Assiut Scientific Nursing Journal
http://asnj.journals.ekb.eg http://www.arabimpactfactor.com
DOI: 10.21608/asnj.2025.352628.1990 http://olddrji.lbp.world/indexedJournals.aspx
https://vlibrary.emro.who.int/journals/assiut-scientific-nursing-journal

Impact of Proprioception Training Program on Knee Function and Health Status among Elderly Patients with Knee Osteoarthritis

Aml Hamdi Mahmoud[1], Hanan Abd- Allah Abozeid[2], Safaa Ali Mahran[3] & Soad Hassan Abd El hameed[4]
[1.] Assistant Lecturer of Gerontological Nursing Department, Faculty of Nursing, Assiut University, Egypt.
[2.] Assistant Professor of Gerontological Nursing, Faculty of Nursing, Assiut University, Egypt.
[3.] Professor of Rheumatology and Rehabilitation, Faculty of Medicine, Assiut University, Egypt.
[4.] Professor of Gerontological Nursing, Faculty of Nursing, Mansoura University, New Mansoura University, Mansoura, Egypt

Abstract
Age related changes take place over time cause knee osteoarthritis that cause knee joint become uncomfortable, edema, stiffness, and weakness, all of which eventually led to impairment and had an adverse impact on health status of elderly patients. **Study aim:** Evaluate the impact of proprioception training program on knee function and health status among elderly patients with knee osteoarthritis. **Design**: Quasi-experimental research was used. **Settings:** This study was done at Rheumatology and Rehabilitation outpatient clinic at Assiut University Hospital. **Sample:** Purposive sample was used and calculated by EPI info; it is estimated that 140 patients. The exercise program applied to 50% of this sample that was 70 geriatric patients. **Tool I: A structured interview questionnaire**. **Tool II: Western Ontario McMaster Universities Osteoarthritis Index:** this tool used to evaluate disability of patients. **Tool III: - 36 - Item Short-Form Health Survey:** this tool was used to measure health status of patients. **Results**: The results of this study supported that proprioception training have positive impact on improving physical function and health status among elderly patients as there was statistically significant difference for study group regarding (SF - 36) P=0.0001. Also, there was statistically significant difference between pretest and posttest regarding (WOMAC) index P =0.0001. **Conclusion:** The findings of this study indicate that proprioception training program is effective on improving physical function and health status among elderly patients with knee osteoarthritis. **Recommendations:** Develop and implement proprioception training program on other musculoskeletal disorders like low back pain among elderly patient.

Keywords: Elderly, Knee osteoarthritis & Proprioception training

Introduction
Aging is a slow and irreversible pathophysiological process. Age causes numerous obvious changes in the human body, and a decline in bodily functions is frequently a part of aging. It manifests as reductions in the activities of tissues and cells and markedly elevated risks of a range of aging-associated disorders, including musculoskeletal disorders **(De Almeida et al., 2022).** The Central Agency for Public Mobilization and Statistics of Egypt (2023) study states that in January 2023, the proportion of the population that was 60 years of age or older was approximately 6.8%. By 2050, this number is anticipated to increase to 20.8% **(Central Agency for Public Mobilization and Statistics., 2023).**
One of the main public health issues is osteoarthritis (OA), a degenerative disease that causes joint discomfort, stiffness, and limited movement. It results from the degeneration of articular cartilage in synovial joints, most frequently the knee. Older persons with OA are more likely to lose their functional independence and need help with everyday living activities. **(You et al., 2021).**
Knee OA is one of the most widespread conditions that lead to disability, particularly among geriatric patients and about 73% of people living with osteoarthritis are older than 65 years **(WHO., 2023).** Stiffness is the most prevalent symptoms of OA, resulting in a reduction in physical activity and a reduction in health status. Osteoarthritis may be primary and secondary primary OA is a genetic illness, whereas secondary OA develops after a stressful event **(Kloppenburg & Berenbaum., 2019).** Osteoarthritis (OA) is the most prevalent form of arthritis, characterized by progressive degeneration, involving not only the articular cartilage, but the entire joint, including the subchondral bone and synovium. Several risk factors are linked to OA, the most prevalent was age, gender, obesity, prior joint injury, genetic predisposition, misalignment, and abnormal joint shape. Gender influences development of OA, with females having a higher risk than males. Once diagnosed, females also experience a higher severity of the disease. Known to be a genetically complex condition, genetic factors play a major role in its development. **(Alyami et al., 2020).**

