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Effect of Evidence Based Progressive Exercise Program on Functional Outcomes for Patients after Total Hip Replacement Surgery

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Abstract: **Hip replacement (total hip arthroplasty) is surgery to replace a worn-out or damaged hip joint. The surgeon replaces the old joint with an artificial joint (prosthesis). This surgery may be a choice after a hip fracture or for severe pain because of arthritis. It also helps relieve hip pain that can't be controlled by other treatments. Aim of the study: To evaluate the effect of evidence based progressive exercise program on functional outcomes for patients after total hip replacement surgery. Aquasi-experimental design was used to conduct the current study in orthopedic unit and outpatient clinics, at Benha university hospital during the period from beginning of November 2019 till beginning of November 2020. Subjects: A convenient sample of 60 patients recruited according to the study criteria. Tools: Four tools were utilized for data collection, 1) Structured interviewing questionnaire sheet, 2) Structured Knowledge questionnaire, 3) Performance based measures and 4) Self-reported measures. Results: Showed that the mean score regarding knowledge, performance based and self- reported measures were significantly higher after implementing the evidence based progressive exercise program than before program implementation. Moreover, there was a positive significant correlation between knowledge and each of HOOS and hip ROM scores, while a negative significant correlation with TUG. Also, there was a negative and significant correlation between Hip disability and Osteoarthritis Outcome and timed up and go test, where the higher the HOOS score the lower the score of TUG (p=<0.001[**]). Besides, there was a positive and significant correlation with hip ROM where the higher the HOOS score the higher the score of ROM (p=<0.001[**]). Conclusion: Implementing evidence-based progressive exercise program was effective in improving knowledge; performance based and self-reported measures for patients' functional outcomes after total hip replacement surgery. Recommendation: Reinforcement of receiving instructions for progressive exercises after THR rather than disease knowledge and complying with follow up visits to physiotherapy clinic is important in order to determine the progress of patients' functional outcome measures after surgery.**

Keywords: **Evidence Based, Functional Outcomes, Progressive Exercise Program, Total Hip Replacement.**

I. INTRODUCTION

Total hip replacement (THR) is a surgical procedure that relieves pain from most kinds of hip arthritis improving the quality of life for the large majority of patients who undergo the operation. Patients commonly undergo THR after non-operative treatments (such as activity modifications medications for pain or inflammation) have failed to provide relief from arthritis symptoms. Most scientific studies that have followed patients for more than 10 years have found "success rates" of 90 percent or more following traditional THR **(Leopold, 2020).**

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Total hip replacement surgery is indicated for patients who have failed conservative or previous surgical treatment options for a deteriorated hip joint due to osteoarthritis, rheumatoid arthritis and avascular necrosis and who continue to have persistent, debilitating pain and significant decrease in the activities of daily living. Patients with significant deformity and limitation of motion may also be candidates if the disability that results is considerable, even in the absence of pain. The decision to proceed with THR is made with an understanding of the potential benefits and risks. A thorough understanding of the procedure and the anticipated outcome is an important part of the decision-making process ***(Erens, et al., 2020; and Hansen, 2020).***

This procedure can bring almost immediate relief to the unremitting pain due to which the functional capacity of the lower limb has been greatly decreased. Especially to those patients with an end stage degenerative joint disease, total hip replacement is often the final attempt that the surgeons can resort to in terms of pain relief, increasing mobility and improved ability to perform routine daily activities ***(Heiberg, et al., 2013).*** Besides**,** as like any surgical procedure, total hip replacements have associated surgical complications. These can be divided into general and procedure specific. General complications include, infections, postoperative pulmonary issues and thromboembolic complications, and regarding procedural specific complications it includes, surgical site infection, hemorrhage, nerve injury, dislocation, leg length discrepancy, peri-prosthetic fractures and heterotrophic ossification ***(Park & Merchant, 2018).***

Despite all technical advances in THA over the last decades, there is still a certain number of dissatisfied patients with residual pain and function deficits regarding the postoperative outcome after THA. Since, hip replacement surgery can be a life altering event for the patient with advanced painful hip disease. Therefore, it is of great interest that routinely follow physiotherapy rehabilitation after a THR is accepted as the standard and essential treatment which contributes to effective recovery after joint replacement surgeries, which aims to maximize a person's functionality and independence and minimize complications such as hip dislocation (for hip replacement), wound infection, deep vein thrombosis, and pulmonary embolism ***(Jacobs, 2013).***

The physiotherapy rehabilitation routine has 4 components: Therapeutic exercise, transfer training, gait training, and instruction on activities of daily living. The effectiveness of evidence based physiotherapy progressive exercise following total hip replacement is well documented in systematic review and meta-analysis which showed that patients receiving physiotherapy exercise had improved physical function at 3-4 months ***(Artz, et al ., 2015),*** and as a result patient-reported as hip disability and osteoarthritis outcome (HOOS) and performance based measures as hip range of motion (ROM) and timed up and go test (TUG) have routinely been introduced by the national health systems and quality networks to ensure clinical standards and supervise outcome and rehabilitative efforts after THA ***(Weber, et al., 2019).***

Hence, the role of the nurse in the care of the hip replacement patient is to educate, provide safe and competent care, and help coordinate the care provided by the multidisciplinary team. The nurse is a critical link in providing the continuity of care required for these patients throughout the perioperative phase ***(Barden & Chandler, 2016),*** and in this context as an important part of post-operative nursing health care, the nurse remind the patient to take medical prescription to mitigate pain. Besides, as a collaborative effort with allied health professionals, the nurse also encourage the patient to undertake the exercise regime prescribed by physiotherapist to enhance activities of daily living during the recovery period, more over providing education to the patient and the carers before the patient is discharged home to promote continuity of therapeutic regimen (e.g. progressive limbs exercise), active participation and understanding of the rehabilitation process and home care after THA ***(Miller, et al., 2017) .***

