Assiut Scientific Nursing Journal
http://asnj.journals.ekb.eg http://www.arabimpactfactor.com
DOI: 10.21608/asnj.2024.297507.1906 http://olddrji.lbp.world/indexedJournals.aspx
https://vlibrary.emro.who.int/journals/assiut-scientific-nursing-journal

Effect of Knee Strengthening Exercises on Quality of Life among Patients with Knee Bursitis

Shaymaa Sayed khalil[1], Islam Mokhtar Mokhtar[2] & Mervat Abd EL-Fatah Ismael[3]
[1] Assistant Professor of Medical-Surgical Nursing, Faculty of Nursing, Assiut University, Egypt
[2] Assistant Professor of Medical-Surgical Nursing, Faculty of Nursing, Benisuef University, Egypt
[3] Lecturer of Medical-Surgical Nursing, Faculty of Nursing, Assiut University, Egypt

Abstract:
Background: Knee bursitis worsens over time leading to severe physical disabilities, and psychological disturbance. Strengthening exercises provide a promise in improving functional capacities and quality of life of the patients**. Aim:** to assess the effect of knee strengthening exercises on quality of life among patients with knee bursitis. **Research design:** Pre-experimental research design one group pre\post test methods. **Research Setting:** The research was applied in orthopedic department at Assiut University hospital. **Research sample:** A purposive sample of 60 patients of both sexes their ages from 20 to 65 years old. **Tools**: **(I):** Patient's assessment sheet (demographic & medical data), **(II):** Modified Cincinnati Rating System Questionnaire and **(III):** The Knee Quality of Life (KQoL-26). **Results:** There were statistically significant correlation between quality of life and physical status after 2 months after application of knee strengthening exercises also between educational levels and both physical functioning and activity limitations (0.001 and 0.009). There was a positive correlation between total scores of both modified Cincinnati rating system and the knee quality of life (KQoL-26) (P.0.001, r. 0.712). **Conclusion**: Application of knee strengthening exercises resulted in significant improvement in the physical status with greater increase in the studied patients' quality of life. **Recommendations:** Regular program's training to maintain the nurses in orthopedic department updated with research-based techniques and an array of interventions for decreasing patients' disabilities and increase the quality of life.

Keywords: Knee Bursitis, Quality of Life & Strengthening Exercises

Introduction
Knee bursitis is the inflammation of a tiny bursa, or sac filled with fluid, near the knee joint. Bursae cushion pressure points and reduce friction between the bones and the tendons, muscles, and skin in the region surrounding the knee joint. There are many bursa in the vicinity of the knee, and they can all become inflamed. However, the areas of the knee most susceptible to bursitis are the kneecap and the lower, inner side of the knee **(Kuwabara & Fredericson, 2021).**

The majority of patients with knee bursitis report pain. Bursitis can cause pain, which can be worse when moving but can also happen even at rest. People who have knee bursitis may also suffer warmth, tenderness, and swelling in the vicinity of the injury. A fever may also be present in a patient with an inflamed bursa. In addition to knee discomfort or swelling, the patient should seek medical attention if they have a temperature **(Codorean & Codorean, 2023).**

Obesity and osteoarthritis (obesity and osteoarthritis frequently coexist with pes anserine bursitis, which affects the inner side of the knee below the joint) are examples of prolonged kneeling (people who work on their knees for extended periods of time), participation in sports that involve direct hits to the knee or frequent falls onto the knee, and osteoarthritis **(Williams et al., 2023**).

To accurately diagnose knee bursitis, a physical examination and a medical history could be sufficient. The following imaging tests, however, may be ordered by the clinician in order to exclude out injuries that could produce symptoms and indications that are similar to those of bursitis: An x-ray can show whether there is a bone or arthritic issue; an MRI can show soft tissues, including bursae; and an ultrasound can show edema in the bursa that is impacted **(Lormeau et al., 2019).**

Options for treatment can range from lifestyle modifications and home cures to prescription drugs, physical therapy, and steroid injections. These medical interventions can help control pain and are frequently successful in treating knee bursitis. The majority of patients with knee bursitis do not need surgery, but if other non-invasive measures aren't helping and you have severe discomfort or limited movement, surgery can be necessary **(Colak et al., 2019).**

One of the best strategies to treat knee bursitis, prevent recurrence, and enhance the quality of life for patients is through knee strengthening exercises.

