Effect of a Physical Training Program on the Functional Health Status among Patients with Knee Osteoarthritis

Dr Amna Y. Saad, Dr Abeer M. El-shatby and Dr Samah M. Sofar

Medical-surgical Nursing department, Faculty of Nursing, Alexandria University, Egypt.
Abeer_elshatby@yahoo.com

Abstract: This study aimed to evaluate the effect of a physical training program on the functional health status among patients with knee osteoarthritis. A quasi experimental design was used. This study was carried out in the Outpatient Clinic at El-Hadara Orthopedic and Traumatology University Hospital, Alexandria. A convenient sample of 20 adult patients with mild or moderate knee osteoarthritis was assigned. Three tools were developed and used; namely tool (I): Osteoarthritis Patient's Assessment was developed, tool (II) Knee Osteoarthritis Assessment Checklist and Tool (III): the Algofunctional for Knee Osteoarthritis Index (AKOI). The exercise training program consisted of stretching, strengthening and range of motion exercises. The studied sample performed a physical training program every day for 6 weeks. The results of the study revealed that there was a statistically significant improvement in the functional health status among patients with knee osteoarthritis following the exercise training program. The study concluded that muscle strengths, pain, range of motion and ability to perform activities of daily living were improved after implementation of the physical training program. The study recommended that nurses should incorporate physical training program into their routine general practice activity.
[Amna Y. Saad, Abeer M. El-shatby and Samah M. Sofar. **Effect of a Physical Training Program on the Functional Health Status among Patients with Knee Osteoarthritis.** *J Am Sci* 2015;11(4):96-109]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 11

Key words: Physical training program, knee osteoarthritis, Functional Health Status.

1. Introduction

Osteoarthritis (OA) is the most common musculoskeletal disease in the world, affecting the synovial joints [(1)]. In 2011, the estimated number of patients with knee osteoarthritis in Japan was approximately 25 million in the total population of 128 million people [(2)]. The available data from Physical Medicine, Rheumatology and Rehabilitation Outpatients in, Alexandria University Hospitals, revealed that around 300 patients were diagnosed with knee osteoarthritis in 2014 [(3)]. The proportions of people affected with symptomatic knee OA are likely to increase by 40% over the next 25 years due to the aging of the population and the high rate of obesity or overweight in the general population [(4, 5)].

Osteoarthritis (OA) is a common, degenerative joint disease affecting to a large extent weight-bearing joints. Although OA may affect any joint in the body, it most commonly affects the knee. It is anticipated that OA will become the eighth most important cause of disability in men and the fourth most important cause of disability in women according to the World Health Organization report.[(6)]

Osteoarthritis (OA) was previously thought to be a normal consequence of aging; however, it is now realized that osteoarthritis results from a complex interplay of multiple factors, including joint integrity, genetic predisposition, local inflammation, mechanical forces, and cellular and biochemical processes. The disease can occur as a primary idiopathic disorder that is localized or generalized. Secondary OA is due to underlying causes such as congenital defects of joint structure, single severe trauma or multiple traumas, inflammatory diseases, or metabolic disorders.[(7)]

The diagnosis of osteoarthritis can almost be made on the basis of history and physical examination. Physical examination of the knee provides a functional assessment of articular cartilage status, range of motion, effusion, and joint line tenderness. Also, Knee radiographs should be ordered to assess the severity of the disease, as well as to exclude other causes of knee pain. The common X-ray findings of Knee OA include loss of joint cartilage, narrowing of joint space; subchondral sclerosis; joint deformity due to degeneration or articular damage; bone spur formation; fusion of joints, and marginal osteophytes [(1,2)]. Kellgren and Lawrence also defined a widely utilized grading system for radiographic evidence of knee OA:

Grade 0: None: Definite absence of OA

Grade 1: Doubtful: Minimal osteophyte, doubtful significance

Grade 2: Minimal: Definite osteophyte, unimpaired joint space.

Grade 3: Moderate: Moderate multiple osteophytes and definite narrowing of joint space and some sclerosis and possible deformity of bone ends.

Grade 4: Severe: Large osteophytes marked narrowing of joint apace, and severe sclerosis of subchondral bone [8].

Patients with knee OA exhibit a characteristic pattern of decrements in functional heath status, generally concerning level of joint pain, stiffness, range of motion in affected joint, quadriceps muscle strength and activities of daily living (ADLs) involving the lower extremities. Clinically, patients with OA experience persistent knee pain, stiffness in the morning or following periods of inactivity, crepitus, loss of motion, muscle weakness, and joint instability, all leading to functional limitation and disability. Poorly managed Knee OA can affect the physical, psychological, emotional, and spiritual well being of patients. It can result in impaired mobility, increased morbidity such as depression, anxiety, physical disability, and sleep disturbance [9].

The overall goals of knee OA management are directed towards controlling symptoms, maintaining and improving joint mobility, increasing level of activity, reducing physical disability and handicap, improving health-related quality of life, limiting the progression of joint damage, and educating patients about the nature of the disorder and its management[7]. Treatment modalities of OA include a combination of the following elements; pharmacological management, physical therapy, weight control, joint protection, and surgical management. [8-10] Several published guidelines currently recommend non-pharmacological interventions as a first line of treatment for knee OA. However, the treatment of osteoarthritis typically requires a combination of nonpharmacological and pharmacological interventions.[11] The osteoarthritis research society international (OARSI) recommended non – pharmacological methods, including patient education programs, weight reduction, coping strategies, and physical exercise programs for treatment of knee OA.[12]

The study done by Rogind *et al.* recommended that physical exercise program as strengthening, stretching and range of motion exercises for patients with mild to moderate OA of knees leads to strength muscle groups around affected joints, offering protection and stabilization of affected joints, improved shock absorption, and reducing mechanical stresses that hasten cartilage degeneration, while, in patients with severe OA strenuous strength exercise program have not been applied. [13]Also, a study done by Fathalla showed that physical training program plays an important part in the complete management of patients with osteoarthritis, because it provides patients with important knowledge for management and control of disease process through behavioral modifications, weight loss and muscle strength.[14]

Exercise is a commonly prescribed and effective treatment for patients with knee OA. It is theorized that regular, 'moderate' exposure to activity is ideal to maintain articular cartilage health[15]. There are three types of basic therapeutic exercise: isotonic, isometric and isokinetic. Isotonic exercises contract the muscle fibers, but without increasing internal tension leading to joint movement. While, isometric exercises contract muscle fibers without movement of limbs or joints and thus require voluntary participation. Sometimes isometric exercises are referred to as muscle setting exercises. Less common, isokinetic muscle movement occurs when a muscle contracts maximally throughout its entire range of motion and requires special equipments, such as that used in sport training. Isometric exercise might be the most appropriate and easy to understand by the patients and can be easily and safely performed at home because it requires no or minimal apparatus. Furthermore, Potter et al, Anwer and Alghadir, showed that isometric exercise causes the least intra articular inflammation, pressure, and bone destruction. Also, these exercises are simple and inexpensive to perform and they rapidly improve strength.[16,17]

Range of motion exercises is a precise set of actions taken to move the joints through their range, as possible for individual patients. Active ROM exercise done by the patient is the preferred type of exercise. Active movement helps to pump away edema fluid, stimulates circulation, and prevents soft tissue adhesion. Patient performing active range of motion may find exercises easier to learn when they are demonstrated first and supplemented with diagrams and then return the demonstration to ensure accuracy and effectiveness. [18]

Nursing care of patients with OA is directed toward preventing the development of the disease on one hand through accurate assessment and identifying the patients at risk and management of the patients complains as joint pain and limited mobility on the other hand. [19, 20].The patient may require cues as well as verbal instructions, and illustrated pictures, particularly in the early phases of exercise program. It is important that these patients use proper body mechanics and body alignment [14]. During and after any exercise session, the nurse should assess for signs of excessive joint strain, presence of pain during activity, lasting more than 1 to 2 hours after exercise, swelling, fatigue, and weakness. If joints hurt or redness or swellings are noticed, then patient is advised to try a little exercise. A warm bath to soothe aching muscles and joints after a workout is important as well as monitoring feelings of patient after exercise [15].