II. SIGNIFICANCE OF THE STUDY

Hip replacement (HR) is the most frequently performed and effective surgeries worldwide, it is mainly carried out among people aged 60 years and over, also during 2018 it was reported that the incidence of primary HR in the USA increased to 300.000 patients every year **(*Organization for economic cooperation and development (OECD), 2019).*** Despite all technical advances in THA over the last decades, there are still a certain number of dissatisfied patients with residual pain and function deficits regarding the postoperative outcome after THA ***(Nabil, 2017).*** Therefore, it is of great interests that routinely follow physiotherapy rehabilitation involving progressive exercise regimen after joint replacement surgeries.

Since functional outcomes has become a basic health professionals concern to ensure that after successful THR surgery. And the effectiveness of physiotherapy progressive exercises following total hip replacement is well documented in systematic review and meta-analysis ***(Yip, 2018).*** Moreover, ***Klapwijk, et al. (2017)*** had approved that Fast track rehabilitation improves early functional outcome and has shown a continued improvement of reported passive range of movements, reduction of pain and gradual improvement in quality of life and function. So, the present study intended to evaluate the effect of evidence based progressive exercise program on functional outcomes for patients after total hip replacement surgery.

The aim of the present study was to evaluate the effect of evidence based progressive exercise program on functional outcomes for patients after total hip replacement surgery. Through:

- Assessing knowledge among patients undergoing total hip replacement surgery.

- Measuring hip ROM, and TUG as performance-based measures.

- Assessing hip disability and osteoarthritis outcome score as a self-reported measure.

- Developing, implementing the evidence based progressive exercise program and evaluating functional outcomes.

III. RESEARCH HYPOTHESES

To fulfill the aim of this study the following research hypotheses were formulated:

H1–Patients receiving evidence based progressive exercise program will display significantly higher knowledge score after implementing progressive exercise program than before program implementation.

H2–Patients receiving evidence based progressive exercise program will exhibit significantly greater improvement in hip disability and osteoarthritis outcome score after implementing progressive exercise program than before program implementation

H3–Patients receiving evidence based progressive exercise program will display significantly greater improvement in hip ROM and TUG scores after implementing progressive exercise program than before program implementation.

Operational definition:

Functional outcomes: The ability to perform a physical activity or task which have indicators for measuring its degree of improvement including:

-Performance based measures as hip range of motion (ROM) and timed up and go test (TUG).

- Self reported measure as hip disability and osteoarthritis outcome score.

IV. SUBJECTS AND METHODS

– Research design: Quasi-experimental design was utilized to conduct the current study.

- Setting:

This study was conducted in orthopedic department at Benha University Hospital then; it was completed in outpatient clinics for follow-up.

- Subjects:

A- Type: Convenient sample.

B-Size: A total 68 of patients were recruited in the current study, who were planned for total hip replacement surgery throughout six months period. They had the exercise program to reach at the end of study period to 60 patients.

C- Inclusion criteria: The patients had been selected according to the following criteria: BMI less than 35, and had arthroplasty in one hip. While, excluded patients who had reoperations in the area of endoprosthesis

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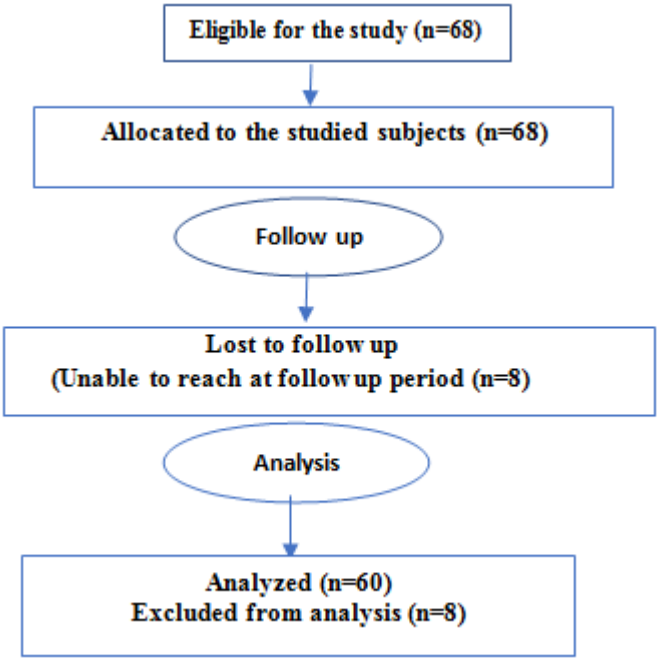

Figure 1: Flow chart of studied subjects

4.4- Tools of Data Collection

Four tools were utilized for data collection.

Tool (I): Structured interviewing questionnaire sheet: it was developed by researchers, to assess the patients' socio-demographic characteristics and health-related data and was divided into two parts:

Part 1: Concerned with socio-demographic characteristics of the study subjects including; age, gender, marital status, residence, education level, nature of work, presence of caring personnel and BMI.

Part 2: Health related data such as; presence of comorbid disease, time since diagnosis, complain before surgery, affected limb, nature of pain, treatment regimen before surgery, assistive device used and chief complain after surgery. etc.

