Effectiveness of Therapeutic Exercises Program on Patients' Knowledge, Pain, and Knee Functional Activity Post Arthroscopic Anterior Cruciate Ligament Surgery

Nehal Mahmoud Abo Elfadl [1], Fatma Mohmed Attia[2] and Nora Fares Mohammed [3]
(1) Assistant Professor of Medical Surgical Nursing, Faculty of Nursing, Benha University, Egypt and (2,3) Lecturer of Medical Surgical Nursing, Faculty of Nursing, Benha University, Egypt.

Abstract

Context: Exercise therapy is considered as a basic element of care that can be provided for patients post-surgery as it could lower need for drugs and promote wound healing and early recovery. **Study aim:** Was to evaluate effectiveness of therapeutic exercises program on patients' knowledge, pain, and knee functional activity post arthroscopic anterior cruciate ligament surgery. The study used a quasi-experimental design, specifically employing a pre/post-test on **purposive sample** of 110 adult patients were involved in the study who distributed equally into study and control groups. **Setting:** orthopedic outpatient clinics at Benha University Hospital, Qualubyia, Egypt. **Tools:** Three tools were utilized for data collection including; I) Patients' Structured Interview Questionnaire, II) Anterior Knee Pain Scale "Kujala Scale", III) Functional Activity Measurement Tool. **Results:** clarified that 60.0% of both groups had poor level of total knowledge preprogram implementation, while post two weeks and post one month of implementation, there was a good knowledge level among study group (83.6% & 67.3% respectively) compared to control group (12.7% &10.9% respectively) with a high statistically significant difference. In addition, throughout program phases, there was a negative and statistically significant correlation between knee pain among studied patients and their muscle strength as well as activities of daily living. Meanwhile, there was a positive and highly statistical correlation between knee range of motion and activities of daily living as p value ≤ 0.001. **Conclusion:** Therapeutic exercises program was effective in improving patients' knowledge, enhancing knee functional activity, and reducing pain level among study group than control group. **Recommendations** :Continuous training programs should be conducted to improve patients' knowledge and practice regarding therapeutic exercises.

Keywords: Exercises Program, Knowledge, Pain, knee Functional Activity, Arthroscopic Anterior Cruciate Ligament Surgery

Introduction

The anterior cruciate ligament (ACL) considered a primary knee stabilizer that mainly is responsible for sustaining injuries from abrupt direction changes during engaging in sports or activities, rapid acceleration or deceleration while sprinting or jumping, unusual landings, and vehicle trauma. Around 70% of patients who have a tear or torn would complain of swelling, heamo-arthrosis, hearing and feeling a sudden "pop", severe knee pain, reduced knee range of motion, difficulty walking, and recurrent "giving way" episodes **(Abd ElKareem et al., 2023).**

Anterior cruciate ligament (ACL) injuries usually occur among young adults by direct or indirect trauma to the knee that usually requires reconstruction as surgical intervention to restore knee stability and function. Reconstruction surgeries for anterior cruciate ligament considered as the most common orthopedic techniques and the golden standard surgical treatment for ACL

tears or injuries. During arthroscopic procedure typically a graft, or a piece of tissue is placed in the knee to replace the torn within minimally invasive surgery through small incision **(Kunze et al., 2024).**

Arthroscopic reconstruction surgery aims to recreate ACL anatomy and function that helps patients to return to normal activity level without pain or weakness. In addition, it can protect against secondary injuries, support long-term joint health, reduce degenerative changes, and prevent osteoarthritis **(Lutz et al., 2022).** Graft choices include auto grafts from the patient's own body and allografts from donors. The most common auto graft choices are quadriceps tendon, quadruple hamstring, and bone-patellar tendon-bone **(Suri et al., 2023).** An allograft can come from patellar tendon, Achilles tendon, and Tibialis Anterior Tendon. Good graft selection crucial for successful reconstruction **(Vasilopoulou et al., 2024).**

Postoperative complications after anterior knee ligament reconstruction surgery include pain, limited range of motion, graft failure or rejection, infection, and deep vein thrombosis. Other rare risks that possible to occur early are fractures, ligament rupture or internal fixation material migration. So, complications should be considered in surgeon' mind before fully repairing the invaded bone and soft tissues and incorporation of the tendon graft are fully accomplished **(Runer et al., 2023).**

Post-operative therapeutic exercise program is crucial for patients with knee injuries that affecting their ability to perform daily activities and overall knee function. Patients play a crucial role in this process including ability to achieve full knee range of motion, reduce swelling, pain management, prescribed medications administration as ordered, and coordination with physiotherapist and nurse to learn some exercises that will help to restore knee functional activity **(Mohamed & Metwaly, 2023).**

Therapeutic approaches include applying ice to knee for 15 to 20 minutes at the first 48 hours, rest, contracting thigh muscles, walking with crutches, and elevation of the affected leg to reduce swelling, maintaining a healthy weight, and enhancing balanced diet to support wound healing **(Giummarra et al., 2022).** In addition, exercise therapy can assist in early knee function recovery, the restoration of normal functional movements involved in activities, supporting muscles strength, alleviating pain, and normalizing the gait mechanics and self-independence **(Dubé et al., 2024).**

The most common therapeutic exercises can be educated to patients by staff are range of motion, strengthen, proprioception and balance training, and functional activities exercises as squatting or jumping up. The progress of exercise program should be based on pain levels, knee strength to avoid re-injury or risks. Because of delayed recovery, patients could experience increasing physical limitations, pain, and functional restrictions that interfere with their ability to perform daily tasks, as well as losses in their social, recreational, and occupational lives, and lower quality of sleep, all of which lower their quality of life (**Almuhaya et al., 2023**).

Significance of the study

The anterior cruciate ligament injuries considered as the most common causing 200,000 cases per year in United States which significantly influence on the productivity and activities of individuals **(Tan et al., 2023).** World widely, more than 400, 000 person undergoing anterior cruciate ligament reconstruction operations annually because

Nehal Mahmoud Abo Elfadl , Fatma Mohmed Attia and Nora Fares Mohammed

ACL injury may destabilize the knee joint and accelerate degeneration of both cartilage and bone in the joint.

Traumatic knee injuries have been ranked among the top ten global sporting related injuries. **In Egypt**, the annual prevalence of ACL injuries was 1 in 200 among the general population resulting in over 100,000 new ACL injuries among adults particularly athletes and traumatic patients **(Ali et al., 2022).**

In 2024, approximately 1436 patients admitted to orthopedic surgical department at Benha University Hospital with approximately 30% (480) of cases underwent to arthroscopic ACLR operations **(Benha University Hospital Statistical Office, 2024).**

Aim of the study: was to evaluate effectiveness of therapeutic exercises program on patients' knowledge, pain, and knee functional activity post arthroscopic anterior cruciate ligament surgery.

Research Hypotheses:

H.1 Study group who engaged in therapeutic exercises program could be attained higher knowledge score than control group post program implementation.

H.2 Study group who performed therapeutic exercises would experience less knee pain than control group post program implementation.

H.3 Functional activity of study group could be improved post therapeutic exercises program implementation than control group.
Operational definition:
Knee Functional Activity refers to the patients' ability of to move knee post-surgery and perform daily living activities with good

muscle strength and with minimal pain that can be measured specific metrics tools as oxford scale for manual muscle strength measurement, KOS-ADL scale for activities of daily living capacity, Goniometer for knee range of motion measurement **(Mahmoud et al., 2022)**.

Subjects & Method:

Research Design:

A quasi-experimental research design (pre/post-test) was used in this study.

Variables: Independent variable was therapeutic exercises program. While the dependent variables were patients' knowledge, pain, and knee functional activity. **Setting:** The study was conducted in orthopedic outpatient clinic at Benha University Hospital, Qualubyia Governorate, Egypt.

Subjects: A purposive sample of 110 adult patients, aged from 21 to 55 years, underwent arthroscopic ACL reconstruction surgery, alert with stable condition, motivated to participate and apply instructions involved in this study. they divided into:

➢ **Study Group (n = 55)** involving patients who participated in therapeutic exercise program and educational sessions
➢ **Control Group (n = 55)** involving patients who received routine care.

