to three different primary in-patient cardiac units, which include the Coronary Care Unit (CCU), the Cardiothoracic and Cardiac Medicine ward, and the step-down unit, the new private wing, as well as the outpatient cardiac units, where cardiac patients come to the cardiac clinics for their initial and follow-up visits. The capacity of the CCU was 16 beds. The average number of cardiac patients admitted in the ward is 10-20 patients per month, and in the new private wing, it is 5-10 patients per month. The average influx of cardiac patients visiting the cardiac outpatient clinics is 100-120 patients per month, as per the medical record and the unit receptionist.

The unit receptionist was contacted to get the lists of cardiac patients who had appointments with the doctors in an outpatient clinic, and also to get their medical record numbers and demographic details of those who are admitted to inpatient cardiac units. After reading their medical records and excluding the 10% of the attrition rate, a sample size of 418 was recruited according to the study's purpose. Of these, 344 participants were eligible for this study as per the inclusion criteria, so data were collected from the 344 participants for the final analysis.

Dependent Variable

Barriers to physical activity are the dependent variable in this study.

Operational Definition of Barriers to Physical Activity

BAPAC (Barriers to Appropriate Physical Activity in coronary artery disease patients) and EBBS (Exercise Benefits/Barriers Scale) questionnaires were used to assess or investigate the perceived barriers to physical activity.

Independent Variables

Personal factors, which include social factors, psychological factors, demographic details, clinical characteristics, and patient factors (knowledge and belief) are all independent variables in this study.

Operational Definition of Personal Factors

Face-to-face interviews were used to gather demographic information using a questionnaire to assess the personal factors that can hinder physical activity. BAPAC (Barriers to Appropriate Physical Activity in coronary artery disease patients) and EBBS (Exercise Benefits/Barriers Scale) questionnaires were used to assess or investigate the perceived barriers, perceived facilitators, and the factors associated with those barriers to physical activity. By determining the perceived barriers and facilitators through these questionnaires, personal factors of cardiac patients can be determined that can discourage or encourage cardiac patients to perform physical activity.

Operational Definition of Physical Activity and Its Prevalence

A physical activity questionnaire that evaluates the two categories of physical activity intensity was used to measure physical activity levels. A mild increase in breathing or heart rate that lasts for ten minutes or longer is considered to be a moderately intense activity (for example, brisk walking). Vigorous intensive activity is defined as an uninterrupted, significant rise in heart rate or respiration that lasts for ten minutes or longer (e.g., jogging). The metabolic equivalent (MET) values for each domain were multiplied by the time factors to determine the energy expenditure for each. The MET value for moderately intense

activities is 4. The MET value for vigorous, intensive physical activity is 8 (19). The International Physical Activity Questionnaire (IPAQ) was used to assess the prevalence of physical inactivity in cardiac patients. By determining the prevalence of physical inactivity, it can also be determined that if cardiac patients perform physical activity, then what type of physical activity they perform i.e., vigorous, moderate, or walking, and how frequently they perform physical activity. After determining it, the average of all types of activities can be calculated for the individual participants, and according to the average, participants can be categorized as physically active or physically inactive categories. Shiferaw et al. categorized participants as "physically inactive" if their weekly total physical activity was less than 600 MET minutes (20).

Data Collection Procedure and Instruments

The data were collected following approval from the Aga Khan University Hospital's Ethical Review Committee (ERC) and permission from the Chief Medical Officer (CMO). The nurse manager and head nurse were also informed when initiating the data collection. Before data collection, written consent was taken from each patient, and the components of the informed consent were briefly explained to them. This document was in English and Urdu, depending on the patient's level of understanding. The data were collected through hard-copy questionnaires distributed to participants. It was in both English and the Urdu language. It took 8-10 minutes to complete the questionnaire. The data collection was executed within 4 months period, i.e., from June 2024 to September 2024, after receiving ethical approval from the ERC.

Data were collected from the participants with the help of questionnaires developed from the previous researches. The researcher combined all three questionnaires and the demographic details in one document, separating them by sections to make it easier for the participants to complete the questionnaires. Formal permission from the respective authors was obtained through an email

for utilizing these questionnaires, and the permission was granted by the authors.

Demographic Details

Section A comprised demographic details of the samples, including 10 questions, i.e., age, gender, co-morbidity, family history of cardiac disease, any other illnesses or past medical history, etc. Data was collected through structured face-to-face interviews and the patient's medical record files through the questionnaire. The researcher prepared the questionnaire of the demographic details based on the previous researches.

International Physical Activity Questionnaire (IPAQ)

The prevalence of physical inactivity was assessed by modifying a questionnaire, the "International Physical Activity Questionnaire (IPAQ)." This instrument records responses to questions regarding walking and moderate-intensity activities totalling at least 600 METs-minutes per week, or 30 minutes of moderate-intensity exercise performed five days a week (150 min each week). For determining the physical activity, the IPAQ is a valid and reliable instrument, that is, Interrater Reliability (kappa) was 0.67–0.73, and Spearman Correlation Coefficient (Spearman's rho) was 0.67–0.81 (21).