Significant of the study:

Care of patients with knee OA is extremely complex and presents many challenges even for an experienced nurse. So, nurses have an important role in performing an exercise plan for the patient and teaching how to perform regular, careful exercise at home which will help the patient manage desired activities of daily living and encourage him or her to perform the exercises regularly to improve flexibility and muscle strength which in turn will help to support the affected joint, reduce pain, and improve functional health status.[21] Hence, this study aimed to evaluate the effect of a physical training program on the functional health status among patients with knee osteoarthritis

Aim of the study

This study aimed to evaluate the effect of a physical training program on the functional health status among patients with knee osteoarthritis

Research hypothesis

Patients with knee osteoarthritis who receive the physical training program will have higher mean functional health status scores than before.

2. Materials and Method

Research design:

A quasi experimental study design was used to conduct this study.

Setting

This study was carried out in the Outpatient Clinic at El-Hadara Orthopedic and Traumatology University Hospital, Alexandria.

Subjects

Subjects of the study included a convenience sample of 20 adult patients of both sexes diagnosed as mild or moderate osteoarthritis of the unilateral or bilateral knee joint recruited from the above mentioned setting. The Epi info program was used to estimate sample size using the following parameters:

a- population size= 25 /month
b- Expected frequency = 50%
c-Acceptable error= 5%
d- Confidence coefficient=95
e- Estimated sample size=20

Criteria for inclusion were:

- Age from 20 years up to 60 years.
- Free from other medical conditions as heart disease, uncontrolled hypertension, rheumatoid arthritis and other inflammatory disease.
- Have not been involved in a scheduled program of regular exercises or strength training within the last 6 months.
- Following their prescribed medical treatment throughout the study.
- Free from central or peripheral nervous system involvement.
- Have not been received intra-articular steroid injections within the previous three months.

Tools of the study

Three tools were used in the study to collect the necessary data:

Tool (I): Osteoarthritis Patient's Assessment: This tool was developed by the researcher based on review of related literature [5,6,14]. It included the following parts:

Part one: This part included the sociodemographic characteristics of the patients, including the patient's name, age, sex, level of education, marital status, perceived economic status, religions and occupation

Part two: This part included patient general assessment as medical diagnosis, body mass index, gait stability, and using assistive device for ambulation and current exercise habits.

Tool (II): The Knee Osteoarthritis Assessment Checklist.

This checklist was developed by the researcher after reviewing of literature [18,21] to assess:

1. Tenderness to pressure around the knee joint.
2. Joint stiffness.
3. Knee joint effusion.
4. Crepitation.
5. Temperature of the skin around the knee joint.
6. Range of motion of both knee joints was measured by a goniometer. The normal knee flexion is (0-135º), and the normal knee extension is (0-15º).
7. Quadriceps muscle strength was assessed by Grading Muscle Strength-Lovett Scale[22] to test the strength of quadriceps muscle by observing how well the muscle work to provide movement at the joint. The scale starts from score 5 and end with 0 as follows: 5= **normal**, very strong with ROM unimpaired against gravity and against full resistance;4= **good**, adequate strength to complete the ROM against gravity and against a mild-to moderate level of resistance;3= **fair**, only enough strength to complete the ROM against gravity but not against any additional resistance;2= Poor, strength to complete the ROM;1= Palpable muscle contraction but no movement;0= No muscle contraction.

Tool (III): The Algofunctional for Knee Osteoarthritis Index (AKOI):

This index was adapted from Lequesne (1997)[23].It was used to evaluate pain or discomfort of the affected joint, maximum distance walked tolerance and activities of daily living. It included three main parts:

Part one: This part was used to evaluate pain or discomfort of the affected joint using the pain section of the Algofunctional osteoarthritis index. It contains five questions concerning the severity of pain during

various activities; each question scored 0-2, patients with higher scores indicating more severe pain.

Part two: this part was used to evaluate maximum distance walked. Scoring system ranged from 0-8, patients with higher scores indicating better walk for unlimited distance without pain or discomfort and lower scores indicating more disability to walk.

Part three: This part was used to assess physical function of the joint during activities of daily living. It contained six questions. The score of each question ranging from 0-2. Score 0 indicates, inability to perform activities of daily living, whereas score 2 indicates perform activities of daily living without difficulty.

Method

1- An official letter from the Faculty of Nursing was submitted to the director of the Outpatient clinic at EL-Hadara Orthopedic and Traumatology University Hospital, Alexandria.

2- A verbal approval was obtained from patients before data collection after explaining the aim of the study.

3- Tools of the study were developed based on the review of related literatures and submitted to 5 experts in the field of Medical-Surgical Nursing and Physical Medicine and Rehabilitation for content validity, completeness, and clarity of the items. Necessary modifications were done thereafter.

4- The reliability of the tools was tested using the Cronbach alpha coefficient and it was 0.81.

5- A pilot study was carried out on a number of five patients to test clarity and feasibility of the tools and necessary modifications were introduced.

6- The study was conducted throughout a period of three months from August 2014 to the end of October 2014.

7- Patients' interviews were carried out individually to collect sociodemographic data and general assessment using the tool I at the Outpatient Clinic, which took approximately 20-30 minutes for each interview.

8- An initial assessment of the knee joint affected was done on primary visits to the Outpatient Clinic to obtain a baseline data for each patient using the tool II and tool III.

9- The exercise program was developed based on a thorough review of related literatures[13,14,18,24].It was then designed to be introduced to patients in Arabic.

10- The physical exercise program was carried out by the researcher for each patient individually. This program consisted of stretching exercise, strengthening exercises and range of motion exercise. Clear and simple instructions were offered to each patient, before exercise training program. Each patient had an individualized exercise prescription with pictures that contained the goal of the exercise, the type of movement in each exercise, the frequency with which the exercise should be performed and the duration. Each patient was asked to redemonstrate the exercises until the patient gained the skills to perform these exercises, correctly and actively, at home.

11-The patients were instructed to perform the following set of exercise every day for 6 weeks. All exercises were performed one set twice a day for the 1st week, and these progressed to two sets twice a day until the 3rd week and three sets twice a day until the 6th week. Patients were instructed to repeat every exercise 10 times.