Tool (II): Structured Knowledge Questionnaire. It was developed and written in Arabic language by the researchers after reviewing relevant literature ***(Grey Bruce Health Network, 2011; Batkin, et al., 2012; American Academy of Orthopaedic Surgeons, 2014; and Vancouver Coastal Health, 2016),*** and agreed upon by a panel of experts to assess subjects' knowledge needs in form of multiple choice questions and closed ended questions. It was divided into three major sections:

Section (a): It entails knowledge regarding total hip replacement surgery (THR): It comprised (9 multiple choices questions and (2) closed ended question) about definition of THR, indications for THR, patients' preparation before surgery, experienced problems after surgery, when to return to undergo another surgery (the total score was 29 marks)

Section (b): It assesses patients' knowledge regarding post discharge instructions, comprised of (30 multiple choice questions & 6 closed ended questions), which are specified to pain management, diet information, medications, position, activities of daily living (ADL) with specific precautions, possible required equipment and safety precautions for its use, and follow up after surgery (the total score was 96 marks)

Section (c): It includes Hip exercise knowledge, comprised (4 multiple choice questions and 4 closed ended questions) which are specified to definition, benefits, frequency, types, tips before hip exercises and during performance (the total score was 16 marks).

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Scoring system: All knowledge variables were weighted according to the items included in each question of multiple choices [a question that implies response with (don't know) scored as "0" and the other correct responses in the same question had a score according to their number. Another question which has a response with "wrong answer or don't know" scored as "0", while correct answer was scored as "1". The total score was 141, patients' knowledge was considered (poor) if percent score was < 50%= <71, (average) if percent score was 50 %-< 70% = 71-<99, and (good) if percent score was ≥ 70%= 99 and more

Tool (III): Performance based measures:

A-Timed up and go test (TUG) This instrument was adopted from ***(Wright, et al., 2011)*** in order to assess strength, agility, mobility and dynamic balance through rising from chair, walking short distance and changing direction.

Scoring system: Total time to arise from chair, walk 3 meters, turn around, return to chair and sit down. Two trials performed and the faster of the two is recorded to the nearest 10th of a second.

B-Hip ROM using Myrin goniometer, which was used to measure active range of motion (AROM), while patients were standing for flexion, extension, abduction, adduction of hip joint**.** Baseline limitation on ROM of a patient can be obtained before treatment, and changes induced in this motion after therapeutic interventions is easily determined

- Flexion 0 to 125 degrees
- Extension 115 to 0 degrees
- Abduction 0 to 45 degrees
- Adduction 45 to 0 degrees

Tool (IV): Self-reported measures, include Hip disability and Osteoarthritis Outcome Score (HOOS): The HOOS is a patient-administered questionnaire, the Arabic version of (HOOS) was adopted from ***(Al-Samhan, et al., 2020),*** is a questionnaire intended to be used to assess the patient's opinion about their hip and associated problems and to evaluate symptoms and functional limitations related to the hip during a therapeutic process, that consists of 40 items, which are answered using a Likert-type scale. These items are divided into 5 subscales: Pain (10 items), symptoms (5 items), activity of daily living (17 items), sport and recreation (4 items), and hip related quality of life (4 items). Scores are calculated for each subscale separately by transforming raw data to a 0-100 point scale - where 0 indicates extreme pain and discomfort, and 100, on the other hand, indicates that respondent has no problems To answer the questions, standardized answer options are given in 5 Likert-boxes with scores from 0 to 4 (no, mild, moderate, severe and extreme). To interpret the score, Scores are calculated for each subscale separately and the outcome measure is transformed in a worst to best scale from 0 to 100, with 100 indicating no symptoms and 0 indicating extreme symptoms. To calculate the total HOOS score the subscales need to be summed up, using following formula for all dimensions. 100 – [(patient's score of the subscale x 100)/ (total score of the subscale)].

Tools validity:

The content validity was done through seven panels of experts in medical and nursing field for face and content validity, and their opinions were requested via an assessment form. The experts were asked to grade each item as "essential," "useful but inadequate" or "unnecessary". Modifications were carried out according to experts' judgment on the clarity and appropriateness of content. The percentage of consensus among experts regarding structured interviewing questionnaire was 96%, Structured knowledge questionnaire was 95%, also**, *(Wright, et al., 2011),*** pointed out that TUG and hip ROM validity, construct - good to excellent. Regarding HOOS scale, the Arabic version may be a good diagnostic tool for patients with hip problems as reported by ***(Nilsdotter & Bremander, 2011).***

Pilot study

It was conducted on 10% of the total sample (6 patients), and they were excluded from the study sample. In order to test the feasibility and reliability of tools. It revealed that, internal consistency for structured interviewing questionnaire was (r= 0.92, 0.90, 92 and 0.96, respectively). Regarding Cronbach's alpha value for **HOOS scale** was 0.98 for the pain subscale, 0.98 for the stiffness, and 0.99 for the physical function subscale. For the second testing, reliability was 0.99,

0.97, and 0.99 (pain, stiffness, and physical function, respectively). This only proves that this tool is an instrument with good reliability. Intra-class correlation coefficients for each of the subscales was between 0.56 (Activity of daily living subscale) and 0.62 (Symptoms subscale), and this puts them all in a category of instruments with moderate reliability ***(Al-Samhan, et al., 2020).*** **Reliability**: **Inter-rater -** excellent in people with hip osteoarthritis within 7 days. **Test-retest** - good in patients with advanced hip and knee OA awaiting hip arthroplasty when retested after 6 months ***(Wright, et al., 2011).*** Flexion and extension (ICC=0.946 and ICC=0. 955) of the hip joint showed excellent reliabilities, followed by hip abduction and adduction concluding that the active range of motion test using a manual goniometer showed very high test-retest reliability ***(Kim & Kim, 2016; and Bhamare, et al., 2017).***

Ethical considerations:

This study was conducted under the approval of the Faculty of Nursing Ethics Committee, Benha University. An explanation about the purpose of the study was given to participants, and they were also informed that they could withdraw from the study at any time before the completion of the study. After agreement for Participation in the study, participants were asked to sign a consent form. Moreover, they were reassured that all information gathered would be confidential and used only for the purpose of the study.