A conscious, unconscious, and semiconscious feeling of the position, force, velocity, and movement of an extremity, joint, or limb in space is known as proprioception. Knee proprioception decrease with increasing age and with presence, progression of knee OA **(Wang et al., 2021).** The joint proprioceptive deficits increase the functional instability in knee osteoarthritic patient. Thus, proprioception training program are recommended exercise which significantly decrease stiffness and enhanced physical function in knee OA patients which as results lead to improve health status of elderly patients **(Ince et al., 2023).**

Gerontological nurses play necessary role in the care of patients with knee osteoarthritis. They can provide them assistance in reducing discomfort, enhancing joint function and improving health status by teaching patients how to exercise through appropriate training regimens **(Al-Omari & Hill., 2020).** Proprioception training program are recommended exercise which are suggested as a means of strengthening the muscles surrounding the knee **(Guede-Rojas et al., 2024).**

Significance of the Study:

Worldwide, Osteoarthritis is the primary cause of persistent impairment in people older than 70 years and has been designated a 'priority disease' by the World Health Organization (WHO) **(Zamri et al., 2019).** In Arar, Saudi Arabia, the total prevalence of osteoarthritis of the knee joint was 24.5%. (**AlKuwaity et al., 2018).** In Egypt, OA cases in rural and urban regions are more than five million **(Gheita & Eesa., 2019).** Physiotherapy plays important role in the management of knee OA, which incorporates proprioception training program that strengthen the muscles, enhance physical function, and ultimately improve health status **(Huffman et al., 2024).**

Aim of the Study:

Evaluate the impact of proprioception training program on knee function and health status among elderly patients with knee osteoarthritis

This aim will be achieved through the following steps:

1. Assess the knowledge, knee function and health status of elderly patients with knee osteoarthritis.
2. Implement proprioception training program to measure knee function and health status among elderly patients with knee osteoarthritis.

Study hypothesis:

Proprioception training program are effective in improving knee function and health status among elderly patients with knee osteoarthritis.

Subject and Method

Technical design:

Research design:

Quasi experimental research design was adopted in this study.

Setting:

The study took place at Rheumatology and Rehabilitation outpatient clinic at Assiut University Hospital.

Sample type:

Purposive sample was utilized in this study.

Sample size calculation:

The total number of elderly patients suffering from osteoarthritis that attending Rheumatology and Rehabilitation outpatient clinic at Assiut University Hospital are around 220 in 2022. Sample size was determined by using the software EPI /Info, version 3, with a 95 % confidence interval (CI). The calculated sample size was 140 patients with taking in to consideration that this study was an intervention study so the exercise program applied to 50% of this sample that was 70 geriatric patients.

Inclusion criteria:

- Elderly patients aged 60 years and above of both sexes.
- Mild and moderate knee OA.

Exclusion criteria:

- Elderly patients who are incapable of participating actively in the study due to cognitive impairment.
- Elderly patients who cannot participate in the study because of neurological impairment or physical disability.

Tools of the study:

Tool I: A structured interview questionnaire:

It was created and developed by the researchers after reviewing of different researches and pertinent literature for gathering of data. It includes three parts:

Part I:

Contained demographic information as age, sex, residence, education, marital status ……etc.

Part II:

Medical health history is evaluated such as past and present history, accidental and falling history, duration of illness, smoking history, history of any other disease and family history, ……etc.

Part III:

Contained assessment of elderly knowledge about osteoarthritis disease (definition, risk factors, causes, signs and symptoms, measures of pain relief, aggravating factors and complications).

Scoring system regarding knowledge

The total number of knowledge questions was 7 list questions. Each correct answer was given one score and zero score for the wrong answer. The total scores

were 7 degrees. Equal and more than 50% were considered satisfactory level and less than 50% was considered unsatisfactory.

Tools III: Western Ontario McMaster Universities Osteoarthritis Index (WOMAC): (Theiler et al., 2002)

This tool used to evaluate level of disability of patients with osteoarthritis of the knee, comprising of 3 domains pain, stiffness, and physical functioning of the joints. The 24 components that make up the WOMAC are separated into three subscales: (a) Pain (5 items): During walking, upstairs, at night, at rest, and heavy lifting, (b) Stiffness (2 items): Stiffness after awakening first time at the morning and later in the same day, (c) Physical Function (17 items): Downstairs, upstairs, rising from sitting position, standing, bending on floor, walking on flat surface, getting in/out of a car, going to shopping, putting on/taking off socks, lying in bed, rising from bed, getting in/out of bath, sitting, getting on/off toilet, heavy household duties and light household duties.