Exclusion Criteria: Patients with significant musculoskeletal or neurological problems affecting lower limbs other than ACL injury, previous major knee surgeries unrelated to reconstruction, overweight patients, severe stiffness, infection, inflammatory disease, mental or psychological disorder

Effectiveness of Therapeutic Exercises Program on Patients' Knowledge, Pain, and Knee Functional Activity Post Arthroscopic Anterior Cruciate Ligament Surgery

The sample size was calculated according Stephen Thompsons equation **(Fearon et al., 2017)** as follows:

$$n = \frac{N \times p\,(1-p)}{\left(\left(N-1 \times (d^2 \div z^2)\right)+ p\,(1-p)\right)} = 121$$

N = Population size is 480

p = Ratio provides a neutral property is equal to 0.12

d = the error rate is equal to 0.05

z = Class standard responding to the level of significance equal to 1.96

Tools of data collection: Three tools were used to collect data pertinent to the research which were:

Tool I: Patients' Structured Interview Questionnaire: It was designed by researchers after literature review **(Reuben & Castellon, (2011); Gustafsson & Jonsson, (2017).** It was divided into three sections:

o **Section 1** focused on patients' personal data, including five questions related to age, gender, marital status, educational level, and occupation

o **Section 2** focused on clinical data of patients, encompassing a series of five inquiries about affected knee, cause of injury, comorbid diseases, past surgical operation, and time of past surgery.

o **Section 3** This section assessed patients' knowledge that composed of 16 multiple choice questions concerning:

1 - Anterior Cruciate Ligament Injury including 10 questions about function of anterior cruciate ligament, causes of injury, signs and symptoms of injury, treatment options, purpose of surgery, risks and benefits of the surgery, analgesics used, precautions after surgery, and potential complications.

2 - Therapeutic exercises including 6 questions about definition, benefits, types, phases, techniques, and time schedule to perform exercises.

Scoring system: Each question was scored as the correct response was scored one point, while incorrect response was scored as zero. The total knowledge score was 16 points. These scores were then transformed into percentages and classified as follow:

▪ **Poor Knowledge level** (less than 50%) = Fewer than 8 points.

▪ **Average Knowledge level** (50-75%) = from 8 to 12 points.

▪ **Good Knowledge level** (More than 75%) = More than 12 points.

Tool II: Anterior Knee Pain Scale "Kujala Scale": It adopted **from Kujala et al., (1993)** that considered as a validated patient-reported questionnaire designed to assess severity of knee pain and its related functional limitations consisting of 13-questions that distributed as;

- **Six questions covering pain intensity during** walking, running, climbing stairs, squatting, jumping, and support use. The minimum score for each item was zero. While maximum score was 5

- **Seven questions about pain related symptoms** as presence of discomfort, swelling, limping, knee flexion difficulty, instability, muscle atrophy, and knee laxity or weakness. The minimum score for each item was zero. While maximum score was 10

Scoring system: Total score was calculated by summing up responses to all items ranging from zero to 100. Higher scores indicate lower pain levels and better knee function and classified into:

o **Mild** = 80-100 points
o **Moderate** =60–79 points

o **Severe** = Below 60 points

Tool III: Functional Activity Measurement Tool: This tool consisted of three basic measurements to evaluate ability of knee to return to its function involving:

1- Oxford Scale for Manual Muscle Strength Testing: It adopted from **(Gandhi et al., 2024)** and used to evaluate strength of knee muscle groups (quadriceps and hamstrings) during active or passive motion. During assessment, the researchers applied passive knee movement (knee flexion or extension) or ask patient to perform specific movement (active) then, evaluate muscle ability to contract against gravity or applied force by researchers. **Grading Scale (0 to 5) as follows:** 0: no contraction or movement; 1: contraction felt without movement; 2: Flicker or trace of contraction; 3: (Fair) some but not complete ROM against gravity ;4: (Good) complete ROM against gravity with some (moderate) resistance; 5: (Normal) complete ROM against gravity with maximal resistance.

2- Goniometer for Range of Motion Measurement (ROM): This tool was adopted from **Norkin& White, (2016)** that used to measure knee joint range of motion angles during active or passive motion for affected knee. During assessment, the researchers applied passive knee movement (flexion or extension) or ask patient to perform specific movement (active) then, measured angle by goniometer and compared it with normal (normal flexion angle was 130º -140º. while extension angle was 180º).

Scoring System: (4) Normal, (3) Slightly limitation, (2) Moderate limitation, (0) Severe limitation.

3- Knee Outcome Survey – Activities of Daily Living Scale (KOS-ADLS): It adopted from **Irrgang & Demeulenaere, (2007)** that considered to be a patient-reported outcome measure that used by researchers to evaluate ability of patient' to perform daily activities. It composed of 14 item scale including:

o **Six symptom-related questions as** (giving away, weakness or knee shift, pain, swelling, stiffness, buckling or limping)

o **Eight function-related questions** to assess how knee joint function could affect patient ability to (walk, stand, squat, go upstairs, down stairs, sit with flexed knee, rise from chair, and kneel on knees). Each question is scored on a 0–5 Likert scale, where:(5) No problem, (4) Slight problem, (3) Moderate problem, (2) Severe problem, (1) Extreme problem, (0) Unable to perform. The maximum score was 70 points.

Scoring system:

▪ **High functional ability level** ($\geq$ 90%) = equal or more than 63 points.
▪ **Moderate functional ability level** ($\geq$ 60%) = equal or more than 42 points.
▪ **Low functional ability level** ($\geq$ 50%) = equal or more than 35points.

Educational program: It was designed by the researchers based on educational needs of patients that was acquired during the pretest phase. It was written in Arabic language with colorful illustrations covering both theoretical and practical aspects to enhance patients' capacity for learning.

▪ **Theoretical part** covered anterior cruciate ligament injury function, causes, signs and symptoms, treatment, reconstruction surgery, precautions after surgery, risks and complications. In addition to, benefits of

exercises, types, phases, and time of application.

- **Practical part** included implementation of therapeutic exercises after surgery as follow:

o 1st two weeks exercises as (flexibility exercises, quadriceps strengthening exercise, ankle exercise, heel slides, towel stretch, gravity-assisted knee extension and quarter squat exercises.

o 2nd two weeks as terminal knee extension exercise (TKE) with resistance band to 45 and balance exercise

o post one-month exercises as repeating exercises in the first four weeks, walking, running, elliptical machine as well as jumping

Content validity:
Four professors in Medical-Surgical Nursing at the Faculty of Nursing, Benha University, and one professor from the college of physiotherapy, Benha University evaluated the tools ' content and face validity and provided valuable feedback.

Tools' reliability: Patients' Structured Interview Questionnaire: was assessed using Cronbach's alpha coefficient, yielding a substantial score of 0.843. As for knee pain scale, its reliability was determined to be 0.785, while for Oxford muscle strength scale and ROM measurement, it was found to be 0.962 & 0.854 respectively. in addition, reliability of KPS-ADL scale was 0.942. These findings indicated that study' tools were highly reliable.

Pilot study: Ten percent of the studied patients (12) was involved in pilot study to estimate the amount of time needed for data collecting, this was done to test the study process's clarity, applicability, and tool

relevance. Consequently, participants of pilot study were excluded later.

Ethical and Administrative Considerations:
Approval was obtained from the Scientific Research Ethics Committee at Benha University's Faculty of Nursing before initiating the research (Code: REC-MSN-P80). Permission to carry out the study was obtained by submitting an official letter from the Dean of Benha University's Faculty of Nursing to the Director of Benha University Hospital and outpatient clinic at Benha University Hospital, clarifying the study's aim and expected outcomes. Prior to gathering data, the researchers provided the participating patients with a thorough explanation of the research goals. Verbal consent was requested from patients to validate their voluntary involvement. The researchers guaranteed the absolute confidentiality and anonymity of all data collected. Patients were free to choose whether to take part in study or withdraw at any time without rationalization.

Field work:
The formal authorization was given by the Director of Benha University Hospital. The data collection period lasted for six months, starting from December 2024 and ending in May 2025 through the following four phases:

Assessment and preparatory Phase:
During this phase, patients who were away from the exclusion criteria divided into two equal groups (study and control groups). Each group included 55 patients. Every patient underwent interview to collect their personal and clinical data using (tool I section 1,2) then began to assess their knowledge using a (tool I section 3). In addition, the researchers

assessed knee pain intensity using (tool II) and knee functional activity using (tool III).

Planning Phase: Researchers designed educational program based on patients' needs, a review of the literature, own experiences, and expert comments. The researchers constructed an instructional booklet in Arabic that included both theoretical and practical parts. The number of sessions, their content, and several teaching methods such as lectures, discussions, demonstrations, and re-demonstrations, as well as a simplified instruction were also determined by the researchers. Training media uses included a booklet, images, a power point presentation, and training videos from a laptop or mobile.

Implementation phase: the researchers visited setting three days per week and provided five educational sessions to study group within three months, time for each session was one hour and accommodating 5 - 6 patients.