A-Stretching Exercises:

These exercises involved the calf and hamstring muscles**.** For a **standing calf stretch**: the patient stands with the heel of the foot on the ground behind the patient, the toes point straight ahead. The patient leans forward until a moderate pull is perceived in the calf musculature. The patient may use his or her arms for support against a wall or furniture as needed. The patients were instructed to hold for 30 seconds. For **hamstrings muscle stretch**: the patient lies in a supine position with the lower extremity maintained as straight as possible, the hip is flexed to 90°,the knee is straightened and the proximal lower leg supported by the hands until a moderate pull is perceived in the posterior thigh and calf and the foot should be dorsiflexed. The patients were instructed to hold for 30 seconds.

B-Strengthening exercises:

These exercises involved statis quadriceps sets in knee extension, straight leg raise, partial squats weight-lessened with arm support as needed, step-ups and isometric hip adduction.

- **Statis quadriceps sets in knee extension**; the patient lies in a supine position supported on elbows with the knee in full extension. Patient is instructed to contract the quadriceps muscle and push the knee down while maintaining the foot in full dorsiflexion. The patients were instructed to hold each contraction for 6 sec with a10- seconds with rest between repetitions.
- **Straight leg raise**: the patient lies in a supine position. They were instructed to perform a maximum quadriceps contraction prior to the lifting phase of exercise. Then they were instructed to lift the leg up to 10 cm above the plinth.The patients were instructed to hold each contraction for 10 seconds.
- **Partial squats weight-lessened with arm support as needed:** the patient performs a partial squat, keeping the knees centered over the feet, return to standing by contracting the quadriceps and gluteal muscles. The patients were instructed to hold each contraction 30 seconds with hips and knees as

straight as possible, repeat for 30 seconds and progress to full body weight without support and additional bouts.

- **Step-ups**: the patient stands in front of a low step; places foot of involved leg on step and bring body over foot to stand on the step, use as little push-off assistance from the contralateral foot as possible and step down with the contralateral foot. The patients were instructed to repeat for 30 seconds and progress by increasing the height of the step and additional bouts. Alternate legs if both knees are involved.
- **Isometric hip adduction**: the patient lies in a supine position. A small pillow was put between the knees. The patients were instructed to perform isometric hip adduction exercise while pressing the pillow between the knees and maintain the adduction with contraction for 5 seconds.

C-Range of Motion Exercises: Range of motion exercises were performed for both legs.

- **Knee in mid-flexion to full-extension:** the patient is positioned supine or supine supported on elbows, Knee is brought to 45° of flexion with the foot sliding on the surface that the patient is lying on.The knee is then fully extended with a strong quadriceps muscle contraction. Patients were asked to repeat two 30-second bouts with 3-second hold at end range.
- **Knee in mid-flexion to full-flexion:** the patient is positioned supine or supine supported on elbows, the knee is brought to full flexion with assistance of the upper extremities or a strap. A gentle challenge to end-range flexion is sustained. Patients were asked to repeat two 30-second bouts with 3-second hold at end range.

12- The patients were followed up weekly in the Outpatient Clinic for six weeks to ensure patients compliance to the instructions given.

13- Evaluation of pain, range of motion of knee joint (flexion, extension), maximum distance walked and activities of daily living were done by the researcher using the tool II and III 3 weeks and 6 weeks, post physical training program to determine the effects of the exercise program on the affected knee joint, for each patient.

Administrative and ethical considerations

An official approval was obtained to conduct the study from the director of the Outpatient Clinic at EL-Hadara Orthopedic and Traumatology University Hospital, Alexandria. Patients' verbal consents were obtained after explaining the aim of the study and assuring them complete confidentiality and that they can withdraw at any time of the study.

Statistical analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0.[25] Qualitative data were described using number and percent. Quantitative data were described using minimum and maximum, mean and standard deviation. Comparison between before exercise, after 3 and 6 weeks regarding categorical variables was tested using Chi-square test. When more than 20% of the cells have expected count less than 5, correction for chi-square was conducted using Monte Carlo correction. To compare between the three periods Friedman test was applied and Wilcoxon signed ranks test to compare between before exercise with each of after 3 and 6 weeks. Significance of the obtained results was judged at the 5% level. [26]

3. Results

Table (1) shows the distribution of osteoarthritis patients according to their general characteristics. The results revealed that the majority of the samples (60%) were in the age group that ranged from 50 to less than 60 years, females (75%), illiterate (75%), married (100%) and more than half of the patients have unilateral knee osteoarthritis. As regards, body mass index, the mean value of BMI was 33.91 ± 4.87 and 70% of the sample had limped gait while, the entire patient did not use any assistive device during ambulation.

Table (2) presents the distribution of the osteoarthritis patients according to their assessment of the affected knee joint before and after the physical training program. The findings showed that the majority (92.9%, 86.7%) of patients suffered from tenderness to pressure around right and left knee joint, respectively, whereas after training program, these percents were significantly decreased to (50%, 33.3%) and (28.6%, 6.7%), after three and six weeks respectively. (87.6%.66.7%) of the sample were complaining of effusion in Rt and Lt knee respectively before the program, while, post implementation of program,there was a statistically significant decrease in both knee joints effusion after 3 and 6 weeks (35.7%, 26.7%), (14.3%, 6.7%), respectively. Concerning crepitus sound, (100%, 93.3%) of the studied sample had crepitation in both right and left knee joints, respectively, however, there was a statistically significant improvement after 3 weeks and 6 weeks after implementation of the physical training program (28.6%, 46.7%) and (14.3%,26.7%) respectively.

Table (3) demonstrates assessment of range of motion and quadriceps muscle strength of the affected knee joint before and after the physical training program. The findings revealed that before the training program, the minority of the sample (14.3%, 40%) was able to complete flexion of the Rt and Lt knees, respectively, while post training program, there was a significantly increase to (71.4%,

80%) and (85.7%, 80%) after 3 and 6 weeks, respectively, with a high statistically significant difference between the three time periods (p<0.001). As regards to complete extension before the exercise program (57.1% and 33.3%) respectively of the sample with Rt and Lt knee affection had complete extension and there was a significant increase after the exercise program to be (85.7%, 80%), respectively.In relation to, quadriceps muscle strength before exercise, (78.6%, 86.7%) of the sample had full range of motion with gravity before exercise for Rt and Lt knees respectively, while post 3 weeks from exercise program the patients were able to perform complete range of motion against gravity with mild or moderate resistance for Rt and Lt knee (85.7%, 73.3%) respectively. While, after 6 weeks there was statistically significant increased to be (92.9%, 86.7%) as the sample was able to perform complete range of motion against gravity with full resistance for Rt and Lt knee, respectively. There were significant differences between before the exercise program and after 3 weeks as well as between before and after 6 weeks. Moreover, there were statistically significant differences between the three periods of the study (before, after 3 and 6 weeks) (p<0.001).