Field of work

Data were collected in the following sequence

- An official permission to carry out the study was obtained from pertinent authorities after explanation of its purpose. Then, structured interview was conducted for patients eligible for the study (fulfilled the inclusion and exclusion criteria) in order to explain the purpose of the study, assure confidentiality and to obtain informed written consent.

- Data collection extended over a period of 12 months from beginning of November 2019 to beginning of November 2020.

Procedures:

The evidence based exercise program comprised the following phases:

A- Assessment Phase:

Patients who were planned for undergoing THR surgery were interviewed in groups before applying the program in order to collect the baseline patients' data using all study tools. This interview took about 30 to 35 minutes.

B- Implementation phase

The evidence based exercise program (involving two parts; theoretical and practical parts) was implemented for the studied patients individually, while they were approached two days before surgery, as well as during their hospital stay after surgery at orthopedic department. **The first theoretical part** was conducted through **two sessions**, the first session was carried out during assessment phase, involved (overview about total hip replacement and experienced problems after surgery, and postoperative management) and the second session involved (Post discharge instructions regarding activities of daily living (ADL) with specific precautions, possible required equipment and safety precautions for its use, as well as it involved (Hip exercise knowledge, comprising its types, and tips before and during hip exercises performance.

While, **the second practical part** was conducted through **five sessions**. Scheduled progressive exercises, based on exercise scheme of ***(Handoll, et al., 2011)*** and other relevant studies. The exercise protocol for studied subjects consisted of 10 basic isometric and AROM exercises commonly performed during the acute phase of recovery from THA. These exercises consisted of ankle pumps, thigh squeezes (quadriceps sets), buttock squeezes (gluteal sets), leg roll out and in, heel slides (hip and knee flexion), leg slides (abduction/adduction), lying kicks (short arc quadriceps), straight leg raises, and sitting kicks (long arc quadriceps) which were implemented individually. Each session took about 30 to 35 minutes, where each exercise was performed from 5-10 sets at morning time till performance was found satisfactory under supervision of researchers and then instructed to repeat the exercises at afternoon and evening times (3 repetitions per day) independently during their hospital stay. Then, patients were recommended to continue practicing these exercises at home in the following 8 weeks, using booklet as a guide. The first follow-up visit was scheduled within the next 2 weeks

to ensure that subjects were performing the exercises correctly and to progress the exercises as needed. If tolerated, all exercises were progressed to 5 repetitions at this time. A second follow-up visit was scheduled within the next 2 weeks. During the second follow-up visit, exercises were again checked for proper form and progressed to 10 repetitions. Study subjects recorded their exercise compliance in an exercise log and turned the log in at the end of the 8 weeks.

The booklet containing the content of the exercise program was given to each patient under the study to help for reviewing, support teaching and training at home. It was developed by the researchers based on review of current literature. It was written in a simple Arabic language and supplemented by photos and illustrations to help the patient understanding its contents.

c- Evaluation phase

-Immediately after implementation of the evidence based exercise program **(prior to their discharge & after one month)**, each patient in the study was interviewed to evaluate knowledge using tool (II) (Structured knowledge questionnaire), and Tool (III) (Functional outcome measures).

After three months from implementation of the intervention, evaluation of patients was done in the out patients clinics using the same previous study tools

After six months, study subjects were reevaluated by the researchers using the same previous study tools

Data Analysis

The collected data were tabulated and statistically analyzed using an IBM computer and the statistical package for social science (SPSS) advanced statistics, version 20 (SPSS Inc., Chicago, IL). Numerical data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage. For quantitative data, paired t test was used for comparison between two study periods. One-way ANOVA for repeated measures at different time intervals for the studied group was done and Pearson method was used to test correlation between numerical variables. A p-value < 0.05 was considered significant, and <0.001 was considered highly significant.

V. RESULTS

Table 1 Shows the distribution of the studied subjects according to their socio-demographic characteristics, where their mean age was **(60.05 ±7.93) years** and 56.7 % of them were females as well as, 73.3 % were married, more over 66.7% were residing in rural areas, regarding their educational level 45% were had primary education besides, 38.3 % were house wives, requiring a hard work effort in about 71.7%. Besides, 66.7% of them had care givers, more over their mean BMI was **(28.99 ±3.26)**.

Table 2 Clarifies the distribution of studied subjects regarding their health related data, with 53.3% of them were smokers and 81.7 % had comorbid disease, also all of them were complaining from low limb pain since a mean period of (3.08 ±0.91) years, chronic in nature among 56.7% of studied subjects, and their treatment regimen before surgery was Analgesics and corticosteroids among 66.7%, and the mean period of their hospital stay was **25.1 ±5.9 days,** moreover 63.4% utilized walker as an assistive device after surgery, and the most frequent problem after surgery was pain in the affected side, then stiffness, weakness and swelling.

Figure 2 Portrays distribution of studied subjects according to indications for surgery, revealing that osteoarthritis was main cause for total hip replacement surgery among (63.3%) of the studied subjects.

