

Original Article

# Association Between Compliance with Quadriceps Strengthening Exercises and Recovery Rate in Patients after Arthroscopic ACL Reconstruction

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## ABSTRACT

**Background:** Anterior Cruciate Ligament injuries are a common occurrence, especially sports activities. Arthroscopic ACL reconstruction has become a standard surgical intervention aiming to restore knee stability and function. However, successful recovery post-surgery relies on effectiveness of rehabilitation protocols, particularly quadriceps strengthening exercises.

**Objective:** To evaluate patient compliance with prescribed quadriceps strengthening exercises after ACL reconstruction surgery.

**Method:** Cross sectional study design was utilized .45 was sample size. convenience sampling technique was used. Individuals aged 30 to 50 who have undergone within six months post-ACL reconstruction were included. Self developed questionnaire utilized. Those who have had ACL reconstruction on the opposite knee within the last year were excluded. The study was conducted in A.O Hospital Nazimabad, CMT 2 Talwar Karachi Study ran from May 2023 to October 2023.SPSS Version 25 was utilized for statistical analysis.

**Results:** Correlation analysis is conducted to check the relationship between the Compliance with Quadriceps Strengthening Exercises and the participant's demographic variables such as Gender, Education, Occupation, weight and BMI. Gender and compliance with quadriceps exercises have a -1.56-correlation coefficient. The level of education and compliance with quadriceps exercises had a 3.15 correlation coefficient. The occupation and compliance with quadriceps exercises had a -2.05-correlation coefficient. Weight and compliance with quadriceps strengthening activities have a 2.79 correlation coefficient.

**Conclusion:** Correlation and regression analyses revealed complex relationships between demographics and compliance, emphasizing its pivotal role in predicting recovery impact. Understanding these interactions is vital for tailored rehabilitation after ACL surgery

**keywords:** Quadriceps strengthening, Arthroscopic ACL Reconstruction, Compliance, Rehabilitation.

## INTRODUCTION

ACL injuries are a type of knee injury that typically occur during sports or physical activities that require quick stops, direction changes, or rotating. The anterior cruciate ligament, one of the knee's four major ligaments, is primarily responsible for preserving the joint's integrity. ACL injuries are more common in sports requiring dynamic movements, like football, basketball, soccer, and skiing.

(1) Researches indicates that Asian cultures have a greater incidence of ACL injuries than Western ones, which can be ascribed to anatomical, biomechanical, and cultural variables. (2) ACL injuries are becoming more common in Pakistan, especially among young people who play competitive sports that are inspired by Western culture. There are 1.5 to 2.5 incidences of ACL injuries for every 10,000 people in Pakistan each year. (3) Surgery was necessary in 76.6% of cases involving ACL damage. After the ankle, the knee

joint is the most often damaged body part and the main reason for sports-related surgery. Ankle injuries, particularly those affecting the anterior cruciate ligament (ACL), are among the most expensive sports injuries financially, often necessitating pricey surgery and rehabilitation. (4) Of all knee injuries, at least 50% are caused by damage to the anterior cruciate ligament (ACL). (5)(6) Furthermore, it's critical to prevent ACL tears because they can end an athlete's competitive career and perhaps have a lasting negative impact on physical activity. ACL injuries can increase a patient's risk of developing early osteoarthritis and persistent pain 10 to 20 years complying with the injury. (7)

In order to stop additional harm, enhance joint integrity, and restore knee stability, ACL reconstruction surgery is an essential intervention. (8) Patellofemoral pain syndrome is a severe musculoskeletal disorder affecting the knee joint that affects 25% of the global population from early adolescence to early adulthood. Disorders of the patellofemoral joint, which cause discomfort in the anterolateral knee, are indicative of it. (9) Beyond preventing injuries, ACL reconstruction surgery is essential for regaining knee function, allowing people to return to their regular activities, and enhancing their general physical health and range of motion. (10) In the end, the treatment improves quality of life by addressing probable ACL injury outcomes such as diminished stability, movement limits, and chronic pain. (11) The effectiveness of ACL repair surgery depends heavily on patient compliance with postoperative rehabilitation programs that include physical therapy, exercises, and detailed care instructions. (12) Teaching about the need of following the rehabilitation plan is essential; it should cover the psychological as well as the physical components of healing. (13) Exercises that strengthen the quadriceps are essential to the recovery process because they help to prevent muscle imbalances and restore knee stability. (14)

