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Correlation of Smoking with Functional Capacity and Quality Of Life among Patients with Post-Operative Coronary Artery Bypass Grafting

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ABSTRACT

Smoking significantly raises the chance of developing cardiovascular disease (CVD), which is one of the leading causes of mortality globally. **Objective:** To ascertain how smoking affects patients' functional ability and quality of life following coronary artery bypass grafting surgery. **Methods:** A cross-sectional design in which patients of both gender aged between 40 and 70 years were selected those who underwent phase 2 rehabilitation phase. Based on their smoking history, patients were chosen from Sardar Fateh Khan Buzdar Institute of Cardiology in Dera Ghazi Khan and split into three groups: smokers and non-smokers. Structured interviews, the SF-36 questionnaire to assess quality of life after five days, and the Six-Minute Walk Test (6MWT) to gauge functional capacity were used to gather data. Patients' demographic information, medical history, and post-operative recovery details were also recorded. Data were analyzed using SPSS version 26.0. **Results:** Of 189 participants, non-smokers (33.9%) showed significantly better 6MWT performance than smokers ($p < 0.05$). Non-smokers had significantly better physical function scores and faster Sit to Stand test times than smokers ($p < 0.05$). Additionally, non-smokers reported a higher Physical Component Score (52.37 ± 6.12) compared to smokers (48.29 ± 7.45, $p < 0.01$). A strong negative correlation was found between the number of smoking packs per year and overall health outcomes, with 24.9% of smokers reporting more than 20 packs per year. **Conclusion:** Smoking negatively impacts rehabilitation by reducing functional capacity and lowering quality of life.

INTRODUCTION

According to the World Health Organization (WHO), cardiovascular diseases (CVDs) are the leading cause of death, accounting for 17.9 million deaths annually; however, by 2030, that number is expected to increase to 23 million [1]. Out of all of these, Coronary Heart Disease (CHD), which is chiefly brought about by atherosclerosis, is a key cause of death in the world. Atherosclerosis gives rise to narrowing or closing of heart's arteries, which can give way to myocardial infarction or stroke [2, 3]. Several studies have highlighted the detrimental impact of smoking on overall quality of life. Goldenberg *et al.*, emphasized that smoking is strongly associated with poorer physical and psychological well-being, often compounding existing health issues and diminishing long-term recovery outcomes, especially in patients with cardiovascular diseases [4]. Similarly, a population-based study from Nepal found a significant inverse relationship between smoking and quality of life, reinforcing the global relevance of smoking cessation interventions in improving health-related quality of life [5]. Nevertheless, despite its efficiency, CABG may be connected with different postoperative complications including pulmonary infections, pleural effusion, renal dysfunction, and impaired functional mobility caused by long-term immobility, as well as an inflammatory reaction. The two main factors that determine how well a patient recovers from heart surgery are quality of life (QoL) and functional capacity. Functional recovery Phase II cardiac

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rehabilitation attempts to reclaim functional independence and minimize long-term outcomes [6-8]. Nevertheless, these consequences tend to depend on remedial causes of risks the most apparent of which is smoking. CVD is well-known to be a concern of smoking, and the latter is a principal risk factor of post-surgical recovery. It slows wound healing, causes hyper-inflammation throughout the body, and lowers the cardiorespiratory performance [9]. When patients smoke after CABG, they risk complications and face poorer physical functioning as well as QoL levels, as opposed to non-smoking individuals [10, 11]. In spite of the fact that CABG relieves cardiac symptoms and enhances survival, the scope of the effect of smoking on functional recovery after surgery and QoL needs to be better investigated. The majority of the previous studies concerned smoking as the preoperative risk, but not the rehabilitation outcome.

The proposed study will fill that gap as the dysfunction capacity and QoL will be compared with smoking status of patients in the second stage of cardiac rehabilitation after CABG procedure.