Table (1): Distribution of the osteoarthritis patients according to their general characteristics (n = 20)

General characteristics/ variable	No.	%
Age (years)		
30 < 40	5	25.0
40 <50	3	15.0
50 < 60	12	60.0
Sex		
Female	15	75.0
Male	5	25.0
Level of education		
Illiterate	15	75.0
Read and write	3	15.0
Primary Education	1	5.0
Secondary Education	1	5.0
Occupation		
Professional	1	5.0
Manual	4	20.0
Housewife	15	75.0
Marital status		
Married	20	100.0
Perceived economic status		
Middle	12	60.0
Low	8	40.0
Religion		
Moslem	20	100.0
Current exercise habits		
Never	18	90.0
Exercise < 3 months	2	10.0
Diagnosis		
Unilateral Knee osteoarthritis:	11	55.0
Right	5	25.0
Left	6	30.0
Bilateral knee osteoarthritis	9	45.0
Weight (kg)		
Min. – Max.	75.0 – 110.0	
Mean ± SD	86.30 ± 10.49	
Height (cm)		
Min. – Max.	150.0 – 165.0	
Mean ± SD	159.75 ± 4.61	
BMI		
Min. – Max.	29.30 – 48.89	
Mean ± SD	33.91 ± 4.87	
Gait		
Stable	6	30.0
Limping	14	70.0
Using of assistive devices for ambulation		
Not used	20	100.0

Table (2): Distribution of the osteoarthritis patients, according to their assessment of the affected knee joint before and after the physical training program.

Assessment of the affected knee joint	Before exercise training		After 3 weeks		After 6 weeks		χ^2	*p*
	No.	%	No.	%	No.	%		
Tenderness to pressure around knee joint								
Right knee (n = 14)								
Yes	13	92.9	7	50.0	4	28.6	12.250*	0.002*
No	1	7.1	7	50.0	10	71.4		
χ^2 (p_1)			6.300* (0.033*)		12.128* (<0.001*)			
Left knee (n = 15)								
Yes	13	86.7	5	33.3	1	6.7	20.405*	<0.001*
No	2	13.3	10	66.7	14	93.3		
χ^2 (p_1)			8.889* (0.003*)		19.286* (<0.001*)			
Knee joint effusion								
Right knee (n = 14)								
Yes	11	78.6	5	35.7	2	14.3	12.122*	0.003*
No	3	21.4	9	64.3	12	85.7		
χ^2 (p_1)			5.250* (0.022*)		11.631* (0.001*)			
Left knee(n = 15)								
Yes	10	66.7	4	26.7	1	6.7	12.600*	0.002*
No	5	33.3	11	73.3	14	93.3		
χ^2 (p_1)			4.821* (0.028*)		11.627* (0.001*)			
Crepitation								
Right knee (n = 14)								
Yes	14	100.0	4	28.6	2	14.3	23.673*	<0.001*
No	0	0.0	10	71.4	12	85.7		
χ^2 (p_1)			15.556* (<0.001*)		21.000* (<0.001*)			
Left knee(n = 15)								
Yes	14	93.3	7	46.7	4	26.7	14.220*	0.001*
No	1	6.7	8	53.3	11	73.3		
χ^2 (p_1)			7.778 (0.014*)		13.889* (<0.001*)			
Temperature of the skin around the knee joint								
Right knee (n = 14)								
Warm	14	100.0	14	100.0	14	100.0		
Cold	0	0.0	0	0.0	0	0.0	-	-
Hot	0	0.0	0	0.0	0	0.0		
χ^2 (p_1)			-		-			
Left knee (n = 15)								
Warm	15	100.0	15	100.0	15	100.0		
Cold	0	0.0	0	0.0	0	0.0	-	-
Hot	0	0.0	0	0.0	0	0.0		
χ^2 (p_1)			-		-	-		

p: p value for comparing between the three periods
p_1: p value for comparing between before exercises with each of after 3 and 6 weeks
χ^2: Chi square test MC: Monte Carlo test
*: Statistically significant at $p \leq 0.05$

Table (4) shows the distribution of the patients, according to the assessment of pain and maximum distance walked before and after the physical training program. The results revealed that the majority of patients (80%, 80%, 100%, 55%) experienced pain only on movement, morning stiffness for less than 15 minutes, in standing more than 30 minutes and during walking, respectively, while these percentages significantly decreased after the exercise program (20%, 55%, 20%, 0%), respectively. There were statistically significant differences between the periods of the study (p<0.001). As regards maximum distance walked, (35%) of the patients were able to walk about a km (in about 15 minutes) before the program, while after exercise (40%) of the patients were able to walk for unlimited distance without pain or discomfort. Also, there were statistically significant differences between before the exercise program and after 3 weeks as well as between before and after 6 weeks. Moreover, there were statistically significant differences between the periods of the study (*p*<0.001).

Table (3): Assessment of range of motion and quadriceps muscle strength of the affected knee joint before and after the physical training program.

Range of motion and quadriceps muscle strength of the affected knee joint	Before exercise training		After 3 weeks		After 6 weeks		χ^2	*p*
	No.	%	No.	%	No.	%		
Right knee Flexion (n = 14)								
Complete	2	14.3	10	71.4	12	85.7	16.333*	<0.001*
Incomplete	12	85.7	4	28.6	2	14.3		
χ^2 (p_1)			9.333* (0.002*)		14.286* (<0.001*)			
Right knee Extension (n = 14)								
Complete	8	57.1	12	85.7	13	71.4	9.472*	0.012*
Incomplete	6	42.9	2	14.3	1	28.6		
χ^2 (p_1)			5.600* (0.018*)		8.023* (0.013*)			
Left knee Flexion (n = 15)								
Complete	6	40.0	12	80.0	12	80.0	7.200*	0.027*
Incomplete	9	60.0	3	20.0	3	20.0		
χ^2 (p_1)			5.000* (0.25)*		5.000* (0.025*)			
Left knee Extension (n = 15)								
Complete	5	33.3	12	80.0	12	80.0	9.504*	0.009*
Incomplete	10	66.7	3	20.0	3	20.0		
χ^2 (p_1)			6.625* (0.010*)		6.652* (0.010*)			
Quadriceps muscle strength								
Right knee (n = 14)								
0=No muscle contraction	0	0.0	0	0.0	0	0.0	51.358*	MC p <0.001*
1=Muscle contraction but no movement	0	0.0	0	0.0	0	0.0		
2= Poor strength to complete ROM	1	7.1	0	0.0	0	0.0		
3=Full ROM with gravity but no resistant	11	78.6	0	0.0	0	0.0		
4=Full ROM against gravity with mild or moderate resistance	2	14.3	12	85.7	1	7.1		
5=Full ROM against gravity with full resistance	0	0.0	2	14.3	13	92.9		
χ^2 (p)			22.240* (<0.001*)		28.733* (0.001*)			
Min. – Max.	2.0 – 4.0		4.0 – 5.0		4.0 – 5.0		Fχ2 26.115*	<0.001*
Mean ± SD	3.07 ± 0.47		4.14 ± 0.36		4.93 ± 0.27			
Z(p_1)			3.419* (0.001*)		3.442* (0.001*)			
Left knee (n = 15)								
0=No muscle contraction	0	0.0	0	0.0	0	0.0	41.680*	MC p <0.001*
1=Muscle contraction but no movement	0	0.0	0	0.0	0	0.0		
2= Poor strength to complete ROM	0	0.0	0	0.0	0	0.0		
3=Full ROM with gravity but no resistant	13	86.7	2	13.3	1	6.7		
4=Full ROM against gravity with mild or moderate resistance	1	6.7	11	73.3	1	6.7		
5=Full ROM against gravity with full resistance	1	6.7	2	13.3	13	86.7		
χ^2 (p_1)			17.451* (<0.001*)		22.304* (<0.001*)			
Min. – Max.	3.0 – 5.0		3.0 – 5.0		3.0 – 5.0		Fχ2 25.000*	<0.001*
Mean ± SD	3.20 ± 0.56		4.0 ± 0.53		4.80 ± 0.56			
Z(p_1)			3.464* (0.001*)		3.419* (0.001*)			

p: p value for comparing between the three periods

p_1: p value for comparing between before exercises with each of after 3 and 6 weeks