- **Session one** was designed to familiarize the patients with the program sessions, clarify its objectives, and explore functions of anterior cruciate ligament, causes of injury, signs and symptoms, and treatment,
  Session two was constructed to clarify purpose of reconstruction surgery, risks of surgery, precautions after surgery therapeutic exercises benefits, types, and its phases.
- **Session three** included demonstration and re-demonstration of the 1st two weeks exercises such as (flexibility exercises, quadriceps strengthening exercise, ankle exercise, heel slides, towel stretch, gravity-assisted knee extension and quarter squat exercises.
- **Session four** included demonstration and re-demonstration of 2nd two weeks exercises such a terminal knee extension exercise

(TKE) with resistance band to 45 and balance exercise
- **Session five** included demonstration and re-demonstration of post one-month exercises as repeating exercises in the first four weeks, walking, running, elliptical machine as well as jumping

Evaluation Phase: Comparison between study and control group findings was done after two weeks and after one month after implementation of the therapeutic exercises program to evaluate its effectiveness by using of the same study tools.

Statistical analysis:
The collected data were systematically organized and analyzed using the IBM computer with Statistical Package for Social Science (SPSS), version 25. Descriptive statistics such as mean and standard deviation were utilized for numeric data, while qualitative data were represented in frequency and percentage. Chi-square tests were employed to investigate associations between qualitative variables
Pearson correlation coefficients were utilized to examine relationships among numerical variables. The independent t-test was used to compare two sample means from unrelated groups to determine if the samples are different from each other. Statistical significance was set at $p \leq 0.05$, with a p-value of 0.001 considered highly significant.

Results:

Table (1): Demonstrates personal data of studied groups clarifying that there was no statistically significant difference between the two groups in relation to the above-mentioned characteristics which indicates that two groups were nearly homogenous, clarifying that 40% & 36.4%, respectively had 26-35 years old with a mean age of 35.945±10.362 &39.527±9.593, while 60 % of study group

were males and 52.7% of control group were female. In addition, 67.3% of both groups were married. As well as, 45.5% & 56.4% of the studied patients had an intermediate qualification. Moreover, 45.5% of study group worked manually &40.0 % of control group had office work.

Table (2) shows clinical data of patients indicating that there was no statistically significant difference between the two groups pointing out that 65.5%&54.5%, respectively, had injury of right knee due to sports among 45.5% of study group. while 50.9% of control group injured due to accidents.   In addition, 52.7 % and 49 % respectively reported didn't have any comorbid disease. Moreover, 68.4% and 64.5% respectively had surgical intervention for period less than 6 months

Table (3) shows comparison between total mean score and standard deviation of studied patients' knowledge regarding anterior cruciate ligament and therapeutic exercises with no significant statistical difference pre - implementation of exercises program. while post exercises program implementation, there was an improvement their knowledge score among study group with a mean of (11.272±2.778&10.618±3.088respectively) compared to control group (6.363±2.669&6.237±2.653 respectively) with a highly statistical significant difference.

Table (4) illustrates frequency and percentage distribution of studied patients' total knowledge level among control and study groups throughout program phases with no significant statistical difference pre - implementation of program, where 60.0% of both groups had poor level of total knowledge pre exercises implementation, while post exercises implementation there was a good knowledge level among study group (83.6%

& 67.3% respectively) compared to control group (12.7% &10.9% respectively) with a highly statistical significant difference.

Table (5) shows comparison between total mean score and standard deviation of studied patients regarding knee pain scale throughout the program phases with no significant statistical difference pre -implementation of exercises.   while   post   exercises implementation, there was highly statistically significant difference among study group and control group as p value ≤ 0.001

Figure (1) illustrates frequency and percentage distribution of studied patients' knee pain severity among control and study groups throughout program phases clarifying that 76.4% and 80% of study and control group experienced severe pain pre-program implementation.   whenever   post implementation, they experienced a moderate knee pain among study group (54.4% & 60% respectively) compared to control group (25.5% &30.9% respectively).

Table (6) shows comparison between total mean score and standard deviation of studied patients regarding manual muscle strength throughout the program phases with no significant statistical difference pre - implementation of exercises program. while post exercises program implementation, there was an improvement in muscle strength score among study group with a mean of (4.072±.790& 4.327±.579 respectively) compared to control group (2.563±.631& 2.709±.657respectively) with a highly statistically significant difference.

Table (7) shows comparison between total mean score and standard deviation of studied patients regarding knee range of motion measurement throughout the program phases

with no significant statistical difference pre - implementation of exercises program among both groups. On the other hand, post exercises program implementation, there was a significant improvement in regard to knee flexion and extension among study group compared to control group as p value ≤ 0.001

Table (8) provides evidence that post implementation of the proposed exercises program, the total mean score of daily living activities of patients were significantly higher among study group (52.072±4.488 & 53.036±3.651respectively) in comparison to control group (47.600±7.349 & 48.890±7.014) with highly statistical difference.

Figure (2) reveals frequency and percentage distribution of studied patients' daily living activities among control and study groups throughout program phases clarifying that 85.5% and 92.7% of study and control group experienced low ability to perform activities of daily living pre-program implementation. whenever post implementation, they experienced a high ability to perform activities of daily living among study group (60% & 69.1% respectively) compared to control group (25.5% &32.7% respectively).

Table (9) clarifies that, throughout program phases, there was a negative and statistically significant correlation between knee pain among studied patients and their muscle strength as well as activities of daily living. Meanwhile, there was a positive and highly statistical difference between knee range of motion and activities of daily living as p value ≤ 0.001.

Effectiveness of Therapeutic Exercises Program on Patients' Knowledge, Pain, and Knee Functional Activity Post Arthroscopic Anterior Cruciate Ligament Surgery

Table (1): Frequency distribution of studied patients (study and control groups) regarding their personal data (n=110)

Personal data	Study group (n=55)		Control group (n=55)		χ^2	P-value
	No.	%	No.	%		
Age in years:						
20-25 yrs.	7	12.7	8	14.5	.376	.945 [n.s]
26-35 yrs.	22	**40.0**	20	**36.4**		
36-45 yrs.	16	29.1	15	27.3		
46-55 yrs.	10	18.2	12	21.8		
Mean± SD	**35.945±10.362**		**39.527±9.593**			
Gender:						
Male	33	**60.0**	26	47.3	1.791	.181 [n.s]
Female	22	40.0	29	**52.7**		
Marital status:						
Single	10	18.2	6	10.9	3.066	.382 [n.s]
Married	37	**67.3**	37	**67.3**		
Divorced	4	7.3	9	16.4		
Widow	4	7.3	3	5.5		
Educational level:						
Illiterate	7	12.7	9	16.4	3.179	.365 [n.s]
Read and write	5	9.1	5	9.1		
Intermediate qualification	25	**45.5**	31	**56.4**		
University qualification	18	32.7	10	18.2		
Occupation:						
Doesn't work	14	25.5	14	25.5	1.766	.414 [n.s]
Manual work	25	**45.5**	19	34.5		
Office work	16	29.1	22	**40.0**		

(n.s) Not significant (p > 0.05)

Table (2): Frequency distribution of studied patients (study and control groups) regarding their clinical data (n=110)

Items	Study group (n=55)		Control group (n=55)		χ^2	P-value
	No.	%	No.	%		
Affected knee:						
Right	36	**65.5**	30	**54.5**	1.364	.243 [n.s]
Left	19	34.5	25	45.5		
Cause of injury:						
Sports	25	**45.5**	17	30.9	2.544	.467 [n.s]
Work	7	12.7	10	18.2		
Accidents	23	41.8	28	**50.9**		
Co-morbid diseases:						
No comorbid disease	29	**52.7**	27	**49.1**	1.114	.981 [n.s]
Hypertension	9	16.4	11	20.0		
Diabetes mellitus	5	9.1	3	5.5		
Heart diseases	2	3.6	3	5.5		
Lung diseases	3	5.5	3	5.5		
Renal diseases	4	7.3	4	7.3		
Liver diseases	3	5.5	4	7.3		
Past surgical operation:						
No surgical operation	36	65.5	24	43.6	6.339	.275 [n.s]
Appendectomy	4	7.3	8	14.5		
Cholecystectomy	3	5.5	8	14.5		
Urology surgery	4	7.3	5	9.1		
Cardiac surgery	4	7.3	5	9.1		
E.N.T surgery	4	7.3	5	9.1		
Time of past surgery:						
Less than 6 months	13	**68.4**	20	**64.5**	2.216	0.137 n.s
More than 6 months	6	31.6	11	35.5		

(n.s) Not significant (p > 0.05)

Table (3): Total mean score and standard deviation of studied patients' knowledge regarding anterior cruciate ligament and therapeutic exercises (study and control groups) throughout the program phases (n=110)

Phases	Study group (n=55) Mean± SD	Control group (n=55) Mean± SD	Independent t-test	P-value
Pre- Program	7.036±1.609	6.472±2.316	1.482	.141
Two weeks post- Program	11.272±2.778	6.363±2.669	9.449	.000**
One-month post- Program	10.618±3.088	6.237±2.653	7.816	.000**

Effectiveness of Therapeutic Exercises Program on Patients' Knowledge, Pain, and Knee Functional Activity Post Arthroscopic Anterior Cruciate Ligament Surgery