Exercise Benefits/Barriers Scale

An EBBS (Exercise Benefits/Barriers Scale) was used to identify barriers to physical activity, explore facilitators that might encourage increased activity, and assess the perceived barriers and facilitators to physical activity in cardiac patients or the factors associated with these barriers. This tool was developed by Nola J. Pender in 1987. This scale is composed of a 43-point scale, out of which the benefits scale consists of 29 items, whereas the barriers scale consists of 14 items. This scale is made up of a four-point Likert scale that we modified to a five-point Likert scale: five for strongly agree and one for strongly disagree. Barriers were scored reversely (22). The Cronbach's alpha coefficient values, which indicate internal consistency, were

0.86 for barriers, 0.95 for benefits, and 0.95 for EBBS overall. The values of the test-retest reliability or correlation coefficients were 0.77 for barriers, 0.89 for benefits, and 0.89 for the total instrument (23).

Barriers to appropriate physical activity in coronary artery disease patients (BAPAC)

A BAPAC (Barriers to appropriate physical activity in coronary artery disease patients) tool was used in this study to assess barriers to physical activity in cardiac patients. This tool was obtained from the study conducted at the cardiology department of the Dijon Cardiac Rehabilitation Unit and the Heart and Health Club in 2017 (24). The researchers assessed the instrument's validity and reliability. A tool's internal consistency was determined by the Cronbach alpha coefficient, which was 0.815. The researchers also confirmed the tool's face and content validity. Test re-test reliability was checked which was reached with the intra-class correlation coefficient of 0.95. Since the tool required only two minutes and 45 seconds to complete, feasibility was also confirmed, which was good (24). This tool is made up of a five-point Likert scale: five for totally disagree and one for totally agree.

Content Validity Index

The Content Validity Index (CVI) was calculated for the IPAQ, BAPAC, and EBBS questionnaires. The field experts score each item using a four-point Likert scale: Four indicates highly relevant and highly clear, and one indicates not relevant and not clear. In the Pakistani context, the calculated CVI of the IPAQ questionnaire was 0.91 for both relevance and clearance. The calculated CVI of the EBBS tool was 0.87 for both relevance and clearance. The calculated CVI of the BAPAC tool was 0.93 for relevance and 0.92 for clearance.

Pilot Testing

The final questionnaires were pilot-tested on about 10% of the final sample size at the Aga Khan University Hospital in Karachi, Pakistan, to

ensure face validity and the participants' understanding of the questionnaire.

Cronbach's alpha

To ensure the instruments are reliable, their internal validity can be measured by calculating Cronbach's alpha. In the Pakistani context, the calculated Cronbach's alpha of the IPAQ questionnaire, EBBS tool, and BAPAC tool was 0.870.

Data Analysis

The IBM Statistical Package of Social Sciences (SPSS) version 26 was used to analyze the data. All of the samples' clinical characteristics and socio-demographic data were analyzed using descriptive analysis. Frequencies and percentages were calculated for all the categorical variables, that is, demographic characteristics, and to assess the prevalence of physical inactivity. For all the Likert scale-type tools, including the EBBS and the BAPAC tools, the mean and standard deviations were calculated to assess the average perceived facilitators and barrier scores. Depending on the independent variables, inferential analysis, such as One-way ANOVA to compare means across multiple groups, and t-test for two independent samples to compare means between two groups, were carried out to determine the association between independent variables (demographic and clinical characteristics and the prevalence rate of physical inactivity) and the dependent variable (barriers to physical activity).

Results

Socio-Demographic and Clinical Characteristics of the Study Participants

A total of 344 participants were included in the analysis of the study. Out of those, more than half of the patients, 70.9% (n = 244), were male. The age group of 61-70 years comprised 30.5% (n=105) patients, representing the highest number of participants as compared to the other age categories. Furthermore, the educational background of the study participants revealed that most of the patients, 39.5% (n=136), had

completed their graduation. With regard to the occupation of the study participants, 33.4% (n=115) were employed. About socioeconomic status, 50.3% (n=173) were earning more than 50,000 rupees. Regarding smoking status, 80.8% (n=278) were non-smokers. The use of substances, such as pan, gutka, naswar, or betel nuts, was reported by 8.7% (n=30) of the patients. However, 86.0% (n=296) did not use any type of substance abuse. Regarding smoking frequency, 3.2% (n=11) used more than 1 pack of cigarettes per day. (Table 1)

Regarding the clinical characteristics of patients, 28.8% (n=99) had all three underlying hypertension, diabetes, and dyslipidemia. Concerning other co-morbidities, the most common cardiac-related co-morbidities were ischemic heart disease 66.6% (n=229), while most of the non-cardiac related co-morbidities were chronic kidney disease 6.4% (n=22), asthma 3.8% (n=13), etc. In addition to that, more than half of the patients, 79.1% (n=272), did not report any non-cardiac related co-morbidities. The majority of the patients, 67.7% (n=233), had previous episodes of heart attack, out of which 57.3% (n=197) patients had one episode and 9.0% (n=31) had two episodes. However, 32.3% (n=111) had no previous episodes of heart attack. Regarding family history, more than half of the samples, 55.5% (n=191), had positive family history. The majority of the patients, 90.4% (n=311), reported past medical and surgical

history. Among cardiac-related past medical and surgical history, 32.0% (n=110) of the patients underwent both angiography and PCI, and 15.7% (n=54) underwent both angiography and CABG surgery. However, 15.4% (n=53) did not report cardiac-related past medical and surgical history. Regarding non-cardiac-related past medical and surgical history, 3.2% (n=11) reported stroke, 3.8% (n=13) reported renal stones, and 3.8% (n=13) reported hernia. However, more than half of the patients, 63.4% (n=218), did not report non-cardiac-related past medical and surgical history. (Table 1)