Scoring system of WOMAC

The scale of difficulty for all items from 0 to 4, zero indicates no difficulty, one indicates mild difficulty, two indicate moderate difficulty, three indicate severe difficulty and four indicate extreme difficulty. With lower scores indicating higher physical disability.

Reliability of the (WOMAC)

Pain, stiffness, and physical function were the three WOMAC subscales that showed internal consistency, with Cronbach's coefficient alpha values of 0.91, 0.81, and 0.84, respectively. In terms of test-retest reliability, ICCs of 0.86, 0.68, and 0.89, respectively, were satisfactory.

Tools III: 36 - Item Short-Form Health Survey (SF-36). (Ware, et al., 2002).

This instrument used to measure health status. Its 36 elements are separated into two summary measures: mental and physical health. There are twenty-one items on the physical health measure. There are fourteen items in the mental health measure. A final question that the patient answers is called "self-reported health transition," however it is not used to determine the score. For each subject we obtained a score upon applying a measurement scale with values from zero (which corresponds to the worst health status) to 100 (best health status).

Reliability of the (SF-36).

A total Cronbach α of 0.87 (with a range of 0.85 to 0.87 on the 8-scale) indicated good internal consistency reliability.

Validity of the tools:

Tools tested for its content validity by group of seven expertise in gerontological nursing, community health nursing and medical surgical nursing. The required modifications were done.

Administrative design:

- An official approval letter was acquired from the Dean of the Faculty of Nursing, to the head of Rheumatology and Rehabilitation department to carry out the study. This letter outlined the purpose and nature of the study and granted authorization to conduct it.

Ethical Considerations

On February 26, 2023, the faculty of nursing's ethical committee authorized the research proposal, which was assigned reference number 1120230581. When the research was being applied, there was no risk to the study participants. The study followed ethical principles in clinical research. Confidentiality and anonymity were assured. Participants had the right to refuse to participate or withdraw from the study without any rational any time. After explaining the goal of the study to an older patient, their informed agreement to participate was acquired. Participants were coded for data input so that their names could not be identified.

Operational design:

Preparatory phase

The researchers conducted an intensive review of the past and current literature covering various aspects of the KOA among elderly patients. This was done using available textbooks and articles in scientific periodicals and journals. Based on this review the tools were prepared in their preliminary forms and reviewed by a panel of nursing and medical specialist professors for content validation.

Pilot study

To evaluate the feasibility, applicability, and clarity of the study tools, a pilot study was conducted on 10% (7) elderly patients; these patients were not included in the study. The appropriate adjustments were made.

Data collection phase (Field work)

The study began in the first of October 2023 and ended at the end of May 2024; data were collected from the previous mentioned setting for eight months. The study sample (70) geriatric patients received proprioception training program. The researcher collected data two days per week, 4 hours each day from 9.30 am to 1.30 pm., and the number which was interviewed was 2-3 elderly patients per day. And for each patient the time of session ranges between 20-30 minutes. Every patient who consented to participate in the study was given an explanation of its nature and goal.

Proprioception training program phases:

Assessment phase:

The researchers conducted the assessment at the outpatient clinics. Individual interviews were conducted with each participant to evaluate baseline data, including demographic data (using Tool I) and perform pretest (using Tools II and III).

Planning phase:

1. During this phase, the program's operating schedule was finalized, including the sessions' times. Also, additional facilities such as the teaching location, time, instructional strategies, and audiovisual aids were examined and organized.
2. The telephone number of the patient was taken to arrange for upcoming meetings, check with them their consistency with program and answer any inquiry
3. Teaching strategies and resources: Prior to the program's implementation, basic teaching strategies such as discussions, lectures, and demonstrations were developed, along with the usage of media such as booklet, audiovisual aids, and photographs.