Individuals who perform knee strengthening exercises report reduced pain, faster bursitis recovery, improved function, and fewer pain flare-ups. Exercises that strengthen the kneecap assist patients live a better quality of life by enhancing their knee strength and control (**Dean, 2021).**

Significance of the study:

The biggest joint in the body is the knee. It is designed to support weight and provide stability and movement. Up to 10% of adults experience some form of bursitis, with knee bursitis being one of the more common types, especially in people engaged in repetitive kneeling or high-impact activities **(Kuwabara & Fredericson, 2021).** Knee bursitis affects a patient's physical status and quality of life by causing discomfort, degenerating muscles, and limiting range of motion in the knee. This study will provide patients with knee strengthening exercises and instructions on how to perform them safely and correctly to restore full motion and improve quality of life. Knee strengthening exercises help to relieve pain, increase muscle strength, enhance knee healing, and improve overall quality of life (**Mark, 2020**).

Aim of the study:

To evaluate the effect of knee strengthening exercises on quality of life among patients with knee bursitis.

Hypotheses:

To fulfil the aim of the study the these research hypothesis were formulated:

- Patient's physical status will be significantly improved among patients with knee bursitis post implementation of the knee strengthening exercises.
- Quality of life will be significantly improved patients with knee bursitis post implementation of the knee strengthening exercises.

Subjects and Methods

Research design: -

This study was conducted using pre-experimental research design one group pre\post test without control group.

Setting:-

The study was conducted in orthopedic department at Assiut University hospital

Patients:

A purposive sample of sixty patients of both sexes who were between the ages of 20 and 65 years with knee bursitis and were eligible to participate in this study.

Exclusion criteria:

- Joint surgery within six months before participate in the study.
- Recent bone or soft tissue injury.
- Uncontrolled chronic diseases and serious physical comorbidities such arrhythmia or ischemic heart disease that is unstable.
- Other infectious arthritis.
- Current use of oral glucocorticoids analgesic therapy.
- History of regular exercise in the last 6 months.
- Previous diagnosis of peripheral nerve system involvement, amyloidosis, cancer, a vitamin B12 deficiency, extra symptoms of connective tissue diseases such sjögren's syndrome and/or vasculitis, and positive pathological reflexes.

Tools:

Three tools were utilized in this study.

It was applied two times (Pre-intervention and 2 months post- intervention).

Tool (I): Patient's assessment sheet.

It was developed by the researcher based on current national and international literatures. It included two parts:

Part (1): Demographic data for the patient as (name, age, gender, occupation, marital status, residence, and level of education).

Part (2): Medical data as: It included questions as (time since diagnosis, history of rheumatoid arthritis or gout, previous knee injuries, surgical history of knee, obesity, prolonged kneeling, participation in certain sports that result in direct blows or frequent falls on the knee.

Tool (II): Modified Cincinnati Rating System Questionnaire (Noyes et al., 1989): to assess knee function in patients, particularly those who have undergone knee surgeries such as ACL reconstruction. It evaluates subjective knee function and activity level in patients, providing both patients and healthcare providers with a clear understanding of knee performance in daily activities

It included eight sections concerning knee assessment:

Pain intensity, swelling, giving way, overall activity level, walking, stairs, running activity and jumping or twisting.

It takes about five minutes to achieve the scale.

While the researchers collected it from patients face-to-face in a clinical setting in the department.

Scoring system:

Grading the Modified Cincinnati Rating System Questionnaire: **(by Bentley et al., 2003).**

Scoring :	
1. Poor	<30
2. Fair	30-54
3. Good	55-79
4. Excellent	>80

Tool (III): The Knee Quality of Life (KQoL-26) 26-item questionnaire (Andrew et al., 2008): It is a comprehensive patient-reported outcome measure

specifically designed to assess the quality of life related to knee health. It focuses on the physical, emotional, and social impacts of knee injuries or conditions, including osteoarthritis, ligament injuries, and other chronic knee issues. The **KQoL-26** provides a detailed assessment of how knee problems affect various aspects of a patient's daily life, making it a valuable tool for both clinical evaluation and research. The KQoL-26 is a self-reported questionnaire for assessing knee-related quality of life. It included 26 items: physical function (15), limitations in activities (5) and emotional function (6).

Scoring system:

- Each one is rated between 0 and 4.
- Total score ranges from 0 (marked pathology conditions) to 104 (optimal state).

