Effect of Life Style Modification on Patients with Knee Osteoarthritis Attending NRC Rheumatology Clinic.

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KEYWORDS
KOA; KOA; Joint; WOMAC score.

ABSTRACT
Background: Osteoarthritis is a prevalent degenerative joint disease, affecting approximately 302 million people globally.
Aim: To promote health and improve quality of life of knee osteoarthritis patients attending National Research Centre Rheumatology Clinic.
Subjects and methods: This prospective interventional study was conducted at the Rheumatology Outpatient Clinic, National Research Centre, Cairo, to promote health and improve quality of life in knee osteoarthritis (KOA) patients. Participants were consecutively recruited, and data collection occurred over two months, from June to August 2022.
Results: Baseline analysis revealed that females had a significant worse total WOMAC score with median 59.0(51.0-69.0) and its domains (pain: 13.0(11.0-15.0) and stiffness: 5.0(4.0-6.0), $p<0.001$. Additionally, participants with less than secondary education levels had significantly higher (worse) WOMAC total scores and its domains including pain, stiffness and physical function ($p<0.001$). Comparing WOMAC scores and domains between baseline and post-intervention, a highly significant decrease was observed ($p<0.001$).
Conclusion: KOA affects those aged 51-60, with women showing more severe symptoms. Home-based exercise and education effectively improve symptoms, knee function, and QoL.
Trial registration: NCT06589960

Introduction

Osteoarthritis (OA) is a degenerative joint disease, the most prevalent form of arthritis, affecting an estimated 302 million people worldwide. It is characterized by pathology involving the whole joint, including cartilage degradation, bone remodeling, osteophyte formation, and synovial inflammation leading to loss of normal joint function (1) It is the fastest growing cause of disability driven by an increasingly older population, and the growing incidence of obesity (2). The cartilage damage occurs from a combination of biomechanical as well as biochemical factors but ultimately the clinical disease results from an imbalance between damage and repair of this tissue (3).

Lifestyle changes are gaining increasing recognition in the management of osteoarthritis and other noncommunicable diseases. In most guide-lines advice on education, exercise and dietary weight management is now given priority over pharmacological therapies regardless of disease severity and co-morbidity (4).

Exercise therapy, which is one of the most important non-pharmacological treatments, is a safe and low-cost method for treating OA that has been shown to delay disease progression, relieve pain, and improve knee function (5).

Rehabilitation physicians and researchers are increasingly recognizing the value of home-based exercise, which is a time-efficient and convenient treatment modality for patients with chronic diseases OA. It can be performed by patients individually at home, unsupervised, and without professional equipment. The goal of home-based is to relieve pain and improve function by strengthening lower limb muscles, improving neuromuscular control, and range of joint motion in the affected knees. In addition, its inexpensive, easy to use, safe, and suitable for being practiced at home (5). The goal of the current study was to promote health and improve quality of life of patients with KOA attending National Research Centre Rheumatology Clinic.

Subjects and methods

Study participants:

This was a prospective interventional study conducted at the Rheumatology Outpatient Clinic, National Research Centre, Cairo Governorate, aimed at promoting health and improving the quality of life of knee osteoarthritis (KOA) patients. patients with KOA were consecutively recruited from the Rheumatology Outpatient Clinic at the National Research Centre. Data collection took place over a period of two months, starting from June 2022 until the end of August 2022. Participants were followed up for five to six months after recruitment to assess the effect of health education and lifestyle modifications on their level of movement and activity, degree of pain (using the WOMAC index) changes in knowledge, attitudes and practices (KAP)

Inclusion criteria: patients with KOA from both sexes ,age above 35 years old and one/both knee joint affection.

Exclusion criteria: Other causes than OA for joint problems (e.g. hip fracture, chronic wide spread pain, acute inflammatory joint disease, or cancer), Patients receiving physical therapy or intra-articular injection in the past 3 months, total joint replacement or other surgery of the knee or hip within the past 3 months, immunosuppressant intake in the past 3 months and pregnancy, end stage disease or malignancy.