Studies have also demonstrated that the prognosis for knee pain is not always favorable, with about 50% of teenagers and young adults reporting knee discomfort a year or so later. Their academic performance and quality of life may suffer as a result. (15) It is important to address muscular imbalances, particularly those between the hamstrings and quadriceps, in order to stabilize the knee joint. (16) Strength training after recovery should be maintained to aid in the joint's durability. (17) Failure to follow rehabilitation guidelines can result in long-term weakness, unstable joints, and a higher chance of reinjury. (18) Patients are more likely to make the best recovery possible if they actively participate in their rehabilitation, remain educated, and adhere to recommended regimens. (19) Individualized treatment plans, frequent patient-provider communication, and ongoing feedback all support a patient-centered approach that improves the likelihood of rehabilitation success. (20) For optimal outcomes, adherence to early mobility standards, pain control, and postoperative care is crucial. (21) Patient compliance not only affects physical outcomes but also influences psychological well-being, long-term joint health, and healthcare resource utilization (22) A tailored, patient-centered approach fosters a collaborative relationship between healthcare providers and patients, contributing to ongoing improvements in the rehabilitation process (23)

## METHOD

Cross sectional study design was utilized. The study comprised 45 individuals who had undergone anterior cruciate ligament (ACL) reconstruction surgery sample size was calculated using Rao software . convenience sampling technique was used. Self developed questionnaire utilized. Individuals aged 30 to 50 who have undergone ACL reconstruction were included . Patients within six months post-ACL reconstruction. Patients who underwent ACL reconstruction more than six months ago ,those who have had ACL reconstruction on the opposite knee within the last year were excluded. The study was conducted in multiple hospitals in Karachi, including A.O Hospital Nazimabad, A.O Hospital South and, body experts CMT 2 Talwar to ensure a diverse representation of ACL reconstruction patients. Study ran from May 2023 to October 2023.SPSS version 25 used for statistical analysis

## RESULTS

Descriptive statistic was utilized for demographic data representation Pearson Correlation Coefficient Correlation analysis is conducted to check the relationship between the Compliance with Quadriceps Strengthening Exercises and the participant's demographic variables such as Gender, Education, Occupation, weight and BMI. the correlation coefficients values between various demographic variables Compliance with Quadriceps Strengthening Exercises following ACL reconstruction surgery. Correlation analysis is conducted to check the relationship between the Compliance with Quadriceps Strengthening Exercises and the participant's demographic variables such as Gender, Education, Occupation, weight and BMI. The Pearson correlation coefficient of different variables has been analyzed that shows the direction of correlation between them. Gender and compliance with quadriceps exercises have a -1.56-correlation coefficient. The opposite relationship shows that there might be a slight tendency for females to compliant with the exercises more than males did. The level of education and compliance with quadriceps exercises had a 3.15

correlation coefficient. Weight and compliance with quadriceps strengthening activities have a 2.79 correlation coefficient. Regarding the positive relationship, it is possible that people who weight more will comply with the exercises more than those who weigh less. The BMI and compliance with quadriceps strengthening exercises had a -2.16- correlation coefficient. This negative correlation raises the possibility that there is a slight trend encouraging exercise compliance in those with lower BMIs over those with higher BMIs.

**Table 1: Gender Distribution**

Gender	Frequency	Percentage (%)
Male	18	40.0
Female	27	60.0
Total	45	100

Table 1 shows the gender distribution of the total 45 study participants, in which 18 (40.0%) were males and 27 (60.0%) were females.