The knee strengthening exercises: This was prepared in a booklet by the researchers based on review of related literature in a simplified Arabic language and was supported by photo illustrations, Exercises were contain of the following:

- Seated Hamstring Stretch.
- Stomach Quadiceps Stretch.
- Calf Stretch.
- Standing iliotibial band Stretch.
- Prayer Stretch.
- Quadiceps set.
- Heel Slides.
- Straight Leg Raise.
- Side-Lying Hip Abduction.
- Ball Squats.

Methods:

Administrative approval:

Official approval permission was gotten from orthopaedic department at Assiut University hospital to gather the needed data after study purpose description.

Tools development:

Tools was developed after extensive national and international literature review.

Validity:

The first tool were tested for face validity by professor expert in the arenas of medicine and nursing for content validity and reliability.

Reliability: Test-retest correlations proving reproducibility have varied from 0.87 to 0.99, while correlations across interview and questionnaire formats have ranged from 0.85 to 0.95.

Pilot study

A pilot study was conducted on 10% (6 patients) of sample in the selected setting to examine the applicability, the feasibility and clarity of the developed tools based on the opinion of experts and required changes were done. Some minor modifications based on the result of the pilot study were made to have more applicable tools for data collection. Some statements were omitted, added or rephrased, and then the final forms were developed**,** so the 10% of the subjects selected for the pilot study were not included in the main study.

Procedure

This study was conducted through:

- The study tools were designed after widespread literature review (nursing and medical text book, journal, internet resources as PubMed, google scholar, MedlinePlus, EKB etc…..) to get a clear picture of all dimensions related to the topic of research, such as (**Laura et al., 2020) and (Siripongpan & Sindhupakorn, 2022)**
- The researchers gave the patient an introduction and described the goal of the study at the start of the interview.
- The participation was based on oral consent.
- The morning shifts of each day (three days a week) was dedicated to gathering study data. The entire set of data was gathered over the course of six months, from the beginning of January 2023 to the beginning of June 2023.
- During the first visit, the researchers began filling out the patient's assessment form in order to evaluate the patient's medical history and demographic traits using **Tool I**. Using the hospital files of the patients, that happened in the patient's room with a physician. It takes roughly ten minutes to complete.
- The researcher then assessed patient’s physical status using **Tool II** and quality of life using **Tool III** (Pre-test).
- After that knee strengthening exercises was explained and demonstrated by the researchers to patients.
- Patients were instructed to do exercises in two sessions.

First session: aimed to provide the patients the definition, type, important contraindications of the strengthening exercises. This session take about 10 minutes.

Second session (practical): aimed to demonstrate the steps of strengthening exercises using video for demonstration and helping the patients to repeat this steps with helping of the researcher.

- Participating patients were asked to re-demonstrate each exercise in front of the researchers.
- This session takes about 20 to 30 minutes and varied according to each participant's understanding.
- Patients were encouraged to adhere to knee strengthening exercises regularly.
- At the end of the 1st visit, a hard copy (coloured form) of the knee strengthening exercises was given to the patients that containing instructions, a description of procedures with pictures and steps.

- The purpose of the demonstration and re-demonstration was to make sure that the participants and their families could precisely follow this process.
- The patients were advised to perform the strengthening exercises for 3 times/day, 5 days/week and to continue for a period of 3 months.
- Follow up was done by the researchers via the telephone on weekly basis to ensure that the participants were following the learnt exercises.
- Patients were asked to come at the end of 3rd month from beginning of knee strengthening exercises for follow-up in which again physical status and quality of life were evaluated through face-to-face interviews using tool II and III. This occurred in the nursing station in orthopaedic department and take about 10 minutes.

Ethical Consideration:

The research proposal was approved by the ethical committee of the nursing faculty (No. 1120240619), ensuring adherence to ethical principles in clinical research. There was no risk posed to the study subjects during the research, and confidentiality and anonymity were strictly maintained. Participants had the right to refuse or withdraw from the study at any time without providing a reason. For data protection, participants were coded during data entry, ensuring that their identities could not be traced. Verbal consent was obtained from each geriatric patient after a thorough explanation of the study's purpose, ensuring that they were fully informed before participating.

Statistical analysis:

The gathered data was organized, categorized, and examined using the statistical software for social sciences (SPSS) version 22. Descriptive statistics were utilized to report the mean and standard deviations of the data for both qualitative and quantitative variables. The statistical tests used were the paired t-test, chi-square test, and correlation r-test. A statistically significant difference was not considered when the p-value was larger than 0.05, and high significance was assumed when it was less than 0.05.