** A highly statistical significant difference P ≤ 0.001

Table (4): Frequency and percentage distribution of studied patients' total knowledge level (study and control groups) throughout the program phases (n=110)

| Phases	Study group (n=55)						Control group (n=55)						χ²	P-value
	Good		Average		Poor		Good		Average		Poor			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Pre-therapeutic Exercises Program	3	5.5	19	34.5	33	**60.0**	1	1.8	21	38.2	33	**60.0**	1.10	.577 **(n.s)**
Two weeks post-therapeutic Exercises Program	46	**83.6**	4	7.3	5	9.1	7	**12.7**	**10**	18.2	38	69.1	55.3	.000**
One-month post-therapeutic Exercises Program	37	**67.3**	8	14.5	10	18.2	6	**10.9**	9	16.4	40	72.7	37.0	.000**

(n.s)Not significant (p > 0.05)   ** Highly significant (p ≤ 0.001)

Table (5): Comparison between total mean score and standard deviation of studied patients (study and control groups) regarding knee pain scale (kujala scale) throughout the program phases (n=110)

Phases	Study group Mean± SD	Control group Mean± SD	Independent t-test	P-value
Pre-therapeutic Exercises Program	50.436±7.514	48.145±7.553	1.595	.114 n.s
Two weeks post-therapeutic Exercises Program	72.309±5.623	53.672±5.395	17.734	.000**
One-month post-therapeutic Exercises Program	70.800±6.436	52.631±5.364	15.160	.000**

** A highly statistical significant difference P ≤ 0.001
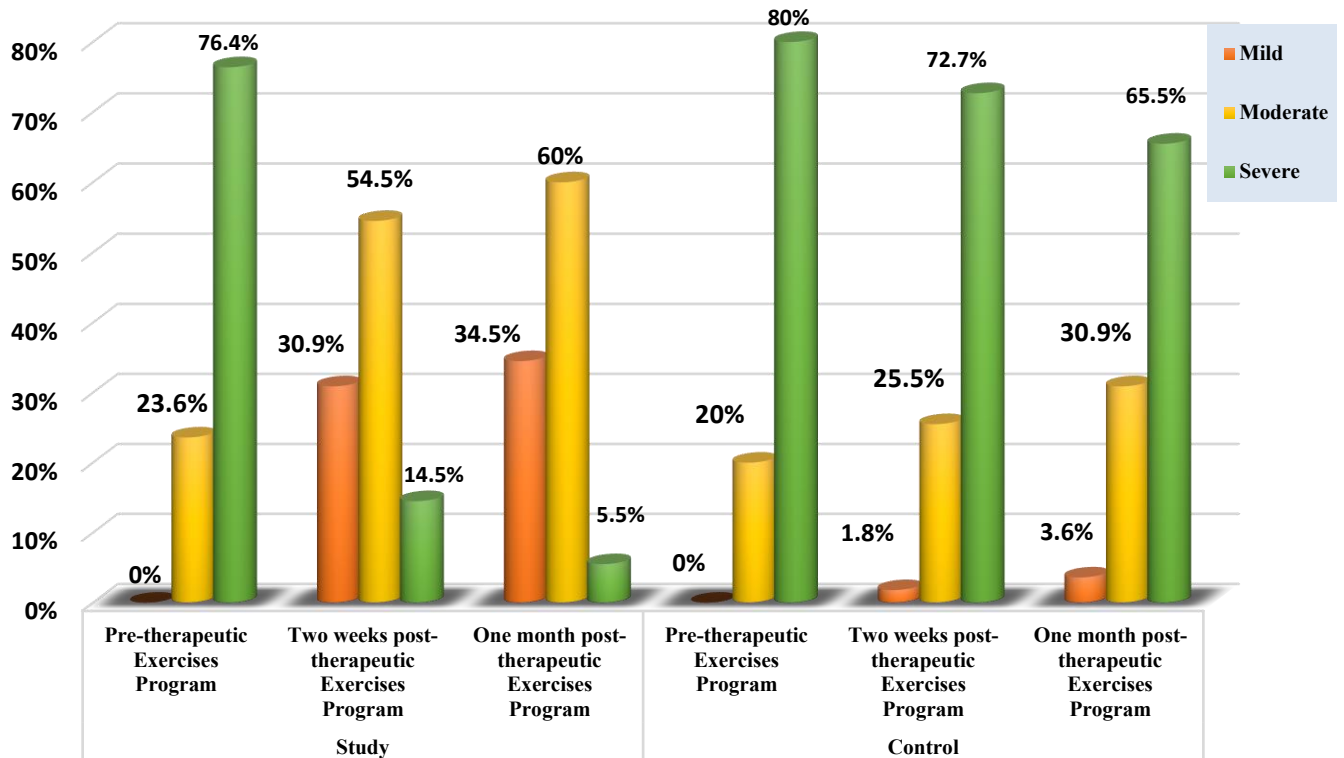
Figure (1): Percentage distribution of studied patients' anterior knee pain severity (study and control groups) throughout the program phases (n=110)

Table (6): Comparison between total mean score and standard deviation of studied patients (study and control groups) regarding manual muscle strength throughout program phases (n=110)

Phases	Study group Mean± SD	Control group Mean± SD	Independent t-test	P-value
Pre-therapeutic Exercises Program	3.018±.526	2.854±.524	1.633	.105 n.s
Two weeks post-therapeutic Exercises Program	4.072±.790	2.563±.631	11.066	.000**
One month post-therapeutic Exercises Program	4.327±.579	2.709±.657	13.697	.000**

(n.s) Not significant (p > 0.05)   ** A highly statistical significant difference P ≤ 0.001

Effectiveness of Therapeutic Exercises Program on Patients' Knowledge, Pain, and Knee Functional Activity Post Arthroscopic Anterior Cruciate Ligament Surgery

Table (7): Comparison between total mean score and standard deviation of studied patients (study and control groups) regarding knee range of motion measurement throughout the program phases (n=110)

ROM	Pre-therapeutic Exercises Program		t-test/ P-value	Two weeks post-therapeutic Exercises Program		t-test/ P-value	One-month post-therapeutic Exercises Program		t-test P-value
	Study group Mean± SD	Control group Mean± SD	P-value	Study group Mean± SD	Control group Mean± SD		Study group Mean± SD	Control group Mean± SD	
Knee extension	64.54±7.714	62.72±8.32	1.18 .237 n.s	88.090±6.70	66.636±8.11	15.12 .000**	96.18±10.92	66.818±8.071	16.02 .000**
Knee flexion	8.490±2.93	8.163±3.01	.056 .955 n.s	8.78±3.62	4.418±2.78	6.066 .000**	8.818±3.10	5.181±2.782	6.778 .000**

** A highly statistically significant difference P ≤ 0.001   (n.s) Not significant (p > 0.05)

Table (8): Comparison between the study and control groups according to total mean score of Knee Outcome Survey Activities of Daily Living Scale (KOS-ADLS) throughout the program phases (n=110)

Phases	Study group Mean± SD	Control group Mean± SD	Independent t-test	P-value
Pre-therapeutic Exercises Program	34.363±4.660	33.581±3.275	1.018	.311 **n.s**
Two weeks post-therapeutic Exercises Program	52.072±4.488	47.600±7.349	3.852	.000**
One-month post-therapeutic Exercises Program	53.036±3.651	48.890±7.014	3.887	.000**