Table 3. Indicates that, the difference in mean scores of knowledge **throughout different study periods** were highly statistically significant (p≤ 0.001), in term of knowledge improvement after program implementation where mean score of knowledge after one month was 112.90± 12.08 and after 3 months of surgery was 105.35± 12.23 to be at the end period (6 months after surgery) 94.75± 11.39 but remain significantly higher than before program implementation which was 71.15± 5.12.

Table 4. Shows that, the difference in **performance based measures for functional outcomes (Hip ROM & TUG) throughout different study periods** were highly statistically significant (p≤ 0.001), indicating an improvement in hip ROM after program implementation. where mean score of ROM after one month was 112.90± 12.08 and after 3 months

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of surgery was 105.35± 12.23 to be at the end period (6 months after surgery) 94.75± 11.39 but remain significantly higher than before program implementation which was 71.15± 5.12, also there was an improvement in TUG after program implementation where mean score after one month was 112.90± 12.08 and after 3 months of surgery was 105.35± 12.23 to be at the end period (6 months after surgery) 94.75± 11.39.

Table 5. Reveals that, the mean difference in **self-reported measures for functional outcomes (HOOS) throughout different study periods** was highly statistically significant ($p \leq 0.001$), indicating an improvement in (symptoms, pain, activity of daily living, functioning, and quality of life) after program implementation. where the total mean score after one month was 52.38± 8.82 and after 3 months of surgery was 66.15± 5.73to be at the end period (6 months after surgery) 75.08± 4.75 but remain significantly higher than before program implementation which was 38.13± 12.51.

Table 6. Clarifies that, there was a significant negative correlation between knowledge and timed up and go test score, and a significant positive correlation with each of hip range of motion and Hip disability and Osteoarthritis Outcome Score. Also there was a negative and significant correlation between Hip disability and Osteoarthritis Outcome Score and timed up and go test, where the higher the HOOS score the lower the score of TUG ($p=<0.001^{**}$), and also it reveals appositive and significant correlation with hip ROM where the higher the HOOS score the higher the score of ROM ($p=<0.001^{**}$).

Table (1). Distribution of the studied subjects according to their socio-demographic characteristics (n=60)

Socio Demographic Data \ Frequency	(No=60)	%
*** Age (in years)**		
< 50	3	5.0
50-<60	17	28.3
60 or more	40	66.7
- Mean ± SD	**60.05 ±7.93**	
*** Gender:**		
Female	34	56.7
Male	26	43.3
*** Marital status:**		
Married	44	73.3
Not married	16	26.6
*** Residence:**		
Rural	40	66.7
Urban	20	33.3
*** Education:**		
Illiterate	5	8.3
primary	27	45.0
Secondary/ Diplomat	16	26.6
High education	12	20.0
*** Occupation:**		
House wife	23	38.3
Free work	17	28.3
Governmental work	7	11.7
Retired	13	21.7
*** Nature of work :**		
Simple work	9	15.0
Moderate work	8	13.3
Hard work	43	71.7

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*** Presence of care givers**		
No	20	33.3
Yes	40	66.7
***BMI**(kg/cm^2)		
< 29 (kg/cm^2)	23	38.3
≥ 29 (kg/cm^2)	37	61.7
Mean ±SD	**28.99 ±3.26**	

(BMI) Body Mass Index (No) Number (SD) Standard Deviation

Table (2): Distribution of studied subjects according to their Health-related data (n= 60).

Frequency / Health -related Data	(No=60)	%
*** Smoking**		
No	19	31.7
Yes but quit now	9	15.0
Continue to smoke	32	53.3
*** Presence of comorbid disease**		
No	11	18.3
Yes	49	81.7
Diabetes mellites	17	28.3
Hypertension	28	46.7
Coronary artery disease	4	6.7
*** Complain #**		
Low back pain	45	75.0
Low limb pain	60	100.0
***Time since complain (in years)**	**3.08 ±0.91**	
*** Pain in lower limb**		
Right	25	41.7
Left	27	45.0
Both	8	13.3
*** Nature of pain**		
Acute (7 days-7 weeks)	4	6.7
Chronic (7 weeks- 6 months)	22	36.7
More than 6 months	34	56.7
*** Treatment regimen**		
Physiotherapy	6	10.0
Heat therapy	2	3.3
Analgesics and corticosteroids	40	66.7
No treatment	12	20
***Duration of hospital stay (in days)**	**25.1 ±5.9 (15-36)**	
***Assistive devices after surgery**		
Commode chair	14	23.3
Wheel chair	8	13.3
Walker	38	63.4
***problems after surgery** #		
Pain	60	100.0
Stiffness	40	66.7
Weakness	40	66.7
Swelling	39	65.0