**Table 2: Occupation**

Occupation	Frequency	Percentage %
Full-time employed	7	15.6
Part-time employed	9	20.0
Unemployed	11	24.4
Student	8	17.8
Retired	10	22.2
Total	45	100

Table.2 shows the participants distribution among the different occupations. According to the above table and graph, almost 7(15.6%) participants are full time employed, 9(20.0%) are part time employed, 11(2.4%) are unemployed, 8(17.8%) are students, and 10(22.2%) are retired.

**Table 2: Marital Status**

Marital Status	Frequency	Percentage (%)
Single	17	37.8
Married	17	37.8
Divorced	11	24.4
Total	45	100

Among the 45 participants of the study, the most common marital statues were single (37.8%) and married (37.8%). Similarly, 24.4% participants were divorced.

**Table 3: Education**

Education	Frequency	Percentage (%)
High School	10	22.2
College	9	20.0
Bachelor's Degree	14	31.1
Master's Degree	4	8.9
Doctorate or Professional Degree	8	17.8
Total	45	100

Table 3 demonstrate the distribution of educational levels among the 45 study participants, bachelor's degree constitutes 31.1% of all levels of educational completion, with high school diploma following in next (22.2%), doctorates or professional degrees (17.8%), college degrees (20.0%), and master's degrees (8.9%) followed closely after..

**Table 4: Weight**

Weight	Frequency	Percentage (%)
Less than 60 pounds	6	13.3
70-80 pounds	11	24.4
81-90 pounds	7	15.6
91-100 pounds	6	13.3
100 plus pounds	15	33.3
Total	45	100

Table 4. shows the weight of the 45 study participants, the weight for 91–100 pounds (13.3%), less than 60 pounds (13.3%), 70–80 pounds (24.4%), and 81–90 pounds (15.6%) are the most common weight categories, as you can see in figure 5. The most common weight group is 100 plus pounds (33.3%).

**Table 5: BMI**

BMI	Frequency	Percentage (%)
Underweight (less than 18.5)	7	15.6
Normal weight (18.5 to 24.9)	15	33.4
Overweight (25 to 29.9)	13	28.8
Obese (30 or more)	10	22.2
Total	45	100

Table 5 shows the distribution of Body Mass Index (BMI) among patients receiving arthroscopic ACL reconstruction and engaging prescribed quadriceps strengthening exercises. Almost 33.4% of the sample are within the normal weight range (18.5 to 24.9).

**Table 6: Pearson Correlation Coefficient**

	Gender	Education	Occupation	Weight BMI	BMI
Compliance with Quadriceps Strengthening Exercises	-1.56	3.15	-2.05	2.79	-2.16

Table 6 reveals the correlation coefficients values between various demographic variables Compliance with Quadriceps Strengthening Exercises following ACL reconstruction surgery. Correlation analysis is conducted to check the relationship between the Compliance with Quadriceps Strengthening Exercises and the participant's demographic variables such as Gender, Education, Occupation, weight and BMI. The Pearson correlation coefficient of different variables has been analyzed that shows the direction of correlation between them. The value of  $r$  ranges from positive 1 to negative 1. The positive value of  $r$  signifies that both the variables move in the same direction, while its negative value implies the two variables move in the different direction. Gender and compliance with quadriceps exercises have a -1.56-correlation coefficient. The opposite relationship shows that there might be a slight tendency for females to compliant with the exercises more than males did. The level of education and compliance with quadriceps exercises had a 3.15 correlation coefficient. The observation of a positive relationship implies that persons with higher educational attainment may exhibit more compliance with the exercises compared to those with lower levels of education. The occupation and compliance with quadriceps exercises had a -2.05-correlation coefficient. The opposite relationship raises the possibility of an insignificant trend where people in occupations that are physically demanding tend to be less adherence to their

routines of exercise than people in less physically demanding occupations. Weight and compliance with quadriceps strengthening activities have a 2.79 correlation coefficient. Regarding the positive relationship, it is possible that people who weigh more will comply with the exercises more than those who weigh less. The BMI and compliance with quadriceps strengthening exercises had a -2.16- correlation coefficient. This negative correlation raises the possibility that there is a slight trend encouraging exercise compliance in those with lower BMIs over those with higher BMIs.