Results:

Table (1): Frequency & Percentage Distribution of Socio-Demographic Characteristics of the Studied Patients (N = 60)

Socio-Demographic Characteristics	Studied Patients (n.=60)	
Items	**N**	**%**
Age		
- ≤ 40 to 49	11	18.3
- 50 to 59	14	23.3
- 60 to 65	35	58.4
Mean ± SD	58.2±9.2	
Gender		
- Male	23	38.3
- Female	37	61.7
Residence		
- Rural	37	61.7
- Urban	23	38.3
Marital status:		
- Single	8	13.4
- Married	27	45.0
- Divorced/separated	11	18.3
- Widow	14	23.3
Educational levels		
- Illiterate	21	35.0
- Read and write	19	31.7
- Diploma	16	26.7
- High education	4	6.6
Occupation		
- House wife	36	60.0
- Office work	14	23.3
- Employ	4	6.7
- Retired	6	10.0

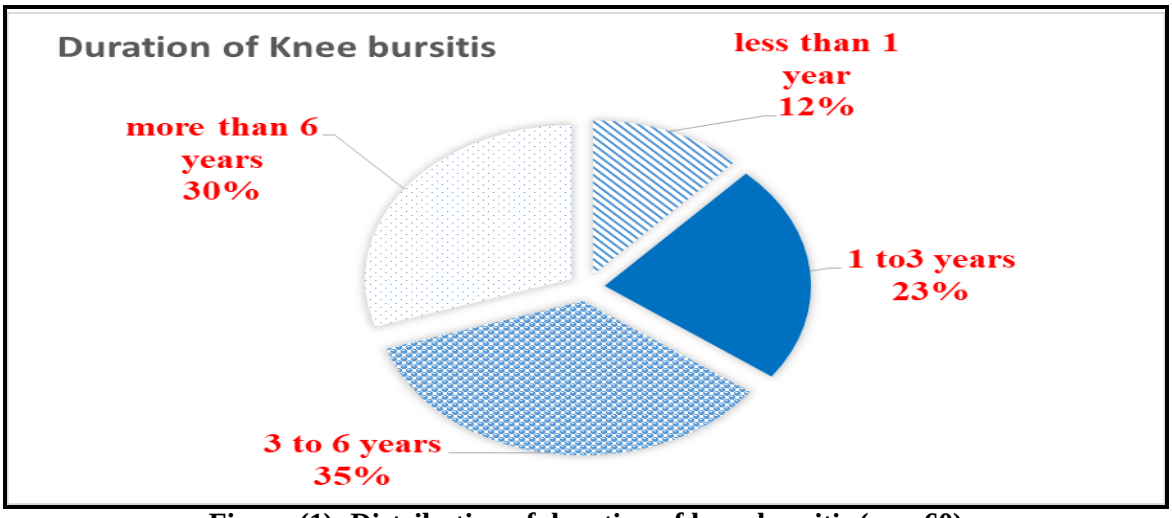


Figure (1): Distribution of duration of knee bursitis (n. = 60)

Table (2): Distribution of medical data of the studied patients (n. = 60)

Presence of medical data	N. (60)	%
Rheumatoid arthritis or gout	51	**85.0**
Previous knee injuries,	49	**81.7**
Surgical history of knee,	37	61.7
Obesity	**53**	**88.3**
Prolonged kneeling,	50	83.3
Participation in certain sports that result in direct blows	23	38.2
Frequent falls on the knee	40	66.7