χ^2: Chi square test $^F\chi^2$: Chi square for Friedman Test

Z: Z for Wilcoxon signed ranks test MC: Monte Carlo test *: Statistically significant at $p \leq 0.05$

Table (5) represents assessment of activities of daily living before and after the physical training program. It was found that the minority of the sample (5%, 0%, 0%, 0%, 0%, 0%) was able without difficulty to put on socks by bending forward, pick up an object from the floor, go up and down stairs,get in and out of a car and bend the knee and walk on uneven ground, respectively, before the training program. However, after 6weeks, there was a significant improvement in performing these activities without difficulties (50%, 40%, 40%, 55%, 60%, 35%) respectively. Also, there were significant differences between before the exercise program and after 3 weeks as well as between before and after 6 weeks. Moreover, there were statistically significant differences between the three periods of the study (before, after 3 and 6 weeks) (p<0.001).

Table (4): Assessment of pain and maximum distances walked before and after the physical training program.

Pain and maximum distances walked	Before exercise training		After 3 weeks		After 6 weeks		χ^2	*p*
	No.	%	No.	%	No.	%		
During bed rest								
None or insignificant.	0	0.0	8	40.0	16	80.0		
Only on movement or in certain positions.	16	80.0	12	60.0	4	20.0	32.13*	MCp <0.001*
With no movement.	4	20.0	0	0.0	0	0.0		
Min. – Max.	1.0 – 2.0		0.0 – 1.0		0.0 – 1.0		Fχ^2 =	
Mean ± SD	1.20 ± 0.41		0.60 ± 0.50		0.20 ± 0.41		28.42 9*	<0.001*
Z(p_1)			3.464* (0.001*)		4.066* (<0.001*)			
Morning stiffness or regressive pain after arising								
None	0	0.0	7	35.0	9	45.0		
< 15 minutes	16	80.0	13	65.0	11	55.0	17.098*	MCp <0.001*
≥ 15 minutes	4	20.0	0	0.0	0	0.0		
Min. – Max.	1.0 – 2.0		0.0 – 1.0		0.0 – 1.0		Fχ^2 =	
Mean ± SD	1.20 ± 0.41		0.65 ± 0.49		0.55 ± 0.51		21.784*	<0.001*
Z(p_1)			3.317* (0.001*)		3.357* (0.001*)			
Remaining standing for 30 minutes increases pain								
No	0	0.0	10	50.0	16	80.0	26.606*	<0.001*
Yes	20	100.0	10	50.0	4	20.0		
χ^2(p)			13.33* (<0.001*)		26.667* (<0.001*)			
During walking								
None	0	0.0	13	65.0	18	90.0		
Only after walking for short distance	9	45.0	7	35.0	2	10.0	46.187*	MCp <0.001*
After initial walking and increasing with continued ambulation	11	55.0	0	0.0	0	0.0		
Min. – Max.	1.0 – 2.0		0.0 – 1.0		0.0 – 1.0		Fχ^2 =	
Mean ± SD	1.55 ± 0.51		0.35 ± 0.49		0.10 ± 0.31		35.524*	<0.001*
Z(p_1)			3.162* (0.002*)		4.00* (<0.001*)			
Pain or discomfort in sitting position for 2 hours								
No	0	0.0	10	50.0	20	100.0	40.000*	<0.001*
Yes	20	100.0	10	50.0	0	0.0		
χ^2(p)			13.33* (<0.001*)		40.0* (<0.001*)			
Maximum distance walked (may walk with pain)								
Unlimited	0	0.0	1	5.0	8	40.0		
More than 1km, but limited	2	10.0	7	35.0	0	0.0		
About a km (in about 15 min)	7	35.0	0	0.0	6	30.0		
From 500-900m (in about 8-15 min)	4	20.0	7	35.0	0	0.0	40.608*	<0.001*
From 300-500m	1	5.0	3	15.0	2	10.0		
From 100-300m	1	5.0	2	10.0	2	10.0		
Less than 100m	5	25.0	0	0.0	2	10.0		
Min. – Max.	2.0 – 7.0		3.0 – 8.0		2.0 – 8.0		Fχ^2 = 7.718*	0.021*
Mean ± SD	4.65 ± 1.81		5.50 ± 1.50		5.90 ± 2.17			
Z(p_1)			2.060* (0.042*)		2.236* (0.025*)			
Walking aids required								
None	19	95.0	20	100.0	20	100.0		
With one walking stick or crutch	1	5.0	0	0.0	0	0.0	1.851	MCp= 1.000
With two walking sticks or crutches	0	0.0	0	0.0	0	0.0		
χ^2(p)			1.000		1.000			

p: p value for comparing between the three periods
p_1: p value for comparing between before exercises with each of after 3 and 6 weeks
χ^2: Chi square test
Fχ^2: Chi square for Friedman Test
Z: Z for Wilcoxon signed ranks test
MC: Monte Carlo test
*: Statistically significant at $p \leq 0.05$

Table (5): Assessment of activities of daily living before and after the physical training program