** A highly statistically significant difference P ≤ 0.001   (n.s) Not significant (p > 0.05)
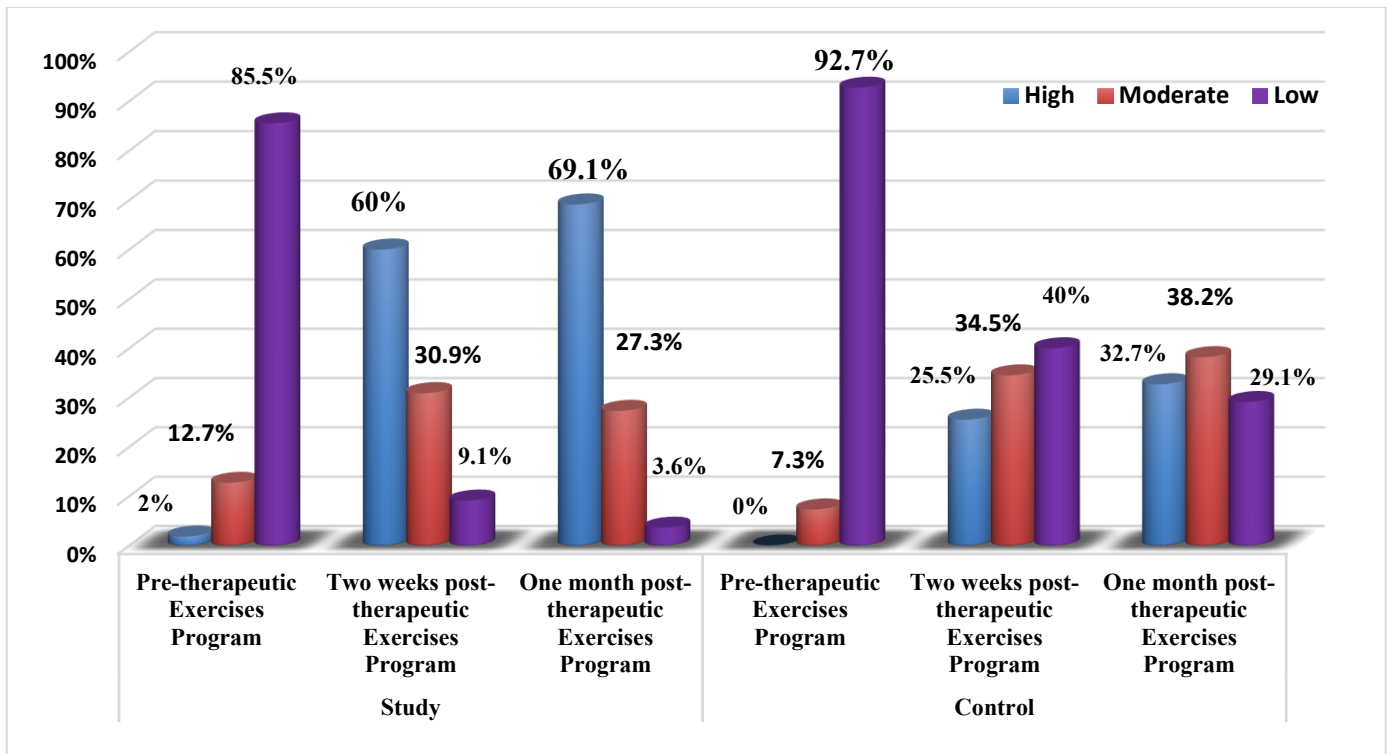
Figure (2): Percentage distribution of studied patients' total level of Knee Outcome Survey Activities of Daily Living (study and control groups) throughout the program phases (n=110)

Table (9): Correlation matrix coefficient between studied variables among patients (control & study groups) throughout the program phases (n=110)

Variables			Anterior Knee Pain	Knee ROM	Activities of Daily Living
Pre-therapeutic Exercises Program	Muscle strength	r/P-value	-.774/.000**	.842/.000**	.816/.000**
	Anterior Knee Pain	r/ P-value	1	-.917/.000**	-.763/.000**
	Knee ROM	r/ P-value		1	.805/.000**
Two weeks post-therapeutic Exercises Program	Muscle strength	r/ P-value	-.672/.000**	.655/.000**	.179/.052*
	Anterior Knee Pain	r/ P-value	1	-.718/.000**	-.237/.013*
	Knee ROM	r/ P-value		1	.447/.000**
One-month post-therapeutic Exercises Program	Muscle strength	r/ P-value	-.598/.000**	.629/.000**	.305/.001**
	Anterior Knee Pain	r/ P-value	1	-.701/.000**	-.225/.018*
	Knee ROM	r/ P-value		1	.405/.000**

** Highly statistically significant difference P ≤ 0.001

* Statistically significant difference P ≤ 0.05

Effectiveness of Therapeutic Exercises Program on Patients' Knowledge, Pain, and Knee Functional Activity Post Arthroscopic Anterior Cruciate Ligament Surgery

Discussion

The aim of therapeutic exercises for patients with reconstruction is to restore strength, range of motion, balance, and return to normal anterior knee function. The exercises are typically progressed within phases that started with gentle movements and gradually increasing in intensity and complexity. These exercises must be carefully tailored to each phase of recovery from immediate post-surgery movements to advanced functional training to help patients safely regain full knee function and return to sports or daily activities with preventing stiffness, muscle atrophy, or instability **(Deshpande et al., 2025).**

Concerning age of studied patients, the findings of the current study clarified two fifths of study group and more than one third of control group aged from 26-35 years old with a mean age of 35.945±10.362 &39.527±9.593. **From researchers perspective**, in this age group, involvement in athletic and physically demanding activities or work nature contributes significantly to anterior cruciate ligament injury.

These results agreed with study conducted by **Ahmed et al., (2021)** about "Can ACL Tears be Restricted to Sports Injuries Alone" clarified that age of patients was between 25 and 35 years. Similarly, **Ali, et al., (2022)** in their study about "anterior Cruciate Ligament knee Injuries and patients' needs" found that just less than two-thirds of studied patients were under the age of 40 years old, on contrast, study of **Mahmood et al., (2023)** about "Demographic characteristics of patients who underwent anterior cruciate ligament reconstruction" showed that the mean age of the patients under study was 23 years.

As regards to gender and marital status, in accordance of findings of the current study, three fifth of study group were males and more than half of control group were females. In addition, both groups were married. **From researchers perspective**, it might be due to fact that ACL injury usually occur because men had high level of effort in their work that might require long standing or more associated risks than woman as well as participating in sports especially football.

Furthermore, **Emmanuel (2021)** study, "Prediction of Patient-Reported Outcome after Arthroscopic Anterior Cruciate Ligament Reconstruction," supports these findings by demonstrating that more than two thirds of participants were male and married. At the same sequence, study done by **Abd Elghany et al., (2019)** entitled 'Effect of Exercises Program on Knee Functional Outcomes for Patients after Arthroscopic Anterior Cruciate Ligament Reconstruction' revealing that studied patients were married but injury was predominated in men more than women in both groups.

This result was in disagreement with **Siegel et al., (2012)** who reported that anterior cruciate ligament injuries were more common in women than men due to their body mass index and variation of ligament laxity and bone strength.

Concerning level of education, the current study showed that, study and control group had intermediate level of qualification. At the same line, study done by **Ali et al., (2022)** clarified that, nearly to thirds of sample were intermediate qualification. On contrast, study done by **Mahmood et al., (2023)** clarified that most of study group were a university graduate. Meanwhile, **Ahmed and Mohamed (2020)** in their study entitled

"Effect of the Rehabilitation Program on the Lower Limbs Function after Anterior Cruciate Ligament Reconstruction Surgery" in Sudan and indicated that the level of education was university among the most of participants.

Concerning occupation, the current study reveals that nearly half of studied groups had a manual or office work. This result agrees with **Abd Elghany et al., (2019)** who revealed that nearly two thirds of patients had working job that needed physical efforts as farmers or athletics as well as more than two thirds were business or desk jobs. Also, **Abdalrahman et al., (2021)** who conducted study to assess knowledge and awareness of patients toward anterior cruciate ligament injury in hail city, Saudi Arabia and found that the most subjects had manual work or participated in sports. On contrast, **Ginjupalli et al., (2025)** in their study about "Clinical Predictors of Surgical Treatment for Anterior Cruciate Ligament Injuries" and stated that the majority of patients were not working.

As regards to clinical data of studied patients, in accordance to the current study results, the most affected knee with injury was right knee due to sports or accidents.   In addition, nearly half or more of studied patients reported not to have any comorbid disease. At the same line, study done by **Pokharel et al., (2022)** about "Anterior Cruciate Ligament Injury among Patients with Knee Injury Visiting the Out-patient Department of Orthopedics" revealed that the majority of patients suffered from right limb injury as result of sports related activities. In addition, **Dennis et al., (2025)** showed in their study that the minority of patients had a comorbid disease. **From researchers perspective**, it might be due to fact that ACL injury usually occur among healthy persons

suddenly as result of ligament torn due to unexpected strain or mechanical force on knee.

Concerning studied patients' total knowledge score regarding anterior cruciate ligament injury and therapeutic exercises, the current study showed that three fifth of both groups had poor level of knowledge pre- program implementation, while post program implementation, it changed to be a good knowledge level among study group compared to control group with a highly statistically significant difference. **From the researchers perspective**, this lack of patients' knowledge pre- program because to patients might be not interested or tried to get information from variable sources about surgery and therapeutic exercises after operation. So that, conducting educational program was effective in patient' knowledge improvement.

These results agreed with **Abd ElKareem et al., (2023)** who conducted a study about "Rehabilitation Program for Patients Undergoing Anterior Cruciate Ligament Reconstruction Surgery " revealing that during the pre-phase of program, the majority of patients had unsatisfactory knowledge level. while, post-program, patients' knowledge level became satisfactory among the majority of patients with highly statistically significant difference and improvement in patients' overall knowledge.

Also, **Fouasson-Chailloux et al., (2022**) who conducted study about "Therapeutic Patient Education after Anterior Cruciate Ligament Reconstruction " showing that therapeutic patient education can prompt healthy recovery and help patients to rehabilitate without any physical or psychological problems. Similarly, **Abdelmonem and Mourad (2019)** found that

the majority of patients' knowledge was poor and unsatisfactory without educational intervention. Besides, **Courtot et al., (2019)** showed in their study that, post educational sessions, a mean score points of study group' knowledge significantly increased compared to control group with statically significant difference.