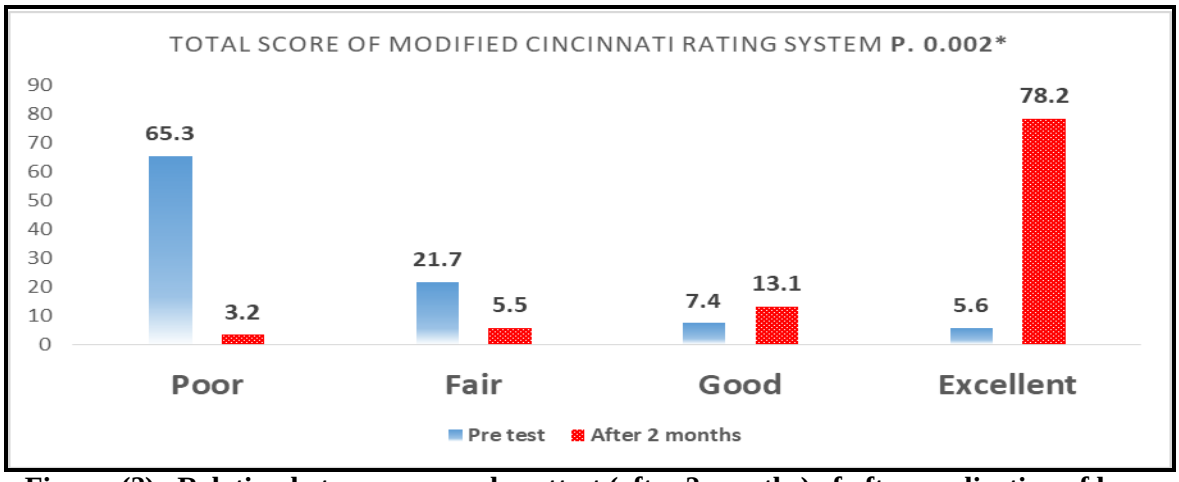


Figure (2): Relation between pre and posttest (after 2 months) of after application of knee strengthening exercises regarding the total score of Modified Cincinnati Rating System (N = 60)

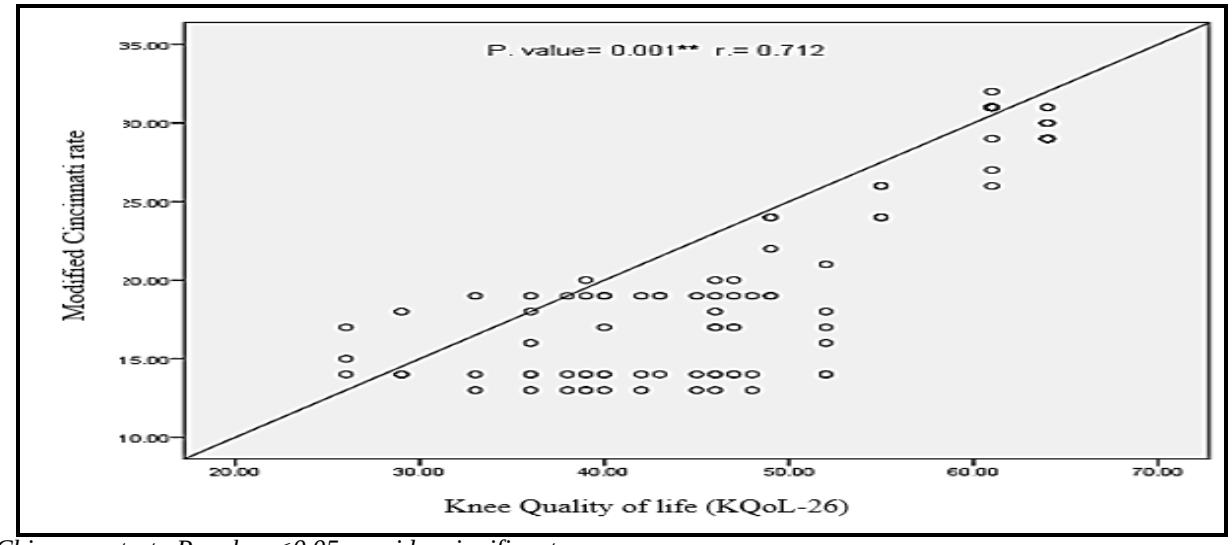
Table (3): Relation between pre and posttest (after 2 months) of after application of knee strengthening exercises regarding the knee Quality of Life (KQoL-26) (N = 60)

The Knee Quality of Life (KQoL-26)	Pre- test	After 2 months	t	P. value
	Mean (±SD)	Mean (SD)		
A) Physical functioning:	37.1 (±23.1)	49.1 (±1.1)	3.913	0.031*
B) Activity limitations	15.1 (±5.3)	5.3 (±1.2)	8.771	0.011*
C) Emotional functioning	12.1 (±5.3)	20.7 (±4.3)	6.246	0.001*
Total	65.4 (±35.3)	92.1 (±22.0)	6.661	0.002*

Compare means, P. value <0.05 consider significant.

Table (4): Correlation between quality of life after 2 months of after application of knee strengthening exercises with their demographic data (n = 60)

Socio-Demographic Characteristics	A) Physical functioning:	B) Activity limitations	C) Emotional functioning
Age	P.= 0.54	P.= 0.63	P.= 0.18
Gender	P.= 0.09	P.=0.85	P.= 0.06
Residence	P.= 0.35	P.=0.14	P. = 48
Marital status:	P.= 0.07	P. = 0.17	P.= 0.33
Educational levels	**P.=0.001***	**P.=0.009***	P. = 0.22
Occupation	**P. = 0.03***	P. = 0.21	P.=0.36



Chi square test. P. value <0.05 consider significant.