METHODS

This cross-sectional study evaluated the relationship between smoking status, functional ability, and Quality of Life (QoL) in patients who had Coronary Artery Bypass Grafting (CABG) using a cross-sectional methodology. The study was conducted from January 2024- April 2024 in compliance with The University of Lahore Ethical Review Committee (Reference No: UIPT/ERB/20/126). Before the participation, all the participants included signed an informed consent form. The sampling method used was convenience sampling. Sardar Fateh Khan Buzdar Institute of Cardiology in Dera Ghazi Khan provided a sample of patients, and divided into two groups smokers (n = 125, 66.1%), non-smokers (n = 36, 19.1%) based on their smoking history. There were two groupings of the participants; Smokers: Those respondents reporting regular smoking status and who had a smoke burden of >= 1 pack year. Non-smokers were those who did not smoke or had a history of smoke <1 pack-year. During the rehabilitation sessions structured face to face interviews were used to determine the smoking status. The subjects were requested to self-report their smoking status, the average amount of cigarettes inhaled by the day and the years the individual had been smoking. A total of 189 participants were included in this study using a non-probability convenience sampling technique. A non-probability convenience sampling method was used to recruit 189 post-operative CABG patients. A post hoc power analysis using G*Power version 3.1 revealed that a minimum of 84 individuals were needed to detect a medium effect size (r = 0.3) with a significance level of $\alpha = 0.05$ and power of 0.80, despite the fact that no a priori sample size calculation was done. In order to guarantee acceptable statistical power for correlation analysis, the final sample size of 189 was sufficient [12]. Structured interviews, the Sit-to-Stand test, the Six-Minute Walk Test (6MWT) to assess functional ability, and the SF-36 questionnaire to assess quality of life after five days were all used to gather data. Patients' demographic information, medical history, and post-operative recovery details were also recorded. Inclusion criteria included patients who had successfully completed Coronary Artery Bypass Grafting (CABG) surgery with no in-surgery and post-surgery complications, and have been assigned to Phase II cardiac rehabilitation and were aged between 40 to 70 years, and were male and female. Other criteria were that they are induced to extubation and hemodynamically stable, stable chronic heart failure, the absence of arrhythmias, and read and write skills. Patients were excluded with a previous history of Ventricular Septal Defect (VSD) repair, cardiac surgery previously, severe renal disfunction which mandates dialysis or change in the level of consciousness. The patients who had musculoskeletal or orthopedic diseases that limited movement or did not allow using lower and upper extremity bikes were excluded. Responses from participants were gathered, and all information was added to an SPSS file. SPSS version 26.0 was used to analyze and interpret the data in order to produce additional findings. The lower extremity functional scale and demographic questions were used to gather data. The data were represented using descriptive statistics of categorical data, including frequency, percentage, cross-tabulation, bar charts, and pie charts. To determine correlations between the variables, spearman correlation was applied.

RESULTS

A thorough summary of the demographic, clinical, and functional traits of 189 patients who had Coronary Artery Bypass Grafting (CABG) is given in this paper. The age distribution of the participants is shown in Table 1, with a mean age of 50.91 ±6.18 years, spanning from 40 to 60 years (Figure 1).

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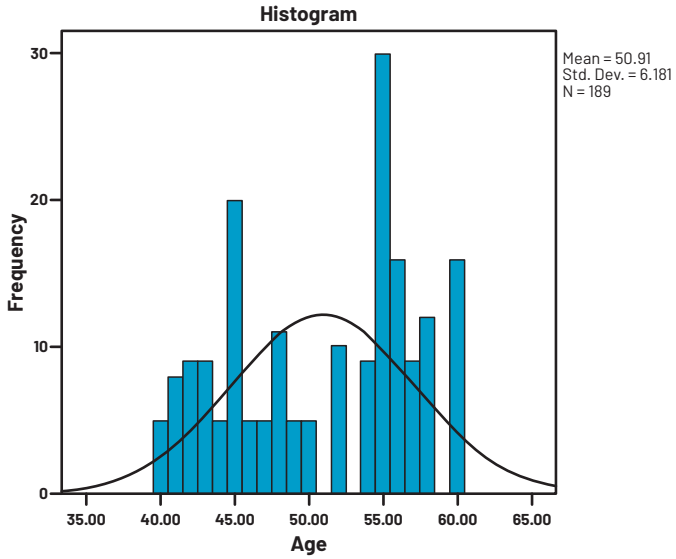

Figure 1: Graphical Representation of Age (n=189)

Out of the entire sample, 136 participants (72.0%) were men and 53 participants (28.0%) were women, according to Table 1. According to the study, 136 participants (72.0%) of the total sample were male, indicating a higher percentage of male patients who had Coronary Artery Bypass Grafting (CABG).

Table 1: Descriptive Statistics of Gender (n=189)

Variables	Category	Frequency (%)
Gender	Male	136 (72.0)
	Female	53 (28.0)

Table 2 presents the smoking status of the study participants. Among the 189 patients, 125 (66.1%) reported a history of smoking, while 64 (33.9%) were non-smokers.

Table 2: Descriptive Statistics of Smoking (n=189)

Variables	Category	Frequency (%)
Smoking Status	Yes	125 (66.1)
	No	64 (33.9)

Table 3 presents the results of the 6-Minute Walk Test (6MWT), where participants walked a minimum distance of 220 meters and a maximum distance of 355 meters. The mean distance walked was 267.24 meters, with a standard deviation of 49.94 meters. Distance of around 267 meters considered slightly below average for healthy adults.