Activities of daily living	Before exercise		After 3 weeks		After 6 weeks		χ^2	^{MC}p
	No.	%	No.	%	No.	%		
Can you put on socks by bending forward?								
Without difficulty	1	5.0	2	10.0	10	50.0		
With mild difficulty	0	0.0	6	30.0	9	45.0		
Moderate difficulty	6	30.0	9	45.0	1	5.0	50.178*	<0.001*
Sever difficulty	1	5.0	3	15.0	0	0.0		
Unable	12	60.0	0	0.0	0	0.0		
Min. – Max.	0.0 – 2.0		0.50 – 2.0		1.0 – 2.0		$^{F}\chi^2$ =	<0.001*
Mean ± SD	0.43 ± 0.59		1.18 ± 0.44		1.73 ± 0.30		37.520*	
Z(p_1)			3.903* (0.001*)		3.912* (<0.001*)			
Can you pick up an object from the floor								
Without difficulty	0	0.0	1	5.0	8	40.0		
With mild difficulty	0	0.0	1	5.0	11	55.0		
Moderate difficulty	1	5.0	16	80.0	1	5.0	77.424*	<0.001*
Sever difficulty	7	35.0	2	10.0	0	0.0		
Unable	12	60.0	0	0.0	0	0.0		
Min. – Max.	0.0 – 1.0		0.50 – 2.0		1.0 – 2.0		$^{F}\chi^2$ =	<0.001*
Mean ± SD	0.23 ± 0.30		1.03 ± 0.30		1.68 ± 0.29		39.519*	
Z(p_1)			3.947* (<0.001*)		4.021* (<0.001*)			
Can you go up and down standard flight of stairs?								
Without difficulty	0	0.0	1	5.0	8	40.0		
With mild difficulty	0	0.0	1	5.0	10	50.0		
Moderate difficulty	1	5.0	13	65.0	2	10.0	68.936*	<0.001*
Sever difficulty	6	30.0	5	25.0	0	0.0		
Unable	13	65.0	0	0.0	0	0.0		
Min. – Max.	0.0 – 1.0		0.50 – 2.0		1.0 – 2.0		$^{F}\chi^2$ =	<0.001*
Mean ± SD	0.20 ± 0.30		0.95 ± 0.36		1.65 ± 0.33		39.519*	
Z(p_1)			3.963* (<0.001*)		4.177* (<0.001*)			
Can you get in to and out of a car?								
Without difficulty	0	0.0	1	5.0	11	55.0		
With mild difficulty	0	0.0	0	0.0	8	40.0		
Moderate difficulty	0	0.0	16	80.0	1	5.0	93.046*	<0.001*
Sever difficulty	1	5.0	3	15.0	0	0.0		
Unable	19	95.0	0	0.0	0	0.0		
Min. – Max.	0.0 – 0.50		0.50 – 2.0		1.0 – 2.0		$^{F}\chi^2$ =	<0.001*
Mean ± SD	0.03 ± 0.11		0.98 ± 0.30		1.75 ± 0.30		39.519*	
Z(p_1)			4.042* (<0.001*)		4.177* (<0.001*)			
Able to bend the knee								
Without difficulty	0	0.0	1	5.0	12	60.0		
With mild difficulty	0	0.0	2	10.0	7	35.0		
Moderate difficulty	2	10.0	14	70.0	1	5.0	68.957*	<0.001*
Sever difficulty	6	30.0	3	15.0	0	0.0		
Unable	12	60.0	0	0.0	0	0.0		
Min. – Max.	0.0 – 1.0		0.50 – 2.0		1.0 – 2.0		$^{F}\chi^2$ =	<0.001*
Mean ± SD	0.25 ± 0.34		1.03 ± 0.34		1.78 ± 0.30		39.519*	
Z(p_1)			4.018* (<0.001*)		4.130* (<0.001*)			
Able to walk on uneven ground								
Without difficulty	0	0.0	1	5.0	7	35.0		
With mild difficulty	0	0.0	1	5.0	8	40.0		
Moderate difficulty	1	5.0	8	40.0	5	25.0	72.556*	<0.001*
Sever difficulty	1	5.0	10	50.0	0	0.0		
Unable	18	90.0	0	0.0	0	0.0		
Min. – Max.	0.0 – 1.0		0.50 – 2.0		1.0 – 2.0		$^{F}\chi^2$ =	<0.001*
Mean ± SD	0.08 ± 0.24		0.83 ± 0.41		1.55 ± 0.39		38.675*	
Z(p_1)			4.028* (<0.001*)		4.056* (<0.001*)			

p: p value for comparing between the three periods

p_1: p value for comparing between before exercises with each of after 3 and 6 weeks

χ^2: Chi square test $^{F}\chi^2$: Chi square for Friedman Test

Z: Z for Wilcoxon signed ranks test MC: Monte Carlo test *: Statistically significant at $p \leq 0.05$

Figure (1) illustrates the mean values changes in activities of daily living, quadriceps muscle strength, pain and maximum distance walked (may walk with pain) pre and post the physical training program. The results revealed that there was a high improvement in the means values regarding activities

of daily living, quadriceps muscle strength, maximum distance walked after 3 and 6 weeks from the physical training program implementation than before (0.2, 1, 1.69), (2.8, 3.75, 4.58), (4.65, 5.5, 5.9) respectively,. As regards pain, this figure showed that pain was markedly decreased after 3 and 6 weeks from the physical training program implementation than before (1.19, 0.52, 0.21) respectively.

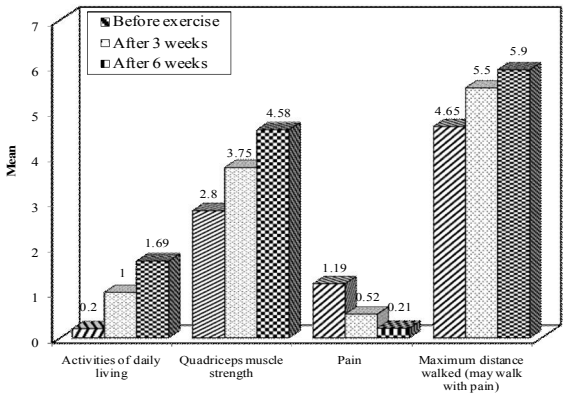

Figure (1); Changes in the mean values of activities of daily living, quadriceps muscle strength, pain and Maximum distance walked (may walk with pain) pre and post the physical training program.

4. Discussion

Knee osteoarthritis (OA) is a common chronic and progressive degenerative joint condition that contributes greatly to disability in the general population [27]. Knee osteoarthritis is characterized by pain, stiffness, decreased range of motion, and muscle weakness. These symptoms can limit the ability to climb stairs, rise from a chair, and walk, causing dependency in daily activities [8,28,29].

The results of the present study showed that the majority of the patient's age ranged from 50-60 years. This finding matches with Connie (2012) [30] who mentioned that aging causes alteration in the matrix composition of the cartilage and chondrocyte synthesis activity. The decrease in chondrocyte activity limits growth, repair, and maintenance of the tissue, which are strongly linked to cartilage thinning during aging. Moreover, this result is in line with Deyle *et al.* (2005) [24] who mentioned that knee osteoarthritis incidence increases with age.

The present study showed that the majority of the samples were females. This could be interpreted by the fact that osteoblastic activity slows between the ages of 30-40. After the age of 40 years, women lose approximately 8 percent of their bone mass every decade, while in men the loss is 3 percent per decade which predisposes women, more for osteoarthritis. Also, it may be attributed to obesity and postmenopausal estrogen deficiencies [31]. This result comes in line with Lundebjerg (2001) [32] who mentioned that the incidence of increase OA occurs most among women older than 45 years. In addition, the Center for Disease Control (CDC) (2006) [33] revealed that knee OA was more common in females than in males with percentages of 33% and 25% respectively.

The current study revealed that illiterate patients formed the greatest proportion of the sample. This could be attributed to the fact that lack of education and prevention knowledge can make people more risky to be exposed to diseases. As a matter of fact, it has been noticed that the main bulk of patients in university hospital are lacking education and prophylactic information concerning health care. This result is supported by Walsh (2010)[34] who mentioned that total adult illiteracy in Egypt represents (66%) from 2005-2010. According to the CDC (2005) reports the level of patient education is correlated with the incidence of knee osteoarthritis. Incidence of knee OA in people with less than 8 years of education was 44%, while in those who received 9-11 years was 41%, and in people receiving high school education was 36%[35].