Figure (3): Correlation between total scores of both modified Cincinnati rating system and the knee quality of life (KQoL-26) among the studied patients after 2months after application of knee strengthening exercises

Table (1): Displays that more than half (58.4 %) of the studied patients were between 60 to 65 years old and married. More than half (61.7%) were females and (60.0%) were housewife. More than one third (35%) of them were Illiterate.

Figure (1): Shows that more than one third (35%) of the studied patients had the knee bursitis from 3 to 6 years.

Table (2): Table shows that majority of the studied patients had obesity, rheumatoid arthritis or gout, Prolonged kneeling and Previous knee injuries (88.3, 85.0, 83.3 and 81.7 respectively).

Figure (2): Reveals that there was a statistically significant difference between pre and posttest (after 2 months) of the studied patients regarding the total score of Modified Cincinnati Rating System. The figure also, showed a great improve of their physical status after application of knee strengthening exercises

Table (3): Reveals that there was a statistically significant difference between pre and posttest (after 2 months) of the studied patients regarding the knee Quality of Life (KQoL-26). The table also, showed a great improve of their quality of life after application of knee strengthening exercises.

Table (4): Reveals no statistically significant correlation was found between quality of life after 2 months of after application of knee strengthening exercises with their demographic data except between Educational levels and both physical functioning and activity limitations (0.001 and 0.009) Also, between the occupation and the physical functioning (P. 0.03).

Figure (3): Reports that there was appositive correlation between total scores of both modified Cincinnati rating system and the knee quality of life (KQoL-26) among the studied patients after 2months after application of knee strengthening exercises.

Discussion:

The present study investigated the effective of knee strengthening exercises on quality of life of patients with knee bursitis. The bulk of the patients under investigation were above sixty years old, conferring to the results of the current study's research of their demographic features. The fact that knee bursitis

symptoms usually manifest between the ages of 50 and 65 may help to explain this result. The ordinary age of all bursitis patients was 55.6 years, according to **Brown et al.,'s (2022)** study, Management of Septic and Aseptic Prepatellar Bursitis: A Systematic Review.

According to the current study, women made up the bulk of the patients under investigation. The researcher opinion that women tend to have certain anatomical differences compared to men, such as a wider pelvis and different alignment of the lower limbs, which may place them at higher risk for knee-related issues. This research's findings **corroborated those of Rhon et al., (2022),** who noted that most study participants were female in their study "Use of Non-Specific Knee Diagnoses and Incidence of Obscure Knee Injuries in a Large Government Health System."

Contrary to **Manac'h et al., (2012),** who claimed that the majority of the investigated patients were workers, the majority of the patients in the current study were married, illiterate, did not work, and resided in rural areas.

It was discovered in the existing study that almost one-third of the patients experienced knee bursitis between the three and six years duration. The researcher point of view that such a long period suggests that knee bursitis may have a recurrent or chronic pattern in many cases. While acute bursitis typically resolves with treatment, chronic bursitis may require ongoing management due to repeated flare-ups. The results of this study were in conflict with those of **Basha et al., (2020),** who said that most of the study group had knee bursitis six months before in their study, "Diagnostic accuracy of ultrasonography in the assessment of anterior knee pain."

According to the current study, the majority of the patients were obese and had prolonged kneeling, the researcher suggested that obesity significantly increases the load on the knee joints, placing excessive pressure on the bursae. The results of this study corroborated those of **Mischke et al., (2017),** who found that most of the patients in their study experienced prolonged kneeling. Their study was titled "Occupational exposure to knee loading and the risk of osteoarthritis of the knee, meniscal knee lesions, and pre-patellar bursitis."

The current study shows that most of the patients had prior knee problems, as the researcher's explanation, the long period may lead to recurrence of the problem. The results of this investigation were in conflict with those of **Laura et al. (2020),** who found that most of the participants in their study, "Prevalence of abnormal findings in 230 knees of asymptomatic adults using 3.0 T MRI," did not have prior knee injuries.

Based on the Modified Cincinnati Rating System, the existing study shows a significant improvement in the patients' physical status following the application of knee strengthening exercises, with a statistically significant difference in their total score between the pre and posttest (after two months).

The overall modified Cincinnati Rating System score be situated statistically significant from baseline ($p = 0.002^*$), the researcher suggested that investigating the role of supported therapies could provide additional relief to patients and help reduce dependence on more invasive treatments. according to **Berta et al.'s (2020)** "Follow-Up Study Evaluating the Long Term Outcome of ChondroMimetic in the Treatment of Osteochondral Defects in the Knee" study.