Table 3: Descriptive Statistics of 6MWT (n=189)

Test	Min	Max	Mean ± SD
6MWT	220	355	267.24 ± 49.94

Table 4 presents the results for the "Sit to Stand" test, with a minimum time of 18 seconds, a maximum time of 57 seconds, and a mean time of 32.90 seconds, with a standard deviation of ±8.38 seconds. This indicates a moderate variation in the performance of participants, with times ranging from 18 to 57 seconds.

Table 4: Descriptive Statistics of Sit to Stand (n=189)

Variable	Min	Max	Mean ± SD
Sit to Stand	18	57	32.90 ± 8.38

According to table 5, quality of life score is presented across various domains. Physical Functioning ranged from 10 to 100, with a mean score of 83.67 ± 20.15, suggesting a generally high level of physical ability among participants. Role Physical and Role Emotional domains both demonstrated high average scores (95.37 ± 15.53 and 97.11 ± 13.46, respectively), indicating minimal role limitations due to physical or emotional problems. Social Functioning had a slightly lower mean of 77.57 ± 16.81, reflecting moderate to good social well-being. Bodily Pain scores ranged from 32.5 to 100, with a mean of 81.08 ± 15.27, suggesting relatively low levels of pain. Mental Health and Vitality had moderate mean scores of 77.58 ± 14.57 and 74.34 ± 15.44, respectively, indicating some variability in emotional well-being and energy levels. General Health had the lowest mean score at 74.05 ± 12.09, indicating a somewhat less favorable perception of overall health. The Physical Component Score and Mental Component Score were both high, averaging 83.54 ± 11.77 and 81.65 ± 11.94, respectively, reflecting overall good physical and mental health status among the participants.

Table 5: Descriptive Statistics of QOL (n=189)

Variable	Min	Max	Mean ± SD
Physical Functioning	10	100	83.67 ± 20.15
Role Physical	0	100	95.37 ± 15.53
Role Emotional	0	100	97.11 ± 13.46
Social Functioning	12.50	100	77.57 ± 16.81
Bodily Pain	32.50	100	81.08 ± 15.27
Mental Health	8	100	77.58 ± 14.57
Vitality	25	100	74.34 ± 15.44
General Health	37.50	85.83	74.05 ± 12.09
Physical Component Score	27.29	98.96	83.54 ± 11.77
Mental Component Score	15.75	100	81.65 ± 11.94

Several functional and quality of life assessments showed statistically significant correlations with smoking status. Higher smoking status (probably interpreted as non-smoking) is linked to better functional outcomes, as evidenced by the moderately positive correlation found between smoking status and the 6-meter walk distance ($r = 0.754$, $p < 0.001$) and the strong positive correlation found between smoking status and the Physical Component Score ($r = 0.815$, $p < 0.001$). Similarly, vitality ($r = 0.407$), physical functioning ($r = 0.589$), general health ($r = 0.546$), and bodily pain ($r = 0.634$) all showed significant positive

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correlations, all of which were p < 0.001. Positive but somewhat weaker correlations were also noted with role physical (r = 0.253), role emotional (r = 0.186, p = 0.010), social functioning (r = 0.341), and mental health (r = 0.319), all indicating that smoking status is linked to better scores in these domains as well. In contrast, a strong negative correlation was observed between the number of smoking packets per year and overall health outcomes (r = –0.851, p < 0.001), highlighting the detrimental impact of smoking quantity on patients' functional capacity and quality of life post-CABG (Table 6).

Table 6: Correlation of Quality of life with smoking status (n=189)

Variable	Spearman Correlation with Smoking Status	Smoking Status	Smoking Packets Per Year
Physical Functioning	Spearman Correlation	0.48**	-0.35**
	Sig. (1-tailed)	0.00	0.00
Role Physical	Spearman Correlation	0.21**	-0.16*
	Sig. (1-tailed)	0.002	0.01
Role emotional	Spearman Correlation	0.15*	-0.16*
	Sig. (1-tailed)	0.017	0.01
Social functioning	Spearman Correlation	0.25**	-0.25**
	Sig. (1-tailed)	0.00	0.00
Bodily pain	Spearman Correlation	0.57**	-0.49**
	Sig. (1-tailed)	0.00	0.00
Mental health	Spearman Correlation	0.31**	-0.22**
	Sig. (1-tailed)	0.00	0.00
Vitality	Spearman Correlation	0.39**	-0.30**
	Sig. (1-tailed)	0.00	0.00
General health	Spearman Correlation	0.49**	-0.41*
	Sig. (1-tailed)	0.00	0.00
Physical Component Score	Spearman Correlation	0.58**	-0.47**
	Sig. (1-tailed)	0.00	0.000
Mental Component Score	Spearman Correlation	0.357**	-0.316**
	Sig. (1-tailed)	0.000	0.000
6 meters walk distance	Spearman Correlation	0.869**	-0.658**
	Sig. (1-tailed)	0.000	0.000