(#) not mutually exclusive (No) Number (SD) Standard Deviation

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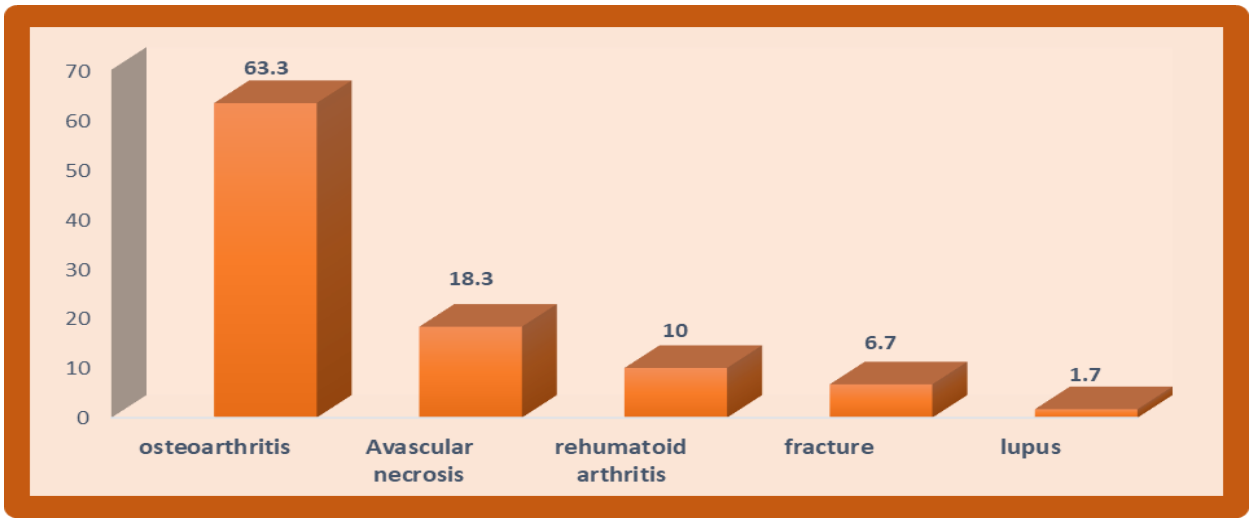

Fig (2): Distribution of studied subjects according to indications for surgery (n= 60)

Table (3): Difference in mean scores of knowledge during different study periods (preprogram, after one month, after three months, and after six months) (n=60)

Different study periods / Patients' Knowledge	Preprogram (1- 2 days before operation)	Post program (at discharge- after one month)	Post program (3 months after operation)	Post program (6 months after discharge)	F (Anova with repeated measures)	
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	F- test	p- value
Osteoarthropathy surgery	9.40± 1.12	22.90± 2.49	21.25± 2.74	18.90± 3.19	0.024	<0.001**
Post discharge instructions	54.30± 4.22	77.10± 7.39	73.35± 8.21	66.70± 7.09	0.065	<0.001**
Hip exercises after surgery	7.45± 1.17	12.90± 2.61	10.80± 1.88	9.15± 1.33	0.170	<0.001**
Total knowledge	71.15± 5.12	112.90± 12.08	105.35± 12.23	94.75± 11.39	0.051	<0.001**
	(1) t test = - 31.21 p value <0.001**		**(2) t test= - 23.71 p value < 0.001****		**(3) t test = - 18.04 p value < 0.001****	

(n.s) Not Statistically Significant (**) Highly Statistically Significant

(1) Mean difference in total knowledge score between pre and Post program (after one month of surgery)

(2) Mean difference in total knowledge score between pre and Post program (after 3 months of surgery)

(3) Mean difference in total knowledge score between pre and Post program (after 6 months of surgery)

Table (4): Difference in mean scores of performance based measures for functional outcomes (Hip ROM & TUG) during different study periods (preprogram, after one month , after three months, and after six months) (n=60)

Different study periods / Performance based measures	Preprogram (1- 2 days before operation)	Post program (at discharge- after one month)	Post program (3 months after operation)	Post program (6 months after discharge)	F (Anova with repeated measures)	
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	F- test	p- value
Hip Flexion	96.90± 5.23	91.35± 5.03	95.50± 5.50	103.40± 5.18	0.066	<0.001**
Hip Extension	6.70± 1.43	5.90± 1.15	6.45± 1.25	7.59± 1.29	0.255	<0.001**
Hip Adduction	24.40± 2.54	22.05± 2.48	23.80± 2.44	26.85± 1.95	0.069	<0.001**
Hip Abduction	21.25± 2.97	19.65± 2.77	20.95± 2.86	24.30± 2.45	0.104	<0.001**
TUG	19.70± 2.82	24.25± 3.43	20.90± 2.79	17.60± 2.42	0.061	<0.001**

(TUG) Timed up and go (**) Highly Statistically Significant

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Table (5): Difference in mean scores of self-reported measures for functional outcomes (HOOS) during different study periods (preprogram, after one month, after three months, and after six months) of intervention (n=60)

Different study periods / Self-reported measures (HOOS)	Preprogram (1- 2 days before operation)	Post program (at discharge- after one month)	Post program (3 months after operation)	Post program (6 months after discharge)	F (Anova with repeated measures)	
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	F- test	p- value
symptoms	35.00± 12.86	53.50± 14.45	67.50± 7.04	73.75± 7.79	0.061	<0.001**
Pain	39.88± 14.41	47.88± 7.28	62.63± 8.15	76.75± 8.06	0.056)	<0.001**
Activity limitations daily living	36.61± 11.47	54.26± 6.68	64.17± 6.39	73.76± 4.22	0.041)	<0.001**
Function, sport and recreational activities	39.38± 16.81	58.13± 12.14	71.56± 4.22	72.81± 2.99	0.115	<0.001**
Hip related quality of life	38.29± 16.13	54.69± 11.94	70.62± 6.01	77.19± 6.39	0.105	<0.001**
Total	38.13± 12.51	52.38± 8.82	66.15± 5.73	75.08± 4.75	0.062	<0.001**
	(1) t test = - 24.53 p value <0.001**		**(2) t test= - 24. 64 p value < 0.001****		**(3) t test = - 28.38 p value < 0.001****	

(ADL) Activity of daily living (HOOS) Hip Disability and Osteoarthritis Outcome Score (**) Highly Statistically Significant

(1) Mean difference in Hip Disability and Osteoarthritis Outcome Score between pre and Post program (after one month of surgery)