Implementation phase:

- The first session included an orientation to the proprioception training program and its purpose to elderly participants in the first week. Also, pretest was done in the first session before implementing exercises to assess elderly knee function and health status.
- The 2nd session included education about definition, components and benefits of proprioception training program for elderly patients with knee osteoarthritis in the first week. Also, was including proprioception training program that included; One-leg balance, Toe walking, Heel walking, Blind advanced one leg balance and instructed them to do these 4 exercises (15-20 repetitions of each) per session, 5 day a week.
- The 3rd session for repetition of exercises to ensure that the patient has learned it well in the second week.
- The 4th session from wk. (3) to wk. (8) to make posttest after implementation session.
- The 5th session from wk. (9) to wk. (16) to do follow up test.

Evaluation phase:

This phase was done for studied elderly patients after the exercise program by using the following tools; tool II, and III from wk. (3) to wk. (8) to make posttest and from wk. (9) to wk. (16) to do follow up test.

Statistical analysis:

The collected data was examined, coded, examined, tabulated, and ready for computer input. The computer application SPSS version (22) was used to do descriptive statistics, such as mean and standard deviation, frequencies and percentages, etc. The Cronbach alpha coefficient was calculated to assess the reliability of the developed tools through their internal consistency. Independent sample T-test and Chi-square tests were used in the relationship. It's considered significant when P. value less than (0.05).

Results:

Table (1): Distribution of studied elderly is according to demographic characteristics.

Demographic data	Group Study(n=70)	
	N	%
Gender		
Male	28	40
Female	42	60
Age		
60– 65	43	61.4
66 – 70	21	30.0
71-75	6	8.6
Mean ± SD	65.6714± 3.15189	
Residence		
Urban	24	34.3
Rural	46	65.7
Marital status		
Single	3	4.3
Married	49	70.0
Widowed	18	25.7
Education Level		
Illiterate	30	42.9
read and write	8	11.4
primary certificate	14	20.0
University degree	18	25.7
Job after retirement		
Farmer	17	24.3
Self- employment	7	10.0
Housewife	39	55.7
Unemployment	7	10.0
Supporting person		
Husband/wife	42	6
Son	11	15.7
Daughter	14	20.0
Non	3	4.3

SD=standard deviation

Table (2): Distribution of studied elderly is according to their present history

Items	Group Study(n=70)		P value
	n	%	
Level of Knee osteoarthritis (based on X-rays)			0.204ns
Mild	32	45.7	
Moderate	38	54.3	
Current complains #			
Pain	70	100.0	0.013ns
Crepitation	28	40	0.431ns
Limited movement	64	91.4	0.372ns
Duration of diagnosis			
Less than 5 years	53	75.7	0.351ns
(5-10) years	17	24.3	

Items	Group Study(n=70)		P value
	n	%	
History of falling			0.025ns
Yes	18	25.7	
No	52	74.3	
Family history of knee osteoarthritis			0.570ns
Yes	25	35.7	
No	45	64.3	
History of Chronic disease #			
Hypertension	40	57.1	0.244ns
Diabetes mellitus	31	44.3	0.004*