On contrast, **Abdalrahman et al., (2021)** in their study revealed that more than three quarters of patients had sufficient knowledge level. as well as, **Alqarni et al., (2022)** showed in their study about prevalence and determinants of anterior cruciate ligament rupture among athletes practicing football showing most participants had satisfactory knowledge about ACL injury.

Regarding manual muscle strength among studied patients throughout the program phases, there was an improvement in muscle strength score among study group compared to control group with a highly statistically significant difference. This result agreed with study done by **Junior et al., (2024)** about "Correlation of muscle strength and reported knee function after Anterior Cruciate Ligament (ACL) graft, unrepaired ACL injury, and healthy knees" showing that the level of muscle strength among patients who did not practice exercises was worse than who practice exercises. Furthermore, study conducted by **Wang, (2023)** showed that, after isokinetic exercise training, the mean score of muscle strength significantly higher among intervention group than control group with high statical significant difference after . Similarly, study proposed by **Yu et al., (2024)** about "Nurse-Assisted Rehabilitation Protocols Following Anterior Cruciate Ligament Reconstruction" clarified that post exercises protocol, patients experienced more muscle strength and

neuromuscular control compared to pre-exercises protocol. On contrast, study conducted by **Lim et al., (2024)** showed that there was no significant difference in knee strength among patients in spite of instructions and education by healthcare team about recommended exercises. **From the researcher perspective**, isometric knee exercises and enhanced protein diet played vital role in rapid muscle building and its strength

Regarding patients' anterior knee pain severity, the current study showed that more than three quarters of study and control groups experienced severe pain pre-program implementation. Whenever, post program implementation, more than half of study group experienced a moderate knee pain compared to more than one fourth among control group with highly statistically significant difference. This result is along with findings of study conducted by **Metwaly and Mahmoud , (2023)** about "Effect of educational program on nurses' performance post arthroscopic anterior cruciate ligament reconstruction and patients' outcomes"clarified that There was a significant improvement in mean scores concerning knee pain. Similary, **Mohmad and El-Kady, (2018)** about "Effect of Core Stability Training on Knee Proprioception after Anterior Cruciate Ligament Reconstruction" indicated that training was effective in reducing pain and improving the knee proprioception. In addition, **Marques et al., (2020)** in their study about "Anterior Knee Pain After Anterior Cruciate Ligament Reconstruction" and reported that the most of patients experienced pain after surgery regardless surgical technique or gender. Similarly, study done by **Zhong et al., (2025)** in their study to assess impact of exercise therapy on rehabilitation outcomes after anterior cruciate ligament reconstruction

showing that exercise therapy had positive effect on lowering anterior knee pain and enhancing knee function. Additionally, **Dai & Li, (2022)** revealed that after 2nd and 4th weeks of program implementation, the study group had lower rates of knee pain than control group. **From the researcher perspective**, in spite of pain had considered as usual complain after surgery, exercise therapy and pharmacological interventions could reduce joint stiffness and swelling that enhance discomfort or pain.

Regarding studied patients' daily living activities, the current study clarified that the majority study group and the most of control group experienced low ability to perform activities of daily living pre-program implementation. Whenever post implementation, they experienced a high ability to perform activities of daily living among study group compared to control group with highly statistically significant differences. These findings are in agreement with **Ahmed and Mohamed (2020)** in their study indicated that the majority of patients had bad score of lower extremity functional scale before program. while, post program, patients had restored their knee function with high score that reflects ability to perform their daily living activities with highly statistically significant differences.

These findings aligned with **Ali and Abdelwahab (2019)** who studied "Short-Term Outcome of Multi-Ligament Knee Injury among Sudanese Patients" and stated that the majority of patients had an excellent score of knee function scale with ability to return to normal activities of life after the completion of program indicating impact postoperative exercise therapy. Also, study done by **Abd ElKareem et al., (2023)** confirmed that patients' functional ability means scores had

statistically significant improved at post-phases of program compared to the pre phase

Similarly, study done by **Moubarak et al., (2023)** showed postoperative exercise program led to a significant improvement in patient' activities of daily living that improve patient' physical and psychological life. Furthermore, **Gsangaya et al., (2023)** clarified that after the program, there were significant improvement in knee function scores among study group compared to control group. Also, these results are further aligned with **Mahmoud et al., (2022)** who conducted rehabilitation program to improve functional outcomes for patients after knee arthroscopic surgery and stated that patients had ability to perform particular functional tasks and activities post intervention than before. As well as, **Taha & Ibrahim (2021)** clarified after educational program, study group patients had better functional outcomes than control group with high significant statistical difference. **From the researcher perspective,** exercise therapy enhances early recovery after surgery that stimulate physical wellbeing and ability to return to normal life.

Regarding studied patients' knee range of motion, post -implementation of exercises program, there was a significant improvement in knee extension and flexion among study group compared to control group. these findings aligned with **Shu et al., (2022)** who found that after training, knee' range of motion among study group was significantly improved and became higher than control group with a statistically significant difference. Similarly, **Mahmoud et al., (2022)** clarified that the majority of patients had higher level of knee extension and flexion abilities immediately post-program and three months later.

These findings were in harmony with **Kotsifaki et al., (2023)** in their study about "Aspetar clinical practice guideline on rehabilitation after anterior cruciate ligament reconstruction" clarifying that therapeutic exercises program could be beneficial during early recovery stages especially when pain, swelling, and range of motion limitations reduced as seen in their study results. In addition, this finding supported by **Mazhar et al., (2023)** in their study "Effect of the Rehabilitation Program on knee Range of motion and muscle power after Anterior Cruciate Ligament Reconstruction Surgery" showing that more than half of patients experienced normal knee functional status (knee flexion and extension range) at 2nd and 6th week after physical exercises program. In addition, study conducted by **Zhang et al., (2022**) about "Effects of Functional Training on Postoperative Anterior Cruciate Injury in Athletes Hospitalized" showed that, immediate and after the 8th week of training program, the most of studied patients had excellent knee ROM function with high statistically significant differences.

Concerning correlation between studied variables, there was a negative and statistically significant correlation between knee pain among studied patients and their muscle strength as well as activities of daily living. These findings supported by **Zhou et al., (2025)** about "How effective is the addition of specific exercise therapy for patients after anterior cruciate ligament surgery? "indicating when patients had high knee pain score, they experienced low of knee function and activities limitation which reflects negative correlation. Similarly, study that done by **Zhong et al., (2025)** about "the impact of exercise therapy on rehabilitation outcomes after anterior cruciate ligament reconstruction" showed that

throughout training program, there was negative correlation between pain and patients' abilities to perform knee ROM as well as activities of daily living among studied patients.

In accordance of this study results, there was a positive and highly statistical difference between knee range of motion and activities of daily living. Study conducted by **Junior et al., (2024)** agreed with this finding as there was a positive correlation between muscle strength, knee ROM as well as knee functional score after isometric exercises training.

Conclusion:

Based on the findings of the present study, it could be concluded that, therapeutic exercises program was effective in improving patients' knowledge, enhancing knee functional activity, and reducing pain level among study group than control group

Recommendations:

- Providing orthopedic patients with informative booklets about recommended exercises post- reconstruction surgery
- Colorful Arabic version of therapeutic exercises posters should be placed in orthopedic units
- Continuous training programs should be conducted to improve patients 'knowledge and practice regarding exercise therapy
- Exercise schedule should be included in patient' care to optimize health outcomes.

References

Abd Elghany, M., AbdEl-Monaem, A. & Hassanin, A. (2019). Effect of Exercises Program on Knee Functional Outcomes for Patients after Arthroscopic Anterior Cruciate Ligament Reconstruction. Mansoura Nursing Journal; 6(1):185-197. https://doi.org/10.21608/mnj.2019.175774

Abd ElKareem, N., Taha, N., Abd Elghaffar, M. & Zatton, H. (2023). Rehabilitation Program for Patients Undergoing Anterior Cruciate Ligament Reconstruction Surgery. Egyptian Journal of Health Care, 14(4): 1457-1483. Doi:10.21608/ejhc.2023.356051.

Abdalrahman, A., Aljarboa, A., Alobaidi, S., Albalawi, A.& Alsayigh, J. **(2021).** Knowledge and awareness about anterior cruciate ligament injury in Hail region. International Journal of Medicine in Developing Countries; 5(1):.294–301. Doi: 10.24911/IJMDC.51-1607705553

Abdelmonem, M.& Mourad, M. (2019). Anterolateral Ligament Tear in Acute Anterior Cruciate Ligament Rupture: Diagnostic Accuracy of MRI.The Medical Journal of Cairo University, 87(9):.3347 3352. Doi: 10.21608/mjcu.2019.65630

Ahmed, E.&Mohamed, A, (2020). Effect of the Rehabilitation Program on the Lower Limbs Function after Anterior Cruciate Ligament Reconstruction Surgery: Case Series from Sudan, Khartoum, 2018-2019, Archives of Physiotherapy and Rehabilitation ,3 (2): 068-075.