Prevalence of Physical Inactivity

According to the International Physical Activity Questionnaire (IPAQ), 46.2% (n=159) of the participants were classified as physically inactive. Participants were classified as physically inactive based on IPAQ criteria if they did not adhere to the physical activity guidelines of either 20 minutes of vigorous-intensity activity on three days per week (totaling 60 minutes per week), 30 minutes of moderate-intensity activity on five days per week (totaling 150 minutes per week), or a combination of walking, moderate-intensity, or vigorous-intensity activities that accumulated at least 600 METs-minutes per week. The mean total physical activity levels of cardiac patients were 404.92 (SD $\pm$ 589.123) METs-minutes per week. (Table 2)

Table 1: Socio-Demographic and Clinical Characteristics of Patients

Variables	n (%)	Variables	n (%)
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Gender		Monthly Income	
Male	244 (70.9%)	Less than 30,000	4 (1.2%)
Female	100 (29.1%)	30,000-40,000	22 (6.4%)
Age Category (in Years)		40,000-50,000	145 (42.2%)
30-40 years	16 (4.7%)	More than 50,000	173 (50.3%)
41-50 years	53 (15.4%)	Smoking Status	
51-60 years	99 (28.8%)	Smokers	28 (8.1%)
61-70 years	105 (30.5%)	Ex-Smokers	38 (11.0%)
71 years and above	71 (20.6%)	Non-Smokers	278 (80.8%)
Educational Status		Frequency of Smoking	
Un-educated		1-2 cigarettes per day	5 (1.5%)
Below Matric	27 (7.8%)	2-4 cigarettes per day	8 (2.3%)
Matric	29 (8.4%)	more than 4 cigarettes per day	4 (1.2%)
Intermediate	88 (25.6%)	more than 1 pack per day	11 (3.2%)
Graduation	37 (10.8%)		30 (8.7%)
Master's and above	136 (39.5%)	Substance Abuse	
Occupation		Pan, gutka, naswar, or betel	1 (0.3%)
Business	27 (7.8 %)66 (19.2%)	Alcohol	17 (4.9%)
Employed	115 (33.4%)	Quit Substance Abuse	296 (86.0%)
Un-Employed	5 (1.5%)	No Substance Abuse	
Retired	71 (20.6%)	Other non-cardiac related co-morbidities	
Housewife	85 (24.7%)	Chronic kidney disease	22 (6.4%)
Left Job due to cardiac disease	2 (0.6%)	Asthma	13 (3.8%)
Co-Morbidities		COPD	5 (1.5%)
Hypertension	40 (11.6%)	Hypothyroidism	4 (1.2%)
Hypertension	16 (4.7%)	Benign prostate hypertrophy	8 (2.3%)
Diabetes	12 (3.5%)	Others	9 (2.6%)
Dyslipidemia	56 (16.3%)	More than one non-cardiac-related co-morbidity	11 (3.2%)
Hypertension and Diabetes	89 (25.9%)	No non-cardiac related co-morbidities	272 (79.1%)
HTN and Dyslipidemia	20 (5.8%)	Previous episodes of heart attack	
Diabetes and Dyslipidemia	99 (28.8%)	Yes	233 (67.7%)
HTN, DM, and Dyslipidemia	12 (3.5%)	No	111 (32.3%)
No co-morbidities		Number of episodes	
Other cardiac-related co-morbidities		One time	197 (57.3%)
Ischemic heart disease	229 (66.6%)	Two times	31 (9.0%)
Valvular heart disease	13 (3.8%)	Three times	3 (0.9%)
Angina	29 (8.4%)	More than three times	2 (0.6%)
Arrhythmias	5 (1.5%)	Past Medical History	
Coronary artery disease	6 (1.7%)	Yes	311 (90.4%)
Others	5 (1.5%)	No	33 (9.6%)
More than one cardiac-related co-morbidity	30 (8.7%)	Non-cardiac-related past medical history	
No cardiac-related co-morbidities	27 (7.8%)	Stroke	11 (3.2%)
Cardiac-related past medical history		Cholecystectomy	6 (1.7%)
Angiography		Appendectomy	5 (1.5%)
Valve replacement surgery	20 (5.8%)		
Angina	6 (1.7%)		
Angiography and PCI	10 (2.9%)		
Angina, Angiography, and CABG	110 (32.0%)		