The results of this study indicate that there was a statistically significant difference in the patients' knee Quality of Life (KQoL-26) between the pre- and post-tests (after 2 months). The researcher outlined that patients likely experienced less pain, improved functionality, and a better ability to perform daily or physical tasks after the intervention. Our results were steady with those of **Saggini et al. (2015),** who investigated "Pes Anserine Bursitis in Symptomatic Osteoarthritis Patients: A Mesotherapy Treatment Study" and discovered that quality of life decreased significantly during both follow-up periods.

According to a relation knee Quality of Life (KQoL-26) and demographic data:

The study's findings demonstrated no statistically significant relationship between the patients' demographic information and their quality of life two months after applying knee strengthening exercises, with the exception of the relationship between educational attainment and physical functioning and activity limitations (**0.001 and 0.009).** as well as the relationship between occupation and activity limitations (**0.03*).** The researcher suggested that while most demographic factors did not significantly impact patients' quality of life after knee strengthening exercises, higher educational attainment and occupation were key influences on physical functioning and activity limitations, indicating the potential role of socio-economic factors in recovery outcomes. However, **Siripongpan & Sindhupakorn (2022)** found a correlation between residential area and other variables of demographic data in their study "A Comparative study of knee pain patients between urban and rural areas in knee severity and quality of life."

According to correlation between total scores of both modified Cincinnati rating system and their knee quality of life (KQoL-26):

The results of this study show that, two months after the patients had started knee strengthening activities,

there was an affirmative link between the patients' knee quality of life (KQoL-26) and the overall scores of both the modified Cincinnati rating system. As a researcher view, the findings indicating a positive correlation between the Knee Quality of Life (KQoL-26) and the modified Cincinnati rating system scores two months after knee strengthening exercises underscore the importance of functional improvements in enhancing patients' overall quality of life, highlighting the effectiveness of targeted rehabilitation strategies. This is corroborated by **Michael et al. (2015)**, who investigated "Rehabilitation Guidelines: Autologous Chondrocyte Implantation using Carticel (autologous cultured chondrocytes)" and discovered that the patients' knee quality of life (KQoL-26) and their total scores of both the modified Cincinnati rating system showed an appositive correlation.

Conclusion:

From the data of this study it concluded more than one third of the studied patients had the knee buritis from 3 to 6 years and majority had obesity, rheumatoid arthritis or gout**,** prolonged kneeling and previous knee injuries. There were statistically significant correlation between quality of life and physical status after 2 months of after application of knee strengthening exercises also between educational levels and both physical functioning and activity limitations. There was a positive correlation between total scores of both modified Cincinnati rating system and their knee quality of life (KQoL-26). Application of knee strengthening exercises resulted in significant improvement in the physical status with greater increase in the studied patients' total quality of life.

Recommendations:

From the research results the researcher recommended the following:

- A regular program of training to keep the orthopedic department nurses up to speed on evidence-based methods and a variety of treatments aimed at reducing patients' limitations and enhancing their quality of life.
- Educating care givers and patients with knee bursitis about the value of knee strengthening exercises in reducing disability and enhancing quality of life.
- A well-thought-out, organized rehabilitation program tailored to each patient's specific needs should be created in order to assess the program's impact on their functional status and overall quality of life of patients with knee bursitis.