(2) Mean difference in Hip Disability and Osteoarthritis Outcome Score between pre and Post program (after 3 months of surgery)

(3) Mean difference in Hip Disability and Osteoarthritis Outcome Score between pre and Post program (after 6 months of surgery)

Table (6) : Correlation between knowledge, self-reported measures (HOOS) and performance measures (Hip ROM & TUG) for functional activity after surgery (after 6 months post program) (n=60)

r-\ p value / performance measures	Self-reported measures (HOOS)		Knowledge	
	r- test	P-value	r-test	P-value
TUG	-0.632	<0.001**	-0.473	<0.001**
ROM (hip flexion)	0.482	<0.001**	0.607	<0.001**
ROM (hip extension)	0.539	<0.001**	0.441	<0.001**
ROM (hip adduction)	0.658	<0.001**	0.604	<0.001**
ROM (hip abduction)	0.523	<0.001**	0.512	<0.001**
Self-reported measures (HOOS)	-	-	0.424	0.001**

(HOOS) Hip Disability and Osteoarthritis Outcome Score (TUG) timed up and go test

(ROM) range of motion (**) Highly statistically significant at ≤0.01

Weak = indicates (r < 0.5) Good = indicates (r > 0.5-0.75)

Fair = indicates (r = 0.5) Very good = indicates (r >0.75)

VI. DISCUSSION

The study aimed to evaluate the effect of evidence based progressive exercise program on functional outcomes for patients after total hip replacement.According to characteristics of the studied subjects, the present study results showed that, the mean age was (**60.05 ±7.93) years** and more than half of them were male, These findings were congruent with that of ***Joy, et al., (2017)***, who revealed in their study about "Influence of Hip Muscle Motor Control Training on Pain and Function Post Total Hip Replacement" that, the mean age of studied subjects was 60.60 ± 14.93 years and the highest percentage of them were female. Also the current study showed that less than half were primary educated, and about two fifths were house wives, requiring a hard work effort in more than two thirds of study subjects besides, having care givers,

and also their mean BMI was **(28.99 ±3.26)**. which is consistent with that of ***Tungtrongjit, et al., (2012),*** who studied "The Effect of Preoperative Quadriceps Exercise on Functional Outcome after Total Knee Arthroplasty" and revealed that, Most patients were females, older than 60 years, primary school educated, housekeeper occupation, besides, ***Çankaya, et al., (2016),*** added in their study about "The influence of social and demographic features on functional level and quality of life after total knee arthroplasty" that, mean BMI of the studied subjects was 29.8±3.1 (kg/cm^2). While was not in the same line with ***Fox, (2014),*** who stated in a study about "Implementing an Integrative Pre and Postoperative Educational Intervention for Older Adults Undergoing Total Hip and Knee Replacement at Holland" that, the majority of their studied subjects were had retired. In the investigator point of view, which may be due to consequence of the operation and its rehabilitation program after the surgery.

Concerning health related data among studied subjects, the present study revealed that more than half of them were smokers and about three fifths had comorbid disease. These finding was congruent with ***Çankaya, et al., (2016),*** who stated that the high percentage were smokers and had associated co morbidities especially cardiovascular disease (CVDs), this might be interpreted as smoking and presence of comorbidities were found to be influential factors. Also, ***Kendir, et al., (2018),*** who conducted study entitled "cardiovascular disease patients have increased risk for comorbidity that there were associations between CVDs and other chronic diseases" and showed that, all CVDs associated with many of comorbidities. Moreover, ***Podmore, et al., (2020),*** concluded in their study about, "Access to hip and knee replacement surgery in patients with chronic diseases according to patient-reported pain and functional status" that, patients with chronic diseases reported more severe joint problems immediately before hip or knee replacement surgery suggesting they have hip or knee replacement later in the course of their joint disease. Also the current study reveals that study subjects were complaining from low limb pain since a mean period of (3.08 ±0.91) years, chronic in nature among more than half of them for More than 6 months, which is consistent with results of ***Rydevik, et al., (2010),*** in their study about **"**Functioning and disability in patients with hip osteoarthritis with mild to moderate pain" and pointed out that the mean duration of pain was (2.3 ± 1.5) years. Moreover, it was revealed that, treatment regimen before surgery was Analgesics and corticosteroids among nearly two thirds, that is similar with the study of ***Tungtrongjit, et al., (2012),*** who reported that, most of patients were using Pre-operative analgesic as NSAIDs as a regimen before surgery. Besides, the mean period of their hospital stay was **25.1 ±5.9** that is congruent with ***Yildirim, et al., (2015),*** who stated in their study about "The impact of hospital rehabilitation on functional outcomes and quality of life after total knee arthroplasty", that duration of hospital- based rehabilitation was (24.1±5.8) days. Also less than two thirds of subjects pointed out that osteoarthritis was the main cause for undergoing total hip replacement surgery and, this finding was supported by ***Belmont, et al., (2015) & Joy, et al., (2017),*** who revealed in their studies that, most of study subjects underwent THR as a result of osteoarthritis.