Chi-square test P<0.05 #: More than one answer

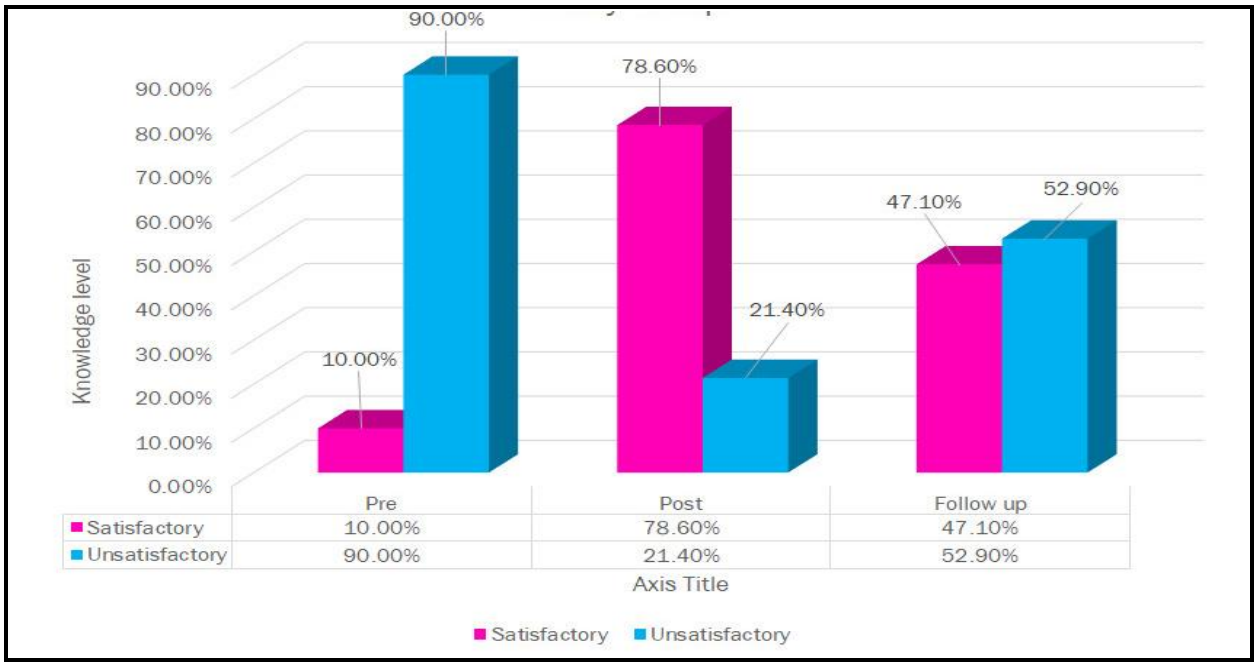

Figure (1): Distribution of studied elderly according total score of knowledge pre, post and follow up about knee osteoarthritis

Table (3): Comparison between pre, post and follow up of the studied elderly patients according to knee function

WOMAC Index	Pre	Post	Follow up	P-value	
	Mean ± SD	Mean ± SD	Mean ± SD	P1	P2
Pain	7.07± 2.65	3.02± 1.82	3.45± 2.15	0.0001*	0.0001*
Stiffens	3.38± 0.905	1.31± 1.03	1.40± 1.08	0.0001*	0.0001*
Physical Function	25.44± 6.82	10.02± 6.64	10.18± 6.68	0.0001*	0.0001*
Total WOMAC score	98.61+42.16	20.92+23.72	21.95+23.96	0.0001*	0.0001*

Independent Samples Test
** highly significant*
P1 between pre-test &post
P2 between pre-test &follow up P<0.05

Table (4): Comparison between pre, post and follow up of the studied elderly patients according to health status

Short form Health Survey (SF-36)	Pre	Post	Follow up	P-value	
	Mean ± SD	Mean ± SD	Mean ± SD	P1	P2
Physical Health Summery	44.00 ± 3.97	53.60 ± 3.43	53.85 ± 3.58	0.0001*	0.0001*
Mental Health Summery	43.18 ± 5.03	49.74 ± 3.56	49.64 ± 3.48	0.0001*	0.0001*

Independent Samples Test **highly significant*
P1 between pre-test &post-test *P2 between pre-test &follow up*

Table (5): Relation between Short form Health Survey (SF-36) and WOMAC index of studied elderly patients

WOMAC index	Short form Health Survey (SF-36)		P. value
	Physical Health Summery	Mental Health Summery	
	Mean ± SD	Mean ± SD	
WOMAC Pain	15.47± 2.38	14.33±2.48	0.0001*
WOMAC Stiffness	16.30±2.35	15.49±2.19	0.0001*
WOMAC Function	11.91±5.17	10.30±4.62	0.0001*
Total WOMAC score	16.44± 1.26	15.85± 0.73	0.0001*

Independent Sample T Test *SD=standard deviation* *P<0.05*

Table (1): Illustrates that more than three fifth (61.4%) of the studied elderly patients aged (60-65) years, and more than half (60%) of them were female, in relevance to residence, slightly less than two third (65.7%) of the patients live in rural areas. In regard to level of education, it was observed that more than two fifth (42.9%) of patients were illiterate. Also, this table revealed that most (70%) of them were married.

Table (2): Shows that more than half (54.3%) of elderly patients had moderate KOA and total number 100% of them were suffering from pain and most of them (75.7%) were diagnosed osteoarthritis in less than five years. furthermore, this table illustrated that more than one quarter (25.7%) of patients had history of fall.

Figure (1): Reveals that there was statistically significant difference between pre, post & follow up regarding knowledge level as satisfactory level score increase from 10% in pretest to78.6, 47.1% in posttest & follow up respectively for studied elderly patients.