Angiography and CABG	18 (5.2%)	Hernia	13 (3.8%)
Angiography, PCI, and CABG	54 (15.7%)	Total knee replacement	5 (1.5%)
Angina and Angiography	9 (2.6%)	Fracture	8 (2.3%)
Angina, Angiography, and PCI	8 (2.3%)	Renal stones	13 (3.8%)
Others	17 (4.9%)	Prostate surgery	4 (1.2%)
No cardiac-related past medical history	39 (11.3%)	Cataract	4 (1.2%)
Family History	53 (15.4%)	Hysterectomy	7 (2.0%)
Yes		Others	50 (14.5%)
No	191 (55.5%)	No non-cardiac-related past medical history	218 (63.4%)
	153 (44.5%)		

Table 2: Prevalence of Physical Inactivity

Variables	Frequency (n)	Percentage (%)
Prevalence Rate		
Physically inactive	159	46.2%
Physically active	185	53.8%
Total	332	100%

Perceived Facilitators to Physical Activity

According to the Exercise Benefits / Barriers Scale (EBBS), most of the facilitators or benefits perceived by cardiac patients were exercising increased level of physical fitness 4.83 (SD $\pm$ 0.595), exercise improves flexibility 4.81 (SD $\pm$ 0.630), improved feelings of well-being from exercise 4.79 (SD $\pm$ 0.686), disposition is improved with exercise 4.78 (SD $\pm$ 0.640), exercising makes them feel relaxed 4.78 (SD $\pm$ 0.744), exercising improves the functioning of

cardiovascular system 4.77 (SD $\pm$ 0.697), exercising increases mental alertness 4.78 (SD $\pm$ 0.649), exercise improves the body looks 4.77 (SD $\pm$ 0.726), exercise improves mental health 4.75 (SD $\pm$ 0.787), exercising will keep from having high blood pressure 4.76 (SD $\pm$ 0.683), and exercise increases stamina 4.77 (SD $\pm$ 0.718). The total facilitator's score as per the EBBS tool was 145. The average perceived facilitator's score was 133.97 (SD $\pm$ 15.420). (Table 3)

Table 3: Facilitators or Benefits of Physical Activity as perceived by cardiac patients

Variables	Mean	Standard Deviation (SD)
Perceived Facilitators		
I enjoy exercise.	4.61	1.021
Exercise decreases feelings of stress and tension for me.	4.73	0.774
Exercise improves my mental health.	4.75	0.787
I will prevent heart attacks by exercising.	4.66	0.882

Exercise increases my muscle strength.	4.71	0.828
Exercise gives me a sense of personal accomplishment.	4.64	0.938
Exercising makes me feel relaxed.	4.78	0.744
Exercising lets me have contact with friends and persons I enjoy.	4.24	1.432
Exercising will keep me from having high blood pressure.	4.76	0.683
Exercising increases my level of physical fitness.		
My muscle tone is improved with exercise.	4.83	0.595
Exercising improves functioning of my cardiovascular system.	4.00	1.611
	4.77	0.697
I have improved feelings of well being from exercise.		
Exercise increases my stamina.	4.79	0.686
Exercise improves my flexibility.	4.77	0.718
My disposition is improved with exercise.	4.81	0.630
Exercising helps me sleep better at night.	4.78	0.640
I will live longer if I exercise.	4.74	0.814
Exercise helps me decrease fatigue.	3.69	1.612
Exercising is a good way for me to meet new people.	4.55	1.043
My physical endurance is improved by exercising.	4.69	0.893
Exercising improves my self-concept.	4.74	0.703
Exercising increases my mental alertness.	4.74	0.692
Exercise allows me to carry out normal activities without becoming tired.	4.78	0.649
	4.64	0.828
Exercise improves the quality of my work.		
Exercise is good entertainment for me.	4.71	0.754
Exercising increases my acceptance by others.	4.09	1.411
Exercise improves overall body functioning for me.	4.46	1.087
Exercise improves the way my body looks.	4.73	0.762
Total Facilitators/Benefits Score	4.77	0.726
	133.97	15.420

Perceived Barriers to Physical Activity

Perceived barriers to physical activity were assessed using two tools, that is, the Exercise Benefits/Barriers Scale (EBBS) and Barriers to Appropriate Physical Activity in CAD Patients (BAPAC). According to the EBBS, the scoring of barrier items was reverse-scored. The lower the scores and means on the barriers scale, the greater the perception of barriers to physical activity and vice versa. Most of the barriers perceived by cardiac patients as per the EBBS tool included that exercise takes too much time from my family responsibilities 2.53 (SD $\pm$ 1.862), exercise tires me 2.88 (SD $\pm$ 1.909), exercise facilities do not have convenient schedules for them 2.96 (SD $\pm$ 1.918), exercise is

hard work for them 4.01 (SD $\pm$ 1.605), exercising takes too much time 4.07 (SD $\pm$ 1.526), and places for exercise are too far away 4.24 (SD $\pm$ 1.487). The total barriers score as per the EBBS tool was 70. The average perceived barriers score in the EBBS tool was 57.62 (SD $\pm$ 8.720).