The current study findings revealed that that the majority of the samples were obese. This result is supported by Foula (2008)[36] who found a statistically significant association between obesity and knee OA and stated that obesity plays an important role through mechanical forces and inflammation in predisposing to knee OA development and its faster progression. Moreover, this result is in line with Messier *et al.*(2004) [37] who reported that obesity is strongly associated with knee OA and that weight loss may prevent the onset of this degenerative joint disease. Accordingly, the American College of Rheumatology Subcommittee (2000)[38] recommended weight loss and exercise for obese patients with knee OA.

As regards, knee joint assessment**;** the present study revealed that there was statistically significant improvement in knee joint effusion, tenderness and crepitation after the exercise program than before. This goes hand in hand with Moguel *et al.*(2004)[39] who reported that rehabilitating patients through exercise programs reduce the inflammatory process, decrease pain, prevent further joint damage, maintain and restore decreased muscle dysfunction.

In relation to knee joint range of motion; it was observed that there was highly statistically significant improvement in both knee joint flexion and extension before and after the exercise program. In this regard Deyle *et al.* (2005) [24] mentioned that limitation in joint movement is considered one of the frequently perceived problems that can be resolved by range of motion exercises. As well as, Taylor *et al.*(2008)[40] and Quintrec *et al.* (2014) [41] emphasized that exercise

programs for patient with knee AO improve joint mobility.

Concerning the quadriceps muscle strength**;** the present study revealed that there was statistically significant improvement in quadriceps muscle strength which ranged from full range of motion with gravity to the complete range of motion against gravity with full resistance in both right and left knee post the exercise program. In this respect Mattson and Pat (2002) [(42)] pointed that, in order to keep muscle strength, patients should perform exercises properly. Disuse of muscles leads to loss of approximately one eighth of its strengths each week of disuse. Therefore, regular strengthening exercises are important to maintain muscle strength and joint mobility. In the same line Penninx *et al.* (2001) [(43)] and Fathalla (2007) [(14)] emphasized that exercise program resulted in increased muscle strength.

Regarding pain and discomfort; it was observed that there was statistically significant decrease in the level of pain during walking and standing more than 30 min and the studied patients experience less morning stiffness after the exercise program. In this line Deyle *et al.* (2000) [(44)] emphasizes that range of motion with closed chain strengthening exercise provides a strong stimulus to connective tissue, resulting in pain relief. Also, Roddy *et al.* (2005)[(29)] reported that both strengthening and aerobic exercise are effective for knee AO which can reduce pain and improve function. Moreover, Thomas *et al.*(2002) [(45)] found that the exercise program produced significant improvement in knee morning stiffness and significant reduction in knee pain, too.

In relation to the maximum distance walked; the present study showed that the proposed exercise program improved the maximum distance walked by the patients with knee OA. In this line Messier *et al.* (2004)[(37)], Deyle *et al.* (2005)[(24)] and Kuptniratsaikul (2002) [(27)] found similar findings and mentioned that exercise program significantly improves walking distance.

As regards level of activity; it was observed that the majority of the sample had a statistically significant improvement in level of performing daily activities. This is in accordance with Rogind *et al.* (1998) [(13)] emphasized that the training exercise program leads to greater muscle strength and perhaps improved agility, which in turn permits greater level of general physical activity and increased functional capacity. In addition Uthman *et al.*(2013)[(46)] stated that the combined intervention of strengthening and aerobic exercise was significantly more effective for improving limitation of function and increasing level of activity. Moreover, Evcik and Sonel (2002) [(28)] reported that the home based exercise program produced statically significant improvement in level of daily activities.

The present study succeeded to improve joint mobility, muscle strength, distance walked level of activity and decrease joint stiffness and the level of pain. This reflects the desirable effect of exercise training on knee OA patients. It emphasized that exercise is important to enhance or maintains muscle strength, physical fitness, relieve the symptoms of knee OA and improve overall health [(47)].

Finally, the obtained result has put in evidence that well planned exercise program carried out by the nurse could be successful in improving patients functional health status.

5. Conclusion

Based on the results of the present study, it can be concluded that the findings revealed that a statistically significant improvements of muscle strengths, pain, range of motion and ability to perform activities of daily living were demonstrated after implementation of the exercise program.

Recommendations

As a result of this study, the following recommendations are suggested:

1. Rehabilitation programs should provide strategies that decrease pain, stiffness and improve physical function.
2. Nurses should incorporate physical training program into their routine general practice activity
3. Encourage the patient to be included in exercise training programs for early management of knee osteoarthritis.
4. Nurses working in rehabilitation unites should update their knowledge through attending in-service training programs and workshops.
5. Emphasize the importance of early diagnosis and management of patients with knee osteoarthritis to minimize functional disability and improve quality of life.

References

1. Fuller R, Matias A, Yokota M. Effectiveness of a long-term use of a minim a list footwear versus habitual shoe on pain, function and mechanical loads in knee osteoarthritis. Biomedcentral Musculoskeletal Disorders Journal 2012; 13(121):3-25.
2. Norimatsu T, Osaki M, Tomita M. Factors predicting health-related quality of life in knee osteoarthritis among community-dwelling women in Japan: The Hizen-Oshima study. Orthopedics Journal 2011; 34(9):535-40.