Table (3): Shows that there was a highly statistically significant difference for study patients between pre, post & follow up according to WOMAC Index for pain, stiffness, physical function and Total WOMAC score. P= (0.0001, 0.0001, 0.0001, 0.0001) respectively.

Table (4): Reveals that there was a highly statistically significant difference for studied elderly patients between pre, post & follow up according to Short Form Health Survey (SF-36) for both physical and mental summary measures (P= 0.0001, 0.0001) respectively.

Table (5): Reveals that there was a highly statistically significant relation between Short form Health Survey (SF-36) for Physical and mental health summery and WOMAC index for pain, stiffness and function P= (0.0001, 0.0001, 0.0001, 0.0001) respectively.

Discussion:

Knee osteoarthritis (OA) is A crippling condition that results in functional limits and the main cause of disability. OA considered the third cause of disability in Egypt **(ElSayed et al., 2020).** Therefore, the present study was implemented to evaluate the impact of proprioception training program on knee function and health status among elderly patients with knee osteoarthritis.

The study found that over three-fifths of the patients were between the ages of 60 and 65, with a mean age of 65.67± 3.15. This could be explained by the fact that KOA is more common in older age groups, and that over half of the study participants were female. This could be because of possible hormonal differences between the sexes, as osteoarthritis (KOA) is more common in women than in men. This is comparable to the findings of a study done by **Mohsen et al, (2021)** who reported that mean age of the studied populations is 66.2 ± 6.4 and more than half of them were female and also these results agree with the results of study done by **AlKuwaity et al, (2018)** who found that mean age of the elderly is 70.4±9.3 and more than half of them were female

As regards to the residency, it was found that slightly less than two thirds of the studied sample live in rural areas. This might be because most elderly individuals have labor-intensive jobs like farming, which can worsen knee OA. This agrees with **Liu et al, (2018)** who reported that more than half of elderly people live in rural areas. According to marital status, it was observed that most of patients were married They can

benefit from this, and having a helping partner and relating to educational level among the studied sample, the present study illustrates that more than two fifth of the studied sample were illiterate. This can be because, in most societies in the past, access to education was restricted, compared to the current situation. This agree with **Mohsen et al, (2021)** who found that less than three quarter of the participants in their study were married and less than third of studied sample were illiterate.

Concerning to job after retirement, it was observed that house wives represented more than half of the studied patients and less than one quarter of them were farmers, this agrees with **Ibrahim et al, (2015)** who found that more than third of the participants were house wives and less than quarter of studied sample were farmers. Regards to supporting person, the present study illustrates that more than three fifths of the studied sample live with their Husband/wife this is fantastic for them due to having an assisting companion. this was similar to **Jaiswal et al, (2021)** who found that more than half of the study elderly live with spouse.

In the current study, all the elderly patients were experienced pain which is one of the most typical KOA symptoms and in terms of duration of disease, it was found that the majority of patients were diagnosed osteoarthritis for less than five years. This agrees with **Abd El Moniem et al, (2020)** who found that all of participants were suffering from pain and less than three quarters of them were diagnosed with OA in less than 5 yrs.

In relation to family history for osteoarthritis, this study indicated that more than one third of the studied patients had a present family history for knee osteoarthritis. One risk factor for knee osteoarthritis is family history. This agrees with **Abd Elhakim et al, (2018)** who found that slightly more than half of the study sample had family history for osteoarthritis. Relating to fall history among the studied sample the present study illustrates that slightly more than one quarter had fallen before as fall history is thought to be a risk factor for osteoarthritis in the knees. This was in the same line with **Ju et al, (2015) who** found that less than quarter of their knee OA patients had a history of falls.

Relating to chronic diseases among the studied sample, the present study illustrates that more than half of the studied sample had hypertension, while less than half had diabetes, this may be related to the aging process and indicates that diabetes mellitus and hypertension are the common chronic diseases among the geriatric patients at this age group. this agrees with **Khalil et al, (2024)** who found diabetes and hypertension are common health problems in the elderly with knee osteoarthritis.

Regarding to elderly patient's level of knowledge, the present study demonstrated that there is a highly statistically significant difference between pre, post and follow up elderly patient's knowledge (p=0.0001) as satisfactory level score increased from 10% in pretest to majority in posttest & less than half in follow up respectively for study patients. This could be because younger elderly are more likely to learn about the illness. This is comparable to what was reported by **Kamsan et al, 2020** who found that older patients with KOA showed good understanding of disease processes and clinical manifestations of knee osteoarthritis.