According to the BAPAC scale, the lower the scores and means on the BAPAC scale, the greater the perception of barriers to physical activity and vice versa. Most of the barriers perceived by cardiac patients as per the BAPAC scale were fatigue 1.63 (SD $\pm$ 1.345), breathlessness during exercise 2.23 (SD $\pm$ 1.737), and weather conditions 2.43 (SD $\pm$ 1.827). The total barriers score was 55 as per the BAPAC

scale. The average perceived barriers score on the BAPAC scale was 41.53 (SD $\pm$ 6.528). (Table 4)

Table 4: Barriers to Physical Activity as perceived by cardiac patients

Variables	Mean	Standard Deviation (SD)
Perceived Barriers		
EBBS Tool		
Exercising takes too much of my time.	4.07	1.526
Exercise tires me.	2.88	1.909
Places for me to exercise are too far away.	4.24	1.487
I am too embarrassed to exercise.	4.92	0.442
It costs too much to exercise.	4.82	0.706
Exercise facilities do not have convenient schedules for me.	2.96	1.918
I am fatigued by exercise.	4.45	1.213
My spouse (or significant other) does not encourage exercising.	4.46	1.259
Exercise takes too much time from family relationships.	4.42	1.286
I think people in exercise clothes look funny.	4.85	0.659
My family members do not encourage me to exercise.	4.59	1.098
Exercise takes too much time from my family responsibilities.	2.53	1.862
Exercise is hard work for me.	4.01	1.605
There are too few places for me to exercise.	4.45	1.284
Total Barriers Score	57.62	8.720
BAPAC Scale		
Fatigue	1.63	1.345
Fear of getting injured	4.70	0.987
Fear of a heart attack	4.76	0.860
Poor physical condition	3.98	1.646
Overall state of health	3.25	1.888
Weather conditions	2.43	1.827
Being alone/or without help in case of a problem during exercise.	4.80	0.771
Breathlessness during exercise	2.23	1.737
Lack of motivation	4.55	1.154
Fear of a cardiovascular problem other than heart attack	4.79	0.846
Your heart disease itself, a medical contraindication, or a side effect of the treatments.	4.41	1.335
Total Barriers Score	41.53	6.528

Association of Barriers to Physical Activity with the Prevalence Rate, Socio-demographic and Clinical Characteristics

The association of socio-demographic and clinical characteristics (independent variables) with the barriers to physical activity (dependent variable) was evaluated by using a t-test for two independent samples for the grouped variables

with the outcome (continuous) variables, that is, total barrier score, and one-way ANOVA for the categorical variables having more than two categories. A p-value of less than 0.05 was considered significant for the analysis. Both the EBBS tool and the BAPAC scale were used to assess the total barrier scores. The EBBS tool

comprised 14 barrier items, and the BAPAC scale comprised 11 barrier items.

Inferential Analysis for the EBBS (Barrier items) Tool

While assessing an association between the prevalence rate and barriers score, there is a high statistical significance between the prevalence rate and barriers' score ($t = -4.933$, $p = <0.001$). Regarding socio-demographic characteristics, results show higher statistical significance in the patient's monthly income ($F = 11.897$, $p = <0.001$) and the patient's educational status ($F = 10.237$, $p = <0.001$) with the barriers score. There was also a statistical significance in the patient's substance abuse ($F = 3.334$, $p = 0.02$) with the barrier score. However, there was no statistical difference ($p = >0.05$) in the patient's gender ($p = 0.83$), age category ($p = 0.42$), occupation ($p = 0.57$), smoking status ($p = 0.28$), and the frequency of smoking status ($p = 0.61$) regarding the barrier score.

The clinical characteristics of cardiac patients, such as previous episodes of heart attack ($t = 2.384$, $p = 0.02$) and the number of episodes of heart attack ($F = 2.756$, $p = 0.03$) were significantly associated ($p = <0.05$) with the barriers score. However, co-morbidities ($p = 0.43$), family history ($p = 0.13$), and past medical

history ($p = 0.08$) were not significantly associated with the barriers score. (Table 5)

Inferential Analysis for the BAPAC Scale

To evaluate the association between the prevalence rate and the barriers score, the results show a significant association between the prevalence rate and the barriers score ($t = -2.549$, $p = 0.01$). While assessing an association between the socio-demographic characteristics and the barriers score, a statistical significance ($p = <0.05$) was found in the patient's monthly income ($F = 3.056$, $p = 0.03$), and a high statistical significance was found in the patient's educational status ($F = 9.912$, $p = <0.001$). However, there was no statistical difference in the patient's gender ($p = 0.09$), age ($p = 0.29$), occupation ($p = 0.13$), smoking status ($p = 0.75$), substance abuse ($p = 0.24$), and the frequency of smoking status ($p = 0.65$) with the barriers score.