Ahmed, S., Ashraf, M., Sahanand, S. & Rajan, D. (2021). Can ACL Tears be Restricted to Sports Injuries Alone? A Retrospective Analysis. Indian journal of orthopaedics, 55(2): 402–408. https://doi.org/10.1007/s43465-021-00387-5

Ali, A.& Abdelwahab, M. (2019). Short-Term Outcome of Multi-Ligament Knee Injury among Sudanese Patients. Open access Macedonian journal of medical sciences, 7(9), 1486–1493. https://doi.org/10.3889/oamjms.2019.282

Ali, A., Mohamed, N. &Abd Elkareem,N .(2022). Anterior Cruciate Ligament Knee Injuries: Patients' needs, Zagazig Nursing Journal, 18 (2): 303-316.

Almuhaya A, Albarrati A, Alhowimel A, Alodaibi F, (2023). Adding a Structured Educational Session to the Rehabilitation Program of Soccer Players Following Anterior Cruciate Ligament Reconstruction: A Feasibility Study. International Journal of Sports Physical Therapy,18(1): 81-91. Doi: 10.26603/001c.68141.

Alqarni, F., Alshehri, K., Alotaibi, T., Alsulami, A.& Alshehri, A. (2022). The prevalence and determinants of anterior cruciate ligament rupture among athletes practicing football in Jeddah Avenues 2020. J Family Med Prim Care; 11(8): 4528-4535. Doi:10.4103/jfmpc.jfmpc_61_22

Benha University Hospital Statistical Office, (2024). Number of admitted patients to orthopedic department at Benha university hospital, Qualubyia, Egypt.

Courtot L, Ferre F, Reina N, Marot V, Chiron P, et al., (2019). Patient Participation During Anterior Cruciate Ligament Reconstruction Improves Comprehension, Satisfaction, and Functional Outcomes: A Simple Way to Improve Our Practices. Orthop J Sports Med; 7(4):2325967119841089. Doi: 10.1177/2325967119841089. 31065554;

Dai J & Li Y, (2022). Effect of Nursing in Operating Room Combined with Intraoperative Heat Preservation Intervention on Prevention of Incision Infection and Improvement of Hemodynamics in Patients with Anterior Cruciate Ligament Injury and Reconstruction under Knee Arthroscopy. Comput Math Methods Med; 2022:2915157. Doi: 10.1155/2022/2915157.

Effectiveness of Therapeutic Exercises Program on Patients' Knowledge, Pain, and Knee Functional Activity Post Arthroscopic Anterior Cruciate Ligament Surgery

Dennis, S., Heather, A., Prentice, J., Anna Davis, G., & Ronald A. (2025). "Diabetes and Untoward Outcomes after ACL Reconstruction." Journal of Orthopaedic Experience & Innovation 6 (1). https://doi.org/10.60118/001c.124072.

Deshpande, S., Ghodke, P., Kale, S. & Shyam, A. (2025). Rehabilitation In Arthroscopic Anterior Cruciate Ligament Reconstruction. Journal of orthopedic case reports, 15(3);1–7.https://doi.org/10.13107/jocr.2025.v15.i03.5312

Dubé, M., Crossley, K., Bruder, A. and Culvenor, A. (2024). Addressing rising knee injury and surgery rates with real-word data; the need for a clinical knee injury registry. JSAMS Plus, 4, 100077. DOI:10.1016/j.jsampl.2024.100077

Emmanuel, B. (2021). Prediction of Patient Reported Outcome after Arthroscopic Anterior Cruciate Ligament Reconstruction, A Cross-Section Study at King Faisal Hospital, Master thesis, Department of Surgery, Medicine and Health Sciences, University of Rwanda, pp.1-20.

Fearon, E., Chabata,S.,Thompson , J., Cowan, F. & Hargreaves,J. (2017). Sample size calculations for population size estimation studies using multiplier methods with respondent- driven Sampling Surveys. JMIR public health and surveillance, 3(3), e59.
https://doi.org/10.2196/publichealth.7909

Fouasson-Chailloux, A., Crenn, V., Louguet, B., Grondin, J., Menu, P., & Dauty, M. (2022). Therapeutic Patient Education after Anterior Cruciate Ligament Reconstruction: Evaluation of the Knowledge and Certitudes with a Self-Report Questionnaire. Healthcare (Basel, Switzerland), 10(5), 934. https://doi.org/10.3390/healthcare10050934

Gandhi, k., Ratnani, G.& Deodhe, N. (2024). Enhancing Muscle Strength Post Anterior Cruciate Ligament Reconstruction, Cureus, 16(2): E54593. Doi 10.7759/Cureus.54593

Ginjupalli, R., Orav, E., McCleary, N., Hubbell, H.&Tanaka, M. (2025). Clinical Predictors of Surgical Treatment for Anterior Cruciate Ligament Injuries. Orthopedic Journal of Sports Medicine. 13(7):23259671251336395. Doi: 10.1177/23259671251336395.

Giummarra M, Vocale L, King M, (2022). Efficacy of Non-Surgical Management and Functional Outcomes of Partial ACL Tears. BMC Musculoskeletal Disorders, 23(1): 332-354. Doi: 10.1186/s12891-022-05278-w.

Gsangaya, M., Htwe, O., Selvi Naicker, A.& Mohammad N. (2023). Comparison between the effect of immersive virtual reality training versus conventional rehabilitation on limb loading and functional outcomes in patients after anterior cruciate ligament reconstruction: A prospective randomized controlled trial. Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology, 34 (3): 28- 37. Doi: 10.1016/j.asmart.2023.09.002.

Gustafsson, H. & Jonsson, H. (2017). Patient-Reported Outcomes and Assessment Tools in Knee Surgery and Rehabilitation: A Review. Knee Surgery, Sports Traumatology, Arthroscopy, 25(4): 1275-1284.

Irrgang, J. & Demeulenaere, J. (2007). Knee Outcome Survey: A Review of the Literature and Its Application to Outcomes

Following Knee Surgery. Journal of Orthopedic & Sports Physical Therapy, 37(9):579-590.

Junior, E., Serenza, F. & Ferreira, A. (2024). Correlation of muscle strength and reported knee function after Anterior Cruciate Ligament (ACL) graft, unrepaired ACL injury, and healthy knees. (2024). Research, Society and Development, 13(1):e8413144755. https://doi.org/10.33448/rsd-v13i1.44755

Kotsifaki, R., Korakakis, V., King ,E., Barbosa, O.& Maree, D. (2023). Aspetar clinical practice guideline on rehabilitation after anterior cruciate ligament reconstruction. British Journal of Sports Medicine, 57(9): 500-514. Doi: 10.1136/bjsports-2022-106158.

Kujala, U., Kvist, M. & Hernesniemi, J. (1993). Anterior knee pain syndrome and patellar tendinopathy in athletes: A prospective study. Knee Surgery, Sports Traumatology, Arthroscopy, 1(3):187-191.

Kunze, K., Pareek, A., Nwachukwu, B. & Williams, R. (2024). Clinical Results of Primary Repair Versus Reconstruction of the Anterior Cruciate Ligament: A Systematic Review and Meta-analysis of Contemporary Trials. Orthopaedic Journal of Sports Medicine, 12(6), 23259671241253591. DOI: 10.1177/23259671241253591.

Lim, J., Choi, A., & Kim, B. (2024). The Effects of Resistance Training on Pain, Strength, and knee Function: Systematic Review and Meta-Analysis. Journal of personalized medicine, 14(12), 1130.https://doi.org/10.3390/jpm14121130

Lutz, M., Achtnich, A., Schütte, V. & Willinger, L. (2022). Anterior cruciate ligament autograft maturation on sequential postoperative MRI is not correlated with clinical outcome and anterior knee stability. Knee Surgery, Sports Traumatology, Arthroscopy, 30(10): 3258-3267. DOI: 10.1007/s00167-021-06777-4.