DISCUSSION

The present study examined the correlations between the smoking status and functional capacity and the Quality of Life (QoL) among patients who received CABG undergoing surgical intervention who experienced post-operative recovery. In terms of physical performance (6-Minute Walk Test and Sit-to-Stand Test) and quality of life (SF-36 categories), the study's findings indicate that non-smokers and smokers performed quite well, but their scores differed greatly. In the present research, the non-smokers performed better than the smokers on the so-called 6-Minute Walk Test (r = 0.714), and the SF-36 Physical Component Score (r = 0.815) and had better bodily pain, general health, physical functioning and vitality (all p < 0.001). Contrarily, greater smoking (packs/year) presented a very significant negative relationship (r = -0.851, p < 0.001) with recovery. Previous studies affirm the same observations, i.e., that smoking has a negative effect on postoperative functional capacity and improvements in QoL [13, 14]. Similarly, the current study found that smoking had a significant negative impact on recovery outcomes. Among the 189 participants, non-smokers demonstrated better results in functional tests such as the Sit-to-Stand and 6-Minute Walk Test, as well as higher quality of life scores, particularly in Physical Component Score. The mean distance walked by participants (267.24 meters) was slightly below the average for healthy adults, with non-smokers showing significantly better performance than smokers. A strong negative correlation was observed between the number of smoking packs per year and overall health outcomes, indicating that smoking may hinder improvements in both functional capacity and perceived well-being after CABG [13]. The strong negative relation between smoking intensity and physical health puts emphasis on the fact that higher preoperative physical health of non-smoking individuals results in higher physical and mental postoperative results [15, 16]. Research by Raidou *et al.*, showed that changes in lifestyle that are manageable have predictive abilities towards postoperative HRQoL: they include, but are not limited to, smoking, alcohol consumption, body mass index, and depression [17]. The results of the present study are in line with existing literature emphasizing the role of modifiable predictors in postoperative QoL outcomes after cardiac surgery. Potential modifiable determinants of quality of life (QoL) outcomes following heart surgery include smoking, alcohol usage, body mass index, body weight, depression, and preoperative health status. In this study, smoking status (interpreted as not smoking) and various QoL measures showed positive correlations, indicating the significant impact of smoking on postoperative recovery, while the number of smoking packets per year showed a strong negative correlation with overall health outcomes (r = –0.851, p < 0.001) [17]. One year following surgery, deteriorating postoperative quality of life has also been linked to preoperative health state. In a similar vein, this study discovered that people who engaged in healthier habits, such quitting smoking, had higher quality of life and postoperative functional capacity. Improved mental health was linked to both better preoperative physical health and worse beforehand mental health, while low preoperative quality of life raised the likelihood of worse physical health following surgery. Accordingly, even though overall results

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were positive, these findings showed lower scores in mental health and vitality when compared to physical functioning [18, 19]. A history of neurological disease was previously found to be a negative predictor of physical health, and CABG was found to be a predictor of mental health decline. Although this study focused on patients aged 40-60, the literature suggests that for elderly patients, functional independence and improved QoL after cardiac surgery may be more important than life extension. Six months following CABG, there also seems to be a relationship between patients' age and QoL, with patients between the ages of 60 and 69 exhibiting the greatest improvement across all QoL dimensions when compared to younger and older age groups. According to another study, patients over 75 years of age showed less improvement in physical and social functioning and role restrictions brought on by physical issues, even if HRQoL and function increased over the course of ten years following surgery [15]. The evidence that smokers who underwent CABG had much poorer results (higher incidences of pulmonary complications, stroke, and postoperative atrial fibrillation) compared to non-smokers, which was the result found in the current study, is in agreement with what the existing literature contains. The recent study by Alsubaiei *et al.*, highlighted that even in case of enhanced recovery, the functional capacity decreased significantly after CABG surgery in smokers, confirming these study that showed lower 6MWT and Sit-to-Stand test outcome in smokers [20]. Additionally, a meta-analysis study by Lee *et al.*, revealed 22–26 percent of the post-operative atrial fibrillation increased risk in smokers, which is consistent with the high prevalence (21.6 %) in the smoking population [21].

CONCLUSIONS

Smoking was found to be significantly correlated with functional capacity and quality of life following coronary artery bypass grafting. Smoking has a detrimental influence on quality of life because heavy smokers have poorer functional capacities and a lower quality of life. It may also affect their rehabilitation. This study encourages people to quit smoking because it has so many negative consequences and can improve both the quality of life for healthy adults and the healing process for patients. There should be implementation of community-based programs to guide families in maintaining a smoke-free environment for CABG patients.

Authors Contribution

Conceptualization: TA
Methodology: MW, ST, MJ, EN
Formal analysis: MW, ST, MJ, EN
Writing, review and editing: MW, ST, MJ, EN

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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