References

- **Andrew M Garratt, Stephen Brealey, Michael Robling, Chris Atwell, Ian Russell, William Gillespie, David King & the DAMASK Trial Team (2008):**Development of the Knee Quality of Life (KQoL-26) 26-item questionnaire: data quality, reliability, validity and responsiveness. Health and Quality of Life Outcomes. volume 6, Article number: 48.
- **Basha M, Eldib D, Aly S, Azmy T, Mahmoud N, Ghandour T, Aly T, Mostafa S, Elaidy A & Algazzar H(2020):**Diagnostic accuracy of ultrasonography in the assessment of anterior knee pain. Insights into Imaging. Vol. (11), No. (7), P.P (107).
- **Bentley G, Biant LC, Carrington RW, Akmal M, Goldberg A, Williams AM, Skinner JA, & Pringle J. (2003):** A prospective, randomised comparison of autologous chondrocyte implantation versus mosaicplasty for osteochondral defects in the knee. J Bone Joint Surg Br. Mar; 85(2):223-30.
- **Berta A, Shive M, Lynn A, Getgood A, Totterman S, Busby G, Hollenstein J, Vásárhelyi G, Kéki I & Hangody L (2020):** Follow-Up Study Evaluating the Long Term Outcome of ChondroMimetic in the Treatment of Osteochondral Defects in the Knee. *Applied. Scinces* Vol. (10), No. (16), P.P (5642).
- **Brown OS, Smith TO, Parsons T, Benjamin M, & Hing CB. (2022):** Management of Septic and Aseptic Prepatellar Bursitis: A Systematic Review **.** Archives of Orthopedic and Trauma Surgery. Vol.(142),No.(10),P.P(2445-2457).
- **Codorean, I., & Codorean, I. (2023):** Condition Causing Anterior Knee Pain. Clinical-MRI Correlations of Anterior Knee Pain: Common and Uncommon Causes, 21-57.
- **Colak C, Ilaslan H & Sundaram M (2019):** Bony changes of the tibia secondary to pes anserine bursitis mimicking neoplasm. Skeletal Radiol p.p 1748:1795.
- **Dean Cole (2021):** knee bursitis. www.arthritis health.com/types/bursitis/knee-prepatellar-bursitis. Accessed at 8 p.m at 4/10/2022.
- **Kuwabara, A., & Fredericson, M. (2021):** Narrative: review of anterior knee pain differential diagnosis (other than patellofemoral pain). Current Reviews in Musculoskeletal Medicine, 14, 232-238.
- **Laura M. Horga, Anna C. Hirschmann, Johann Henckel, Anastasia Fotiadou, Anna Di Laura, Camilla Torlasco, Andrew D'Silva, Sanjay Sharma, James C. Moon & Alister J. Hart(2020):** Prevalence of abnormal findings in 230 knees of asymptomatic adults using 3.0 T MRI. Skeletal Radiology. Vol.(49), No.(15), P.P(1099–1107).

- **Lormeau C, Cormier G, Sigaux J, Arvieux C & Semerano L (2019):** Management of septic bursitis. Joint Bone Spine. Vol. (86), No. (5), P.p (583-588).
- **Manac'h A, Descatha A, Imbernon E & Roquelaure Y (2012):** Prevalence of knee bursitis in the workforce. Occupational Medicine, Vol. (62), No. (8), P.P (658-660).
- **Mark G. (2020):** Pes Anserine Bursitis Clinical Presentation. Physical Medicine and Rehabilitation.Medscape accessed at 9 P.M AT 4/10/2022.
- **Michael M. Reinold, PT, ATC, Kevin E. Wilk, PT, Jeffrey R. Dugas, MD, E. Lyle Cain, MD,Scott D. & Gillogly, MD(2015):** Rehabilitation Guidelines: Autologous Chondrocyte Implantation using Carticel (autologous cultured chondrocytes). VERICEL. Vol. (53), No. (65), P.P (347).
- **Mischke C, Robinson R, Verbeek J, Kuijer P, Ijaz S, Kievit R, Ojajärvi A, & Neuvonen K(2017):** Occupational exposure to knee loading and the risk of osteoarthritis of the knee, meniscal knee lesions and pre-patellar bursitis. Saftey and Health at Work. .Vol. (8), No. (2), P.P (130-142).
- **Noyes FR, Barber SD & Mooar LA. (1989):** A rationale for assessing sports activity levels and limitations in knee disorders. Clin Orthop Relat Res. (246):238-49.
- **Rhon DI , Yuan X, Barlow BT, Konitzer LN, & Cook CE (2022):** Use of Non-Specific Knee Diagnoses and Incidence of Obscure Knee Injuries in a Large Government Health System. Dovepress. Vol. (14), No. (3),p.p(1123-1133).
- **Saggini R, Stefano A, Dodaj I, Scarcello L & Bellomo R. (2015):** Pes Anserine Bursitis in Symptomatic Osteoarthritis Patients: A Mesotherapy Treatment Study. The Journal of Alternative and Complementary Medicine. Vol.(21), No. (8), P.P (236).
- **Siripongpan A & Sindhupakorn B (2022):** A Comparative study of knee pain patients between urban and rural areas in knee severity and quality of life. Health Psychol Res. Vol.(30), No.(10),P.P(35466).
- **Williams CH., Jamal Z., & Sternard BT., (2023**): StatPearls [Internet]. StatPearls Publishing. https://pubmed.ncbi.nlm.nih.gov/30020712. Accessed at 15/12/2023.at 12 p.m.