3. Statistical Records, Alexandria Main University and El Hadara Hospital 2014.
4. Zhang Y, Jordan JM. Epidemiology of osteoarthritis. Clinics in Geriatric Medicine Journal 2010; 26: 355-69.
5. Bindawa S, Grady J, Graham J. Evidence of reduced health-related quality of life in older Mexican Americans with arthritis. Ethnicity & Disease Journal 2011; 21(2): 230-6.
6. Murray J. Lopez D. The global burden of the disease. Geneva: World Health Organization 1997.
7. Argoff C, Gloth F. Topical nonsteroidal anti-inflammatory drugs for management of osteoarthritis in long-term care patients. Therapeutics and Clinical Risk Management Journal 2011;7: 393–9.
8. Ahamed D. Relationship between the radiological gradings and both functional performance and health related quality of life among women with knee osteoarthritis. Doctoral Thesis. Faculty of Nursing. Alexandria of University, 2014.
9. Jeffrey B, Boehret S, Balasubramanian E. Medication and supplement use for managing joint symptoms among patients with knee and hip osteoarthritis: A cross-sectional study. Biomedical Central Musculoskeletal Disorders Journal 2012; 13(47):1471-79.
10. Perlman A, Ali A, Njike V. Massage therapy for osteoarthritis of the knee: A randomized dose-finding trial. Public library of Science ONE Journal 2012; 7(2): 30-48.
11. Moskowitz RW, Nuki G.OARSI recommendations for the management of hip and knee osteoarthritis, part I: critical appraisal of existing treatment guidelines and systematic review of current research evidence. Osteoarthritis Cartilage, 2007, 15: 981–1000 [PubMed].
12. Moskowitz RW, Nuki G.OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. Osteoarthritis Cartilage, 2008, 16: 137–162 [PubMed].
13. Rogind H. Nielsen B. Jensen B. Moller H. Bliddal H. The effects of a physical training program on patients with osteoarthritis of the knees. Arch. Phys. Med. Rehabil. 1998:79:1421-1427.
14. Fathalla N. Effect of the Quadriceps Muscle Strength Exercise on the Functional health Status among Patients with Osteoarthritis of the Knee Joint. Master Thesis. Faculty of Nursing. Alexandria University, 2007.
15. Teixeira P, Mata J. Self-regulation, motivation, and psychosocial factors in weight management. Journal of Obesity 2012; 2012(1):1-12.
16. Potter P, Perry A, Ostendor F. Clinical Nursing Skills and Techniques. 8th ed. Canada: Elsevier Mosby Inc., 2013; 976.
17. Anwer S. Alghadir A. Effect of Isometric Quadriceps Exercise on Muscle Strength, Pain, and Function in Patients with Knee Osteoarthritis: A Randomized Controlled Study. Journal of Physical Therapy Science. May 2014; 26(5): 745–748.
18. Escalante Y, Saavedra J, Garcia-Hermoso A. Physical exercise and reduction of pain in adults with lower limb osteoarthritis: A systematic review. The Journal of Back and Musculoskeletal Rehabilitation 2010; 23(4):175-86.
19. Hassan B. Comparative Clinical Study of Non Pharmacologic Interventions for Relieving Moderate to Severe Knee Pain in Elderly Patients. Unpublished Doctoral Thesis. Faculty of Nursing, Alexandria University, 2011.
20. Greene B. Lim S. The role of physical therapy in management of patients with osteoarthritis and rheumatoid arthirits. Rheum di. 2004: 52(4):133-138.
21. Weber J, Kelley J. Health assessment in nursing. 2nd ed. Philadephia: Lippincott Williams & Wilkins, 2003: pp496-539.
22. Dmico D, barbarito c. Health & physical assessment in nursing. New Jersey. Pearson Education, 2007: pp690-743.
23. Lequesne MG. The algofunctional indices for hip and knee osteoarthritis. J Rheumatol. 1997; 24: 779-781.
24. Deyle G, Allison S, Matekel R, Ryder M, Stang J, Henderson N, Garber M. Physical Therapy Treatment Effectiveness for Osteoarthritis of the Knee: A Randomized Comparison of Supervised Clinical Exercise and Manual Therapy Procedures Versus a Home Exercise Program. Physical Therapy Journal 2005; 85:1301-1317.
25. Kirkpatrick LA, Feeney BC. A simple guide to IBM SPSS statistics for version 20.0. Student Ed. Belmont, Calif.: Wadsworth, Cengage Learning 2013.
26. Kotz S, Balakrishnan N, Read CB, Vidakovic B. Encyclopedia of statistical sciences. 2nd Ed. Hoboken, N.J.: Wiley-Interscience 2006.
27. K, Tosayanonda O, Nilganuwong S, Thamalikitkul V. The efficacy of a muscle exercise program to improve functional performance of the knee in patients with osteoarthritis. Journal of the Medical Association of Thailand 2002; 85(1):33-40.

28. E, D, Sonel B. Effectiveness of a home-based exercise therapy and walking program on osteoarthritis of the knee. Journal of Rheumatology International 2002; 22 (3): 103-106.
29. Roddy E, Zhang W, Doherty M, Barlow J, Birrell F, Carr A, Chakravarty K. Evidence-based recommendations for the role of exercise in the management of osteoarthritis of the hip or knee—the MOVE consensus. Rheumatology *Journal* 2005;44:67–73.
30. Connie M. The Effect of Physical Activity on Medial Tibial Cartilage Health in Clinical Knee Osteoarthritis. Published Master Thesis. Submitted to the School of Graduate Studies. McMaster University, 2012. Available at: http://www.eulc.edu.eg.
31. Felson D, Lawrence R, Dieppe P, Helmick C, Jordan J. *Osteoarthritis:* New Insights. Part 1: The Disease and Its Risk Factors. Annual International Medical Journal. *2000; 133(8):635-646.*
32. Lundebjerg N. American Geriateric Society panel on exercise and osteoarthritis. Exercise prescription for older adult with osteoarthritis pain: consensus practice recommendation. American Geriatric Society Journal 2001;49:808-823.
33. Center for disease control and prevention: Physical activity and health, 2006. Available at: http://www.cdc.gov/nccdphp/sgr/ataglan.htm.
34. Walsh H. Unicef Egypt statistics 2010. Available at: http://www.unicef.org/infobycountry/egypt_statistics.html.
35. Center for Disease Control and Prevention: Health-related quality of life among adults with arthritis: Behavioral risk factors surveillance system, 1996-1998. Morbidity and Mortality Weekly Report 2000; 49(17): 366-369.
36. Foula W. Obesity and Knee Osteoarthritis. Master Thesis, Faculty of Medicine, Alexandria University, 2008.
37. Messier S, Loeser R, Miller G, Morgan T. Exercise and Dietary Weight Loss in Overweight and Obese Older Adults with Knee Osteoarthritis: The Arthritis, Diet, and Activity Promotion Trial. Arthritis & Rheumatism Journal 2004; 50(5): 1501–1510.
38. American College of Rheumatology Subcommittee on Osteoarthritis Guidelines. Recommendations for the medical management of osteoarthritis of the hip and knee: 2000 update. Arthritis & Rheumatism Journal 2000; 43:1905–15.
39. Moguel G, Zarco, Garia M. Functional assessment in patients with knee osteoarthritis treated with glucosamine and rehabilitation program. Acta Orthopedic Journal 2004; 18(1):529-533.
40. Taylor E, LeMone P, Lillis C, Lynn P. Fundamentals of Nursing: The Art and Science of Nursing Care. 6th ed. Wotters: Lippincott Williams and Wilkins, 2008; 1273-1329.
41. Quintrec J, Verlhac B, Cadet C, Bréville P, Vetel J. Physical Exercise and Weight Loss for Hip and Knee Osteoarthritis in Very Old Patients: A Systematic Review of the Literature. The Open Rheumatology Journal 2014; 8: 89-95.
42. Mattson P, Pat M. Pathophysiology Concepts of Altered Health Status. Philadelphia: Lippincott, 2002; 1433-7.
43. Penninx B, Messier S, Rejeski J, Williamson J, DiBari M, Cavazzini C. Physical Exercise and the Prevention of Disability in Activities of Daily Living in Older Persons With Osteoarthritis. Arch Intern Med Journal 2001; 161:2309-2316.
44. Deyle G, Henderson N, Matekel R, Ryder M, Garber M, Allison S. Effectiveness of Manual Physical Therapy and Exercise in Osteoarthritis of the Knee: randomized controlled trial. Annals of Internal Medicine Journal 2000; 132(3): 173-181.
45. Thomas K, Muir K, Doherty M, Jones A, O'Reilly S, Bassey E. Home based exercise program for knee pain and knee osteoarthritis: randomized controlled trial. BMJ 2002; 325:325-752.
46. Uthman O, vander D, Jordan J, Dziedzic K, Healey E, Peat G. Exercise for lower limb osteoarthritis: systematic review incorporating trial sequential analysis and network meta-analysis. BMJ 2013; 347: 1136-1149.
47. Abbott JH, Robertson MC, Chapple C, Pinto D, Wright AA, Leon de la Barras L. Manual therapy, exercise therapy, or both, in addition to usual care for osteoarthritis of the hip or knee: a randomized controlled trial. I: Clinical effectiveness. Osteoarthritis and Cartilage Journal 2013; 21:525-34.