Regarding the clinical characteristics, there is a significant association between the patient's past medical history and the barriers score ($t = 2.010$, $p = 0.045$). However, there was no significant association found between the co-morbidities ($p = 0.25$), previous episodes of heart attack ($p = 0.54$), number of episodes of heart attack ($p = 0.19$), family history ($p = 0.97$), and the barriers score. (Table 5)

Table 5: Association between the Prevalence rate, Socio-demographic, and Clinical Characteristics with the Barriers Score

Tools	EBBS Tool			BAPAC Scale		
Independent Variables	Mean $\pm$ SD	Statistics	P-Values	Mean $\pm$ SD	Statistics	P-Values
Prevalence Rate		$t = -4.933$	$<0.001^{**}$		$t = -2.549$	0.01^*
Inactive	55.20 ± 10.325			40.57 ± 7.019		
Active	59.70 ± 6.387			42.35 ± 5.972		
Socio-demographic Characteristics						
Gender		$t = 0.220$			$t = 1.671$	0.09
Male	57.69 ± 8.852		0.83	41.90 ± 6.556		
Female	57.46 ± 8.431			40.61 ± 6.401		
Age Category		$F = 0.971$			$F = 1.232$	0.29
30-40 years	57.81 ± 7.960		0.42	44.00 ± 5.465		

41-50 years	57.40 ± 10.315			40.60 ± 7.809		
51-60 years	57.30 ± 8.925			42.08 ± 6.527		
61-70 years	56.83 ± 8.877			41.57 ± 6.232		
71 years and above	59.37 ± 6.869			40.82 ± 6.065		
Monthly Income						
Less than 30,000	44.00 ± 18.403			35.25 ± 6.946	F= 3.056	0.03*
30,000-40,000	49.27 ± 13.292			41.18 ± 7.932		
40,000-50,000	58.67 ± 7.386	F= 11.897	<0.001**	42.54 ± 5.593		
More than 50,000	58.12 ± 8.005			40.87 ± 6.932		
Educational Status						
Matric	59.26 ± 6.096			43.34 ± 5.399		
Intermediate	59.00 ± 7.004			40.49 ± 5.684	F= 9.912	<0.001**
Graduation	58.93 ± 7.521			42.62 ± 5.798		
Un-educated	51.74 ± 12.492			35.67 ± 7.691		
Below Matric	49.45 ± 12.091	F= 10.237		37.59 ± 6.423		
Masters and above	58.44 ± 8.473		<0.001**	41.63 ± 8.363		
Occupation						
Business	58.58 ± 7.266			42.79 ± 5.598		
Employed	57.34 ± 9.864			42.15 ± 6.990	F= 1.722	0.13
Un-Employed	51.40 ± 12.260			37.20 ± 11.541		
Retired	57.96 ± 8.077			40.83 ± 6.331		
Housewife	57.28 ± 8.489			40.60 ± 6.259		
Left job due to cardiac disease	60.50 ± 6.364			39.00 ± 4.243		
Smoking Status		F= 0.779				
Non-Smoker	57.84 ± 8.421			41.54 ± 6.329		
Ex-Smoker	55.53 ± 11.195		0.57	40.95 ± 7.293	F= 0.289	0.75
Smoker	58.29 ± 7.717			42.18 ± 7.528		
Substance Abuse						
Alcohol	63.00			36.00		
Pan, Gutka, naswar, or betel nuts	57.60 ± 8.842			39.83 ± 6.406	F= 1.405	0.24
Quit Substance abuse	51.29 ± 11.988			40.00 ± 9.069		
No substance abuse	57.97 ± 8.391			41.80 ± 6.360		
Frequency of Smoking Status						
1-2 cigarettes per day	60.20 ± 6.496	F= 1.269		39.00 ± 13.565		
2-4 cigarettes per day	57.75 ± 5.175			41.88 ± 4.454		
more than 4 cigarettes per day	62.00 ± 7.303		0.28	45.50 ± 3.786	F= 0.546	0.65
More than 1 packs per day	56.45 ± 9.893			42.64 ± 7.173		
Clinical Characteristics		F= 3.334				
Co-Morbidities	56.88 ± 9.235			41.58 ± 7.110		
Hypertension	58.69 ± 7.021		0.02*	43.88 ± 5.045		
	54.08 ± 10.475			39.58 ± 8.575		

Diabetes	56.82 ± 9.402			41.23 ± 6.915	F= 1.295	0.25
Dyslipidemia						
Hypertension and diabetes	59.33 ± 6.501			42.28 ± 6.083		
Hypertension and dyslipidemia	58.05 ± 11.803	F= 0.603		40.10 ± 7.203		
Diabetes and dyslipidemia	57.20 ± 8.973		0.61	40.79 ± 6.259		
Hypertension, diabetes, and dyslipidemia	56.08 ± 10.255			44.42 ± 5.728		
No co-morbidities	58.39 ± 8.133			41.67 ± 6.247		
Previous episodes of heart attack	56.01 ± 9.681			41.22 ± 7.102		
Yes					t= 0.607	0.54
No	58.72 ± 7.892			42.02 ± 6.003		
Number of episodes of heart attack	57.48 ± 8.374	F= 1.004		40.35 ± 6.375		
	54.67 ± 13.317			38.33 ± 9.018		
One time	46.00 ± 16.971		0.43	33.50 ± 19.092	F= 1.533	0.19
Two times						
Three times	56.99 ± 9.091			41.51 ± 6.710		
More than three times	58.41 ± 8.195			41.54 ± 6.316		
Family history	57.89 ± 8.175			41.76 ± 6.223		
Yes	55.12 ± 12.671			39.36 ± 8.739		
No					t= -0.041	0.97
Past medical history						
Yes					t= 2.010	0.045*
No						
		t= 2.384				
			0.02*			
		F= 2.756				
			0.03*			

		t= -1.506				
		t= 1.738	0.13			
			0.08			

SD=Standard Deviation, *p= <0.05, **p= <0.001, t= Independent t-test (t-value), F= ANOVA