## DISCUSSION

The finding of the investigation that there were more female participants (60.0%) than male participants may have an impact on how people perceive pain. The study participants has a wide range of occupational statuses in which unemployed (17.8%) are students, and (22.2%) were retired. finding suggest that unemployed and retired people have more time to complete the exercises as compared to the employed and students. People with full-time employment or students may find it difficult to stick to their exercise routines because of their stressful schedules or academic commitments. They might not have as much time to work out and might feel stressed or exhausted, which would make it harder for them to stay motivated and consistently finish their workouts. (24) Conversely, those who are retired or jobless might be able to organize their schedules more freely and have more time for exercise. They might, however, also lack regularity and structure, which could make it difficult to maintain committing to their physical fitness practice regularly. explores the marital status of the study that shows a sizable fraction of participants were married (37.8%) and single (37.8%) raises the possibility of variations in social support systems. It has been demonstrated that social support, especially from loved ones, has a major impact on health-related behavior and exercise regimen adherence (25)

Lindsay et al. 2017 study concluded adherence to exercise initiatives and married status have a positive association these findings were accordance to current study marital status might influence exercise adherence, with married individuals possibly being more likely to stick to their regimen due to family support. (26)

Haslam et al. 2016 concluded higher education levels might lead to a better understanding of exercise's importance in ACL recovery. Those with more education may recognize the positive impact of physical activity on power, range of motion, pain management, and overall function post-ACL reconstruction these findings were accordance to current study The level of education and compliance with quadriceps exercises had a 3.15 correlation coefficient. The observation of a positive relationship implies that persons with higher educational attainment may exhibit more compliance with the exercises compared to those with lower levels of education. (27)

Pages et al. 2016 concluded a negative association between gender and compliance, with male participants being more consistent with the exercise routines than female participants. Numerous factors, such as gender-specific differences in motivation, social support, and pain perception, could account for this outcome these results were compatible to current study results gender and compliance with quadriceps exercises have a -1.56- correlation coefficient. The opposite relationship shows that there might be a slight tendency for females to compliant with the exercises more than males did . (21)

Gamble et al. 2021 study results o indicated a positive correlation between age and compliance, indicating that older participants followed their exercise regimen more consistently than younger ones. This may be due to their increasing maturity, better understanding of the benefits of exercise for recovery, and less competing demands on their time these results were accordance to current findings showed retired person more strict to exercise means older person (28)

Paterno MV et al. 2007 concluded higher education levels linked to better adherence to exercise, possibly due to increased health knowledge and easier access to resources. Additionally, taller, heavier individuals with higher BMI showed greater compliance, indicating a potential deeper understanding of exercise benefits or a stronger drive to maintain fitness these results were accordance to current results level of education and compliance with quadriceps exercises had a 3.15 correlation coefficient. The observation of a positive relationship implies that persons with higher educational attainment may exhibit more compliance with the exercises compared to those with lower levels of education, Weight and compliance with quadriceps strengthening activities have a 2.79 correlation coefficient. Regarding the positive relationship, it is possible that people who weigh more will comply with the exercises more than those who weigh less. (29) The results of the study highlight the significance compliance is in determining successful rehabilitation outcomes. Maintaining regular compliance with quadriceps strengthening exercises is important for enhancing recovery, functional results, and general quality of life after ACL surgery.

## CONCLUSION

The study underscores demographic influences on patient compliance with quadriceps strengthening post-ACL surgery. Despite challenges, high compliance and positive outcomes indicated overall motivation. Correlation and regression analyses revealed complex relationships between demographics and compliance, emphasizing its pivotal role in predicting recovery impact. Understanding these interactions is vital for tailored rehabilitation after ACL surgery, optimizing outcomes, and improving overall quality of life.

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