Mahmood, A., Vatsya, P., Garika, S., Mittal, R. & Nagar, M. (2023). Demographic characteristics of patients who underwent anterior cruciate ligament reconstruction at a tertiary care hospital in India. World journal of clinical cases, 11(15), 3464–3470. https://doi.org/10.12998/wjcc.v11.i15.3464

Mahmoud, H., Ahmed, R.& Mohamed, H. (2022). Effect of Nursing Rehabilitation Program on Knee Functional Outcomes for Patients undergoing Arthroscopic Meniscus Surgery. Egyptian Journal Care; 13(2): 1-26. Doi: 10.21608/ejhc.2022.227166

Marques, F., Barbosa, P., Alves, P., Zelada, S., Nunes, R., de Souza, M., Pedro, M., Nunes, J., Alves, W. & de Campos, G. (2020). Anterior Knee Pain After Anterior Cruciate Ligament Reconstruction. Orthopaedic journal of sports medicine, 8(10), 2325967120961082. https://doi.org/10.1177/2325967120961082

Mazhar, T., Saddique, I., Riaz, S., Arif, A.&Aziz, A. (2023). Effect of the Rehabilitation Program on knee Range of motion and muscle power after Anterior Cruciate Ligament Reconstruction Surgery. Pak J Med Health Sci; 17(7): 28-30. DOI: https:// doi. org/ 10.53350/pjmhs202317728

Mohamed, A. & El-Kady, M. (2018). Effect of Core Stability Training on Knee Proprioception after Anterior Cruciate Ligament Reconstruction. The Medical Journal of Cairo University. 86. 231-240. 10.21608/mjcu.2018.55091

Mohamed, S. & Metwaly, E. (2023). Effect of Educational Program on Nurses' Performance Post Arthroscopic Anterior Cruciate Ligament Reconstruction and Patients' Outcomes. Assiut Scientific Nursing Journal, 11(38): 120-133. DOI: 10.21608/asnj.2023.220103.1621

Moubarak, E., Youssef, E., Dawood, R., El Shamy, A.& Abdelrahem, M. (2023). Effect of adding preoperative exercise to postoperative rehabilitation program of progressive exercises on anterior cruciate ligament reconstruction. EJPT. 2023;15:18-26.

Norkin, C. & White, D. (2016). Measurement of Joint Motion: A Guide to Goniometry (5th ed.), Davis Company, United States of America, chapter 9, pp 100-110.

Pokharel, S., Thapa, S& Lamichhane, A. (2022). Anterior Cruciate Ligament Injury among Patients with Knee Injury Visiting the Out-patient Department of Orthopaedics of a Tertiary Care Centre: A Descriptive Cross-sectional Study. JNMA; journal of the Nepal Medical Association, 60(254), 853–856. https://doi.org/10.31729/jnma.7402

Reuben, D. & Castellon, L. (2011). The Use of Patient-Reported Outcomes in Evaluating the Effectiveness of Clinical Interventions. American Journal of Managed Care, 17(6): S198–S207.

Runer, A., Keeling, L., Wagala, N. & Musahl, V. (2023). Current trends in graft choice for primary anterior cruciate ligament reconstruction–part II: In-vivo kinematics, patient reported outcomes, re-rupture rates, strength recovery, return to sports and complications. Journal of Experimental

Orthopedics, 10(1): 40. Doi: 10.1186/s40634-023-00601-3.

Shu, C., Han, L.& Yang, H. (2022). Effect of Rehabilitation Training on Cruciate Ligament Injury. Rev Bras Med Esporte; 28(3):pp.180 182. doi:10.1590/1517-8692 2 0 2 2 2 8 0 3 2 021_0475

Siegel, B., Carol Vandenakker, D. & David, M. (2012). Anterior Cruciate Ligament Injuries: Anatomy, Physiology, Biomechanics, and Management, Clin J Sport Med Volume, 22(4):349-55. Doi: 10.1097/JSM.0b013e3182580cd0.

Suri, M., Verma, A., Khalid, M. & Godshaw, B. (2023). Functional anterior knee pain and return to sport following bone-patellar tendon-bone anterior cruciate ligament reconstruction. Ochsner Journal, 23(1): 27-33. Doi: 10.31486/toj.22.0085

Taha, A. & Ibrahim, R. (2021). Effect of Educational Program on Nurses' Knowledge, Practices and Patients' Outcomes Post Total Knee Arthroplasty. Evidence-Based Nursing Research; 3(4):23-38. doi: 10. 47104/ ebnrojs3. v3i4.217

Tan, T., Gatti, A., Fan, B. and Shea, K. (2023). A scoping review of portable sensing for out-of-lab anterior cruciate ligament injury prevention and rehabilitation. NPJ Digital Medicine, 6(1): 46. DOI: 10.1038/s41746-023-00782-2.

Vasilopoulou, A., Angelis, S., Balfousias, T. & Apostolopoulos, A. (2024). Types of Ligament Reconstruction and Rehabilitation Following Anterior Cruciate Ligament Reconstructions.https://www.intechopen.com /books.DOI: 10.5772/intechopen.1006153.

Wang, k. (2023). Effect of isokinetic muscle strength training on knee muscle strength, proprioception, and balance ability in athletes with anterior cruciate ligament reconstruction: a randomized control trial, Frontiers in Physiology,14:1237497. Doi: 10.3389/fphys.2023.1237497

Yu, F., Xiao, L. E., Wang, T., Hu, Y., & Xiao, J. (2024). Nurse-Assisted Rehabilitation Protocols Following Anterior Cruciate Ligament Reconstruction. Orthopedic nursing, 43(3), 163–178. https://doi.org/10.1097/NOR.0000000000001030

Zhang, F., Wang, C., Chen, X.& Li, H. (2022). Effects of Functional Training on Postoperative Anterior Cruciate Injury in Athletes Hospitalized. Rev Bras Med Esporte; 28(5): 528 531. https://doi.org/10.1590/1517 8692202228052022_0040

Zhong, Z., Guo, W., Gu, Q., Pang, T., Li, L. & Hao, A. (2025). The impact of exercise therapy on rehabilitation outcomes after anterior cruciate ligament reconstruction: a network meta-analysis. BMC musculoskeletal disorders, 26(1):632.

Zhou, H., Qian, J., Xing, Y. M., Cui, L., & Bu, Y. F. (2025). How effective is the addition of specific exercise therapy for patients after anterior cruciate ligament surgery? A systematic review and meta-analysis. Frontiers in physiology, 16, 1501458. https://doi.org/10.3389/fphys.2025.1501458

فعالية برنامج التمارين العلاجية على معلومات المرضى والألم والنشاط الوظيفي للركبة بعد جراحة الرباط الصليبي الأمامي بالمنظار

نهال محمود ابو الفضل   ـ   فاطمه محمد عطيه ـ نورا فارس محمد

يُعدّ العلاج بالتمارين الرياضية عنصرًا أساسيًا في الرعاية الصحية التي تُقدّم للمرضى بعد الجراحة حيث يُقلّل من الحاجة إلى الأدوية ويُعزّز التئام الجروح والتعافي المُبكر. **هدف الدراسة:** تقييم فعالية برنامج التمارين العلاجية على معرفة المرضى، وتخفيف الألم، ونشاط الركبة الوظيفي بعد جراحة الرباط الصليبي الأمامي بالمنظار. **المكان:** عيادات العظام الخارجية في مستشفى جامعة بنها، القليوبية، مصر وقد تم استخدام تصميم شبه تجريبي يتمثل في اختبار قبلي وبعدي علي عينه هادفه من من ١١٠ مريض بالغ حيث تم تقسيمهم بالتساوي إلى مجموعتين وهما مجموعة الدراسة ومجموعة المراقبه. **الأدوات:** تم إستخدام ثلاث أدوات لجمع البيانات وهما استبيان المقابلة المنظمة للمرضى، مقياس ألم الركبة الأمامي "مقياس كوجالا" وأداة قياس النشاط الوظيفي. **النتائج:** أوضحت أن ٦٠٪ من كلتا المجموعتين كان لديهم مستوى ضعيف من المعرفة الكلية قبل تنفيذ البرنامج، بينما بعد أسبوعين وبعد شهر واحد من البرنامج أصبح لدي مجموعة الدراسة مستوى معرفة جيد (٨٣,٦٪ و ٦٧,٣٪ على التوالي) مقارنة بمجموعه المراقبه (١٢,٧٪ و ١٠,٩٪ على التوالي) مع وجود فرق كبير ذي دلالة إحصائية. بالإضافة إلى ذلك، طوال مراحل البرنامج، كان هناك ارتباط سلبي وذو دلالة إحصائية بين ألم الركبة بين المرضى الذين خضعوا للدراسة وقوة عضلاتهم وكذلك أنشطة الحياة اليومية. وفي الوقت نفسه، كان هناك ارتباط إيجابي وذو دلالة إحصائية عالية بين نطاق حركة الركبة وأنشطة الحياة اليومية . **الاستنتاج:** كان برنامج التمارين العلاجية فعالاً في تحسين معرفة المرضى وتعزيز النشاط الوظيفي للركبة وتقليل مستوى الألم بين مجموعة الدراسة مقارنة بمجموعه المراقبه. **التوصيات:** يجب إجراء برامج تدريبية مستمرة لتحسين معرفة المرضى وممارساتهم فيما يتعلق بالتمارين العلاجية.