Discussion

The results of this study highlight that 46.2% of the participants were physically inactive after the cardiac event. The results are almost similar to those of other studies conducted on cardiac patients. The prevalence of physical inactivity was reported to be 48.8% in Brazil (25), 52.1% in India (26), 56.8% in Punjab, India (27), and 50.3% in Bangladesh (28). On the contrary, the present study showed a lower prevalence of physical inactivity as compared to similar studies conducted in Jordan and China. In those studies, the prevalence of physical inactivity was reported as higher at 76% and 63.1%, respectively (21; 29). Moreover, the mean physical activity level in this study was 392.70 (SD ± 538.912) METs-minutes per week. In contrast, the present finding was low as compared to the previous study conducted in Korea on patients with coronary artery disease, which reported 1268.63 (SD ± 1054.43) MET-minutes per week (30).

The results of this study reported that most of the facilitators or benefits cardiac patients perceive were increased levels of physical fitness, improved flexibility, disposition, and feelings of well-being, relaxation by exercising, improved functioning of the cardiovascular system, increased mental alertness, improved mental health, prevention of having high blood pressure, increased stamina. The findings of this study are in line with the study conducted in Jordan, which found that the majority of the patients with coronary artery disease reported that perceived facilitators of physical activity were enhanced cardiovascular

fitness, improved muscle flexibility, and increased strength (21). Another similar study conducted by Fraser et al. in Scotland also reported similar findings of improvement in their well-being, and mental health and were able to manage other diseases with exercise. Additionally, they reported some different findings from the present study, that is, improvement in breathing patterns, weight maintenance, improvement in confidence levels, and bringing happiness and energy in daily living by performing exercise (31). However, another study carried out on Saudi Arabian females living in the United Kingdom, reported different perceived facilitators of physical activity such as strengthening the relationships in families due to more time spent together while engaging in physical activity rather than sitting in front of the television, attractive and enjoyable weather and climate, availability of low-cost gyms, lifestyle change as seeing other people to go to walk and gym every day, transportation system, culture, increased individual freedom, and decreased social commitments (32).

The results and findings of this study highlighted some of the barriers that cardiac patients perceived. Most of them were lack of time for family responsibilities due to exercise, fatigue, or feeling tired, lack of facilities, and inconvenient schedules to avail those facilities, perceiving exercise as difficult and time-consuming tasks, unavailability of exercise places nearby, having shortness of breath during exercise, weather, poor health, and physical conditions. The findings of this study are consistent with several studies

conducted on cardiac patients, who reported lack of time, feeling fatigue, lethargy or being lazy, lack of facilities or parks, costly gym, weather, and age as barriers perceived by cardiac patients (21; 31; 19). However, another research conducted in Korea reported a lack of social support, lack of self-efficacy, and lack of autonomous motivation that contribute to the barriers to physical activity in patients with coronary artery disease (35).

According to several studies, factors that contribute to barriers to physical activity include gender, age, low educational status, low income, high number of perceived barriers, negative health perception, and number of co-morbidities (28; 25). The univariate analysis of this study demonstrated a significant association ($t = -4.933$, $p = <0.001$; $t = -2.549$, $p = 0.01$) of prevalence rate (active or inactive) with the barriers to physical activity (barriers score). This study's findings align with research conducted in Jordan, which found that physically active patients perceive more benefits and fewer barriers to physical activity than physically inactive patients (21). Another study carried out in Brazil by Vieira et al. also reported a higher number of perceived barriers to physical activity in the physically inactive group (25). In this study, a statistically significant association ($F = 11.897$, $p = <0.001$; $F = 3.056$, $p = 0.03$) was also found between the patients' monthly income and the barriers to physical activity. These findings are consistent with the cohort study conducted in the United States, which found that the participants with high household income were more likely to engage in cardiac rehabilitation ($OR = 1.68$, 95% $CI = 1.17-2.42$, $p = <0.01$) than the participants with low household income (29). Another cross-sectional study carried out in the United States by Carrasco-Marcelo et al. also reported a significant association between the patient's family income and physical inactivity ($p = <0.001$) (30). However, a cross-sectional study conducted in Malaysia by Mohd Saat et al. reported no statistically significant difference between the patients' income and physical activity levels ($H(2) = 3.62$, $p = >0.05$) (36). In the present study, a highly statistically significant