The present study showed that there was a highly statistically significant difference for study and control groups of patients related to (WOMAC) for pain, stiffness and physical function. (p=0.0001). this may be related to the simplicity of the steps of proprioceptive training program for elderly patient to do. This agrees with study conducted by **Sumaila et al, 2016** who reported that proprioceptive training significantly improved WOMAC pain and function scores (p=0.003). Also, **Sri Shankar, 2016** documented that there was marked difference in WOMAC score after Proprioceptive exercises.

According to the current study, there was a highly statistically significant difference for studied patients regarding health status according to Short form Health Survey (SF-36) P=0.0001 indicating that proprioceptive training program were more successful in improving health status. This agrees with study conducted by **Richhariya et al, (2023)** who reported that proprioception circuit training demonstrate a more substantial improvement in health status.

Conclusion:

Based on the findings of the present study it was concluded that proprioception training program are effective on enhancing knee function and improving health status among elderly patients with knee osteoarthritis.

Recommendations:

- Generalize the findings, further studies are needed and can be conducted on a larger sample.
- Develop and implement proprioception training program on other musculoskeletal disorders like low back pain among elderly patient.
- Provide a rehabilitation program to improve the function activities among the elderly with osteoarthritis.
- Conduct follow-up for elderly patients with knee osteoarthritis.

References:

- **Abd Elhakim., & Mohamed M(2023):** Patients' Knowledge and Practices toward Osteoarthritis Disease. Egyptian Journal of Health Care, 14(4), 347-360.
- **Abd El Moniem A., Ismaiel S., Reda H, & Mohamed H (2020):** Effect of physical Exercise and Heat Application on Pain and Morning Stiffness in Osteoarthritis Patients. Egyptian Journal of Health Care, 11(3), 1187-1201.
- **AlKuwaity, K., Mohammad, T., Hussain, M., Alkhanani, A., & Ali, A. (2018):** Prevalence and determinant factors of osteoarthritis of the knee joint among elderly in Arar, KSA. The Egyptian journal of hospital medicine, 72(9), 5173-5177.
- **Al-Omari, B., & Hill, B. (2020):** Nursing people with osteoarthritis. British Journal of Nursing, 29(18), 1060-1063.
- **Alyami, A., Alswat, M., Omer, I., Ahmed, M., Alshammari, S., Alsaggaf, K., & Aljafari, D. (2020):** General population knowledge about osteoarthritis and its related risk factors in Jeddah Saudi Arabia. Saudi medical journal, 41(5), 516.
- **Central Agency for Public Mobilization & Statistics (2023):** Egypt, population Available at 20238713628_pop2023 - e.pdf.
- **De Almeida, A., de Oliveira, J., da Silva Pontes, L., de Souza Júnior, J., Gonçalves, T., Dantas, S. & de Medeiros, I. (2022):** ROS: basic concepts, sources, cellular signaling, and its implications in aging pathways. Oxidative medicine and cellular longevity, 2022(1), 1225578.
- **ElSayed, M., Al Sebaee, A.,Mohammed, A., & Nawito, O., (2020):** Effect of Lavender Oil Massage on Pain among Patients with Knee Osteoarthritis. EXECUTIVE EDITOR, 11(01).
- **Gheita, T., & Eesa, N. (2019):** Rheumatology in Egypt: back to the future. Rheumatology International, 39(1), 1-12.
- **Guede-Rojas, F., Benavides-Villanueva, A., Salgado-González, S., Mendoza, C., Arias-Álvarez, G., Soto-Martínez, A., & Carvajal-Parodi, C. (2024):** Effect of strength training on knee proprioception in patients with knee osteoarthritis: a systematic review and meta-analysis. Sports medicine and health science, 6(2), 101-110.
- **Huffman, K., Ambrose, K., Nelson, A., Allen, K., Golightly, Y., & Callahan, L. (2024):** The critical role of physical activity and weight management in knee and hip osteoarthritis: A narrative review. The Journal of Rheumatology, 51(3), 224-233.
- **Ibrahim, H., Ahmed, T., & Elkady, H. (2015):** Self-Efficacy Management Program on Physical Function of Knee Osteoarthritis among Elderly Patients at Assiut University Hospital. Assiut Scientific Nursing Journal, 3(5.0), 170-181.
- **Ince, B., Goksel Karatepe, A., Akcay, S., & Kaya, T. (2023):** The efficacy of balance and proprioception exercises in female patients with knee osteoarthritis: A randomized controlled study. Clinical Rehabilitation, 37(1), 60-71.
- **Jaiswal, A., Goswami, K., Haldar, P., Salve, H. R., & Singh, U. (2021):** Prevalence of knee osteoarthritis, its determinants, and impact on the quality of life in elderly persons in rural Ballabgarh, Haryana. Journal of family medicine and primary care, 10(1), 354-360.
- **Ju, S., Park, G., & Kim, S. (2015):** Effects of proprioceptive circuit exercise on knee joint pain and muscle function in patients with knee osteoarthritis. Journal of physical therapy science, 27(8), 2439-2441.
- **Kamsan, S., Singh, D., Tan, M., & Kumar, S. (2020):** The knowledge and self-management educational needs of older adults with knee osteoarthritis: A qualitative study. PLoS One, 15(3), e0230318.
- **Khalil A., Gamal M., & Khalil I. (2024):** Instructional Guidelines on Selected Health Outcomes among Elderly with Knee Osteoarthritis. Egyptian Journal of Health Care, 15(1), 60-81.
- **Kloppenburg, M., & Berenbaum, F. (2020):** Osteoarthritis year in review 2019: epidemiology and therapy. Osteoarthritis and cartilage, 28(3), 242-248.
- **Liu, Q., Wang, S., Lin, J., & Zhang, Y. (2018):** The burden for knee osteoarthritis among Chinese elderly: estimates from a nationally representative study. Osteoarthritis and cartilage, 26(12), 1636-1642.
- **Mohsen, M., Sabola, N., El-khayat, N., & Abd El-Salam, E. (2021):** The Effect of Nursing Intervention on Knowledge and Practice among Elderly with Knee Osteoarthritis. International Journal of Novel Research in Healthcare and Nursing, 8(1), 716-726.
- **Richhariya, N., Mudaliar, S., & Kumar, D. (2023):** Efficacy of Proprioceptive Exercises and Core Strengthening with Conventional Physiotherapy on Pain and Quality of Life in Knee Osteoarthritis. Vol. 8; Issue: 1; International Journal of Science and Healthcare Research, https://doi.org/10.52403/ijshr.20230138.
- **Sri Shankar, M. (2016):** Effect of Proprioceptive Exercise and Strengthening Exercise on Functional Ability of Patients with Knee Osteoarthritis (Doctoral dissertation, KG College of Physiotherapy, Coimbatore).