Concerning patients' knowledge during different study periods, the present study revealed that the difference in mean scores of knowledge was highly statistically significant ($p \leq 0.001$), in term of knowledge improvement after program implementation where mean score of knowledge was higher than before program implementation, **which supported the first research hypothesis.** With regards to the term of lower mean score of knowledge before program implementation may be due to that, doctors/ nurses focus on providing brief guidelines just before discharge to be significantly higher after program implementation, assuring the effectiveness of the program, and also indicating that, when the information is given to patients in a simplified way their knowledge improves. This result was in agreement with ***Muhammad & Mujaisar, (2012),*** who reported that, in a study about "Assessment of patients' knowledge toward total hip replacement home-care, at Iraq", that, the majority of the sample were lacking knowledge related to hip joint replacement. Then with, ***Billon, et al., (2017),*** who added in their study about "Prospective assessment of patients' knowledge and informational needs and of surgeon-to-patient information transfer before and after knee or hip arthroplasty" and pointed out that, the level of patients' knowledge was fairly low and varied considerably across individuals and time points in the management process. Also consistent with ***Bakr, (2018),*** who studies" Effect of Educational Program on Quality of Life for Patients Post Hip Joint Replacement" and revealed that there were highly statistically significant satisfactory level regarding knowledge differences at pre, post and follow up periods of education program implementation

Regarding difference in performance measures for physical functioning (Hip ROM & TUG) throughout different study periods, there was highly statistically significant improvement in hip ROM & TUG after program implementation **Which supported the second research hypothesis,** this may be attributed to that, the exercise program affect positively

of patient knowledge and improve their adherence, and as a result played more vital and essential part in such improvement, also more than two thirds of studied subjects had care givers, Which may be interpreted as living with family had a positive impact on change of physical functioning. This is consistent with previous research about "The connection between strong social support and joint replacement outcomes", showing social support to positively affect outcomes in patients with joint replacement surgery, which was conducted by ***Theiss, et al., (2011).***

These results were supported by ***Correia, et al., (2019),*** who reported in his study entitled "Digital Versus Conventional Rehabilitation After Total Hip Arthroplasty" that, intervention group showed superiority at all-time points for TUG (change between baseline and 4 and 8 weeks: P<.001; change between baseline and 3 and 6 months: P=.001 and P=.005, respectively), with a difference between median changes of −4.79 seconds (95% CI −7.24 to −1.71) at 6 months post total hip arthroplasty. Between baseline and month 6, results were also superior in the intervention group for the HOOS sports and QoL subscales and all ROM except for standing flexion. Meta-analysis conducted by ***Lee, et al., (2017),*** concerning, "Effect of lower-limb progressive resistance exercise after hip fracture surgery" and revealed that, progressive resistance exercises (PRE) after hip fracture surgery improves mobility, activities of daily living, balance, lower-limb strength or power, and performance task outcomes.

Concerning mean difference in self-reported measures for physical functioning (HOOS) throughout different study periods, the current study revealed that, there was highly statistically significant improvement in (symptoms, activity of daily living, functioning, and quality of life) after program implementation **Which supported the third research hypothesis,** This might be due to the effect of exercise program in improving functioning and ROM which should provide adequate mobility to perform the majority of task of daily living & as a result improves quality of life and decreasing symptoms & level of dependency post program implementation.

These results were in the same line with ***Villadsen, et al., (2013),*** who studied "Postoperative effects of neuromuscular exercise prior to hip or knee arthroplasty" and reported that, the intervention group experienced a statistically significant short-term benefit in ADL and pain, suggesting an earlier onset of postoperative recovery than control group. Also, this result was in the same line with ***Fox, (2014),*** who reported in the study "Implementing an Integrative Pre and Postoperative Educational Intervention for Older Adults Undergoing Total Hip and Knee Replacement", that, improvement in pain control with the use of a preoperative educational intervention in patients undergoing TKRs and THRs showed significantly improved outcomes with multidisciplinary education. Moreover, these results were agreed with ***Ward, (2017),*** who mentioned in his study entitled "A physiotherapy-led exercise program after total hip replacement" that, at 18 weeks post-operation, the intervention group showed a statistically significant improvement in pain levels, joint stiffness, physical function and walking speed.

Regarding Correlation between knowledge, self-reported measures (HOOS) and performance measures (hip ROM & TUG) for functional activity after surgery, the current study showed that there was a significant negative correlation between knowledge with timed up and go test score, and a significant positive correlation with each of hip range of motion and Hip disability and Osteoarthritis Outcome Score which is consistent with ***Murphy, et al., (2011) & Tayswee-Cheng, et al., (2015)*** studies which pointed out that patient education is closely linked to the recovery process and promotes early recovery, also the current study showed a negative and significant correlation between Hip disability and Osteoarthritis Outcome and timed up and go test, where the higher the HOOS score the lower the score of TUG (p=<0.001**). And also it reveals appositive and significant correlation with hip ROM where the higher the HOOS score the higher the score of ROM (p=<0.001**).

These results were in agreement with ***Abdelaleem & Rizk, (2018),*** who studied "Health-related quality of life in Egyptian patients with osteoarthritis: correlation with performance-related measures" and mentioned that, There was a statistically significant negative correlation between all of the KOOS (Knee Injury and Osteoarthritis Outcome Score) domains and Timed Up and Go (P≤0.01).

VII. CONCLUSION

Implementing evidence-based exercise program was effective in improving knowledge, besides hip disability and osteoarthritis outcome score as a self-reported measures as well as hip ROM and TUG as a performance based measures for functional outcomes after total hip replacement.

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VIII. RECOMMENDATIONS

Based on the results of the study, the following recommendations are suggested :

1. Assuring the importance of implementing the planned instructions for patients with THR before and after operation as well as during recovery period

2. Reinforcement of receiving instructions for progressive exercises after THR rather than disease knowledge.

3. Complying with Follow up visits to physiotherapy clinic is important in order to determine the progress of patient's functional outcome measures after surgery.

4. Conducting in-service training programs periodically and regularly to teach THR patients self-care skills after surgery. In addition, Innovative educational programs are needed to improve patients' knowledge and practices.

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