association ($F = 10.237$, $p = <0.001$; $F = 9.912$, $p = <0.001$) was also found between the patients' educational status and barriers to physical activity. These findings are consistent with the other studies conducted in the United States and the western part of Iran, where they found an association between the level of education and participation in cardiac rehabilitation (34; 37). According to Bachmann et al., individuals with higher or tertiary education exhibited increased participation rates ($OR = 1.61$, 95% $CI = 1.06-2.44$, $p = <0.05$) in comparison to those who completed only high school education (34). Another cross-sectional study carried out in the western part of Iran by Soroush et al. reported that patients with lower literacy levels were less likely to participate in cardiac rehabilitation programs ($p = 0.433$) compared to those with higher educational attainment (37). However, a cross-sectional study conducted in Kuala Lumpur, Malaysia by Mohd Saat et al. reported no statistically significant difference between the patients' educational status and physical activity levels ($U = 393$, $p = >0.05$) (36). In the present study, barriers to physical activity were statistically significantly associated with the previous episodes of heart attack and the number of episodes of heart attack ($t = 2.384$, $p = 0.02$; $F = 2.756$, $p = 0.03$) by using the EBBS tool. No previous studies were found in the literature regarding the association between episodes of heart attack and barriers to physical activity. In this study, barriers to physical activity were significantly associated with past medical history ($t = 2.010$, $p = 0.045$) by using the BAPAC scale. This study is in line with research carried out in Sweden, but it found the opposite association between past medical history and barriers to physical activity. It was found that patients with a past medical history were less likely to engage in physical activity than those with no past medical history. According to Borg et al., history of stroke ($OR = 1.37$, $CI = 1.21-1.55$), percutaneous coronary intervention (PCI) ($OR = 1.28$, $CI = 1.16-1.42$), coronary artery bypass graft ($OR = 1.31$, $CI = 1.16-1.42$), acute myocardial infarction ($OR = 1.19$, $CI = 1.08-1.31$), and diabetes ($OR = 1.20$, $CI = 1.13-1.28$)

were identified as predictors for non-attendance in cardiac rehabilitation (38).

Strengths and Limitations

This analytical cross-sectional quantitative study allows a thorough examination of physical activity, its prevalence, and the association between prevalence rate, socio-demographic, and clinical characteristics with the barriers to physical activity. No similar study has been carried out in Pakistan to answer similar research questions, to the researcher's best knowledge. The tools used in this study were translated and validated in Urdu as per the understanding level of the Pakistani population. The calculated CVI was found satisfactory for the overall study tools. The sample size of the study was large to ensure generalizability.

Since the cross-sectional study gives us a snapshot, it limits the establishment of the cause-and-effect relationship between the variables. However, to find the association between the outcome of the study and the factors associated, prospective cohort studies can also be done. Future studies could benefit from qualitative or mixed-method study designs to find out the perceptions of cardiac patients regarding physical activity. Only one tertiary care hospital was selected for this study, which restricts the generalizability of the results and could also limit the comparison of results between the hospitals and the applicability of the results to different healthcare settings and geographical locations. There was an unequal number of male and female participants in this study due to an increased number of male cardiac patients coming to the hospital.

Conclusion

This study presented a cross-sectional view of the prevalence of physical inactivity, perceived facilitators, barriers, and the factors associated with those barriers to physical activity among cardiac patients at a tertiary care hospital in Karachi, Pakistan. The results obtained from this study indicated that almost half of the participants were physically inactive.

Additionally, the findings showed a statistically significant association between the prevalence rate, monthly income, educational status, heart attack episodes, and past medical history with the barriers to physical activity. Data obtained from this study will help the researcher, policymakers, and healthcare administrators to address this important issue and suggest implications for nursing practice. The strengths and limitations of this study were also acknowledged in this study; it will help in future replication studies. This study highlighted a few recommendations at the educational, policy, clinical practice, and research levels. These include the development of effective policies and strategies to assess the prevalence of physical inactivity and its barriers in cardiac patients and the ways to overcome those barriers to physical activity. Such initiatives aim to mitigate the barriers to physical activity, motivate cardiac patients to engage in physical activity, reduce long-term complications of cardiac disease, and enhance the overall cardiovascular health of the patients following cardiac events.

Declarations

Ethical Considerations

The Ethical Review Committee of the Aga Khan University Hospital was contacted for ethical approval by sending them the ERC proposal and application form. The permission letter was obtained from the chief medical officer (CMO) of the Aga Khan University Hospital. Informed consent was explained and provided to all the selected samples to ensure their voluntary participation in the study. It was also explained to the selected samples that they can withdraw from the study at any time. Permission was also obtained from the authors of the selected questionnaire and tools used in the study by sending them an email. Moreover, the information provided by the samples selected remained anonymous and confidential throughout the process by assigning codes to their identities. Permission was also obtained from the participants regarding the publication and dissemination of this study findings. The electronic data obtained was saved in a password-

protected file on the laptop, and its backup was saved in the password-protected USB and Google Drive. The hard copies of the questionnaires and informed consent filled by the participants were saved and stored in the locked cabinet, and one copy of the informed consent was provided to the participants. All soft data was deleted, and hard copies were burned after the completion of the study.

Availability of Data and Materials

The data and materials used in this study are available from the corresponding author upon request.

Funding

This research study was funded by the Center of IMPACT Grant Agency.

Author contributions

NJ and RB planned the research. NJ carried out the data collection, analyzed the data, and wrote the manuscript. FBH supervised the data analysis and sample size calculation. All authors reviewed the manuscript for publication and approved the submitted version.

Acknowledgments

The authors of the manuscript sincerely thank the management, nursing staff, and unit receptionists of the cardiac inpatient and outpatient units for their invaluable input, assistance, and support during data collection. We also extend our heartfelt gratitude to all the cardiac patients who gave their permission and valuable time for the data collection. Additionally, we sincerely thank the Impact Grant and its team for providing the funding.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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