- **Sumaila, F., Shittu, A., & Abdurrahman, U. (2016):** Comparative Study of The Effects of Proprioceptive Exercises Versus Ultrasound Therapy in the Management of Knee Osteoarthritis, Journal of Evidence-Based Physiotherapy, Vol. 2 No. 2 Articles Open Access.
- **Theiler, R., Spielberger, J., Bischoff, H., Bellamy, N., Huber, J., & Kroesen, S. (2002):** Clinical evaluation of the WOMAC 3.0 OA Index in numeric rating scale format using a computerized touch screen version. Osteoarthritis and cartilage, 10(6), 479-481.
- **Wang, Y., Wu, Z., Chen, Z., Ye, X., Chen, G., Yang, J., & Xu, X. (2021):** Proprioceptive training for knee osteoarthritis: a systematic review and meta-analysis of randomized controlled trials. Frontiers in Medicine, 8, 699921.
- **Ware J., Kosinski M., Turner-Bowker D., & Gandek B., (2002):** How to Score Version 2 of he SF-12® Health Survey (With a Supplement Documenting Version 1). Lincoln, RI: QualityMetric Incorporated.
- **World Health Organization, (2023):** Osteoarthritis, available at https://www.who.int/news-room/fact-sheets/detail/osteoarthritis
- **You, Y., Liu, J., Tang, M., Wang, D., & Ma, X. (2021):** Effects of Tai Chi exercise on improving walking function and posture control in elderly patients with knee osteoarthritis: A systematic review and meta-analysis. Medicine, 100(16).
- **Zamri, N., Harith, S., Yusoff, N., Hassan, N., & Ong, Y. (2019):** Prevalence, risk factors and primary prevention of osteoarthritis in Asia: a scoping review. Elderly Health Journal, 5 (1).