Data collection technique and tools:

In the first phase (pre-intervention), data collection involved multiple tools: a sociodemographic questionnaire to gather details on age, gender, marital status, occupation, education, smoking habits, disease duration, medical history and medications. The Western Ontario and McMaster Universities Arthritis Index (WOMAC) to assess pain, stiffness, and physical function in knee/hip osteoarthritis.

The second phase involved implementing a health education program through nine 120-minute sessions attended by 104 participants. Sessions included presentations and expert-led discussions on topics like the role of physical activity, weight management, and non-surgical symptom reduction in KOA. A rheumatologist and physiotherapist covered KOA risk factors, symptoms, diagnosis, and treatment, including the risks of long-term NSAID use. A home-based exercise program, divided into

three two-week phases, was introduced to strengthen lower-limb muscles, improve flexibility, and reduce pain. Participants received an educational booklet with OA information, exercise instructions, and lifestyle tips. WhatsApp groups were created for each phase to share content, exercise videos, and motivational messages, alongside follow-up phone calls to encourage adherence.

In the third phase (post-intervention), the program's impact was evaluated after six months using the WOMAC index.

Sample size and technique: A convenient sample was taken from patients with KOA attending the Rheumatology Outpatient Clinic at the National Research Centre. All patients who met the inclusion criteria during the data collection period were included in the study. The sample size was calculated using IBM sample power 3, it was measured based on the mean difference in WOMAC score pre and post intervention (51.79±18.32 and 45.21±19.13 respectively) (5) among patients with OA with alpha level set at 0.005 and power of 85%. A total 75 participants were required which was increased to 84 to adjust for 10% dropouts,

Data management and statistical analysis:

Data entry, cleaning, and analysis were performed using SPSS version 27. Normality testing was conducted using the Kolmogorov-Smirnov (KS) test. Descriptive statistics were calculated using numbers and percentages for qualitative variables, while mean and standard deviation or median and interquartile range (IQR) were used for quantitative variables, depending on their distribution. The Chi-square test was used to assess significant relationships between qualitative variables. For inferential statistics, the independent t-test and ANOVA were applied to normally distributed quantitative variables, while the Mann-Whitney U and Kruskal-Wallis tests were used for non-normally distributed variables. Changes in scores before and after the intervention were analyzed using the paired sample t-test and Wilcoxon signed-rank test. Spearman correlation was employed to examine relationships between two quantitative variables.

Ethical consideration

The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants after providing a full explanation of the study's objectives and procedures. The study protocol was approved by the ethical committee of the National Research Center under approval number (1111022021) and was registered on ClinicalTrials.gov with ID number (NCT06589960). All data collected were kept confidential and private, with access restricted to the researcher and supervisors.

Results

Table (1) shows demographic characteristics among the studied participants. More than half of the participants were between 51-60 years old (44.0%), more than three quarters of them were females (88.1%). Most of the participants had a university degree (38.1%) and worked in administrative jobs (61.9%). The weight mean was 89.1±16.5 kilograms, the height mean was 160.5±11.0 cm and the body mass index mean was 34.6±7.3. The mean of waist circumference was 107.6±14.6 cm and of the hip circumference was 119.9±16.0 cm. In addition, the mean of systolic blood pressure and diastolic blood pressure were 128.3±19.0 mmHg and 80.1±11.5 mmHg respectively.

Table (1): Socio-demographic characteristics and clinical assessment of the studied participant

Variables	**n=84**	
	n	**%**
Age categories		
≤ 50	**22**	**26.2**%
51- 60	**37**	**44.0**%
≥ 61	**25**	**29.8**%
Sex		
Males	**10**	**11.9%**
Females	**74**	**88.1**%
Education		
Illiterate-preparatory	**2**	**2.4**%
Secondary-Diploma	**22**	**26.2**%
University	**32**	**38.1**%
Postgraduate	**28**	**33.3**%
Occupation		
Professional Staff members	**32**	**38.1**%
Administrative	**52**	**61.9**%

Measurement	**Mean±SD**	**Minimum**	**Maximum**
Weight	89.54±15.17	54.00	131.30
Height	160.50±7.51	143.00	196.00
Body Mass Index	34.89±6.15	19.60	53.27
Waist	109.66±16.28	61.00	151.00
Hip	125.14±14.62	71.00	150.00
Waist/Hip	0.88±0.10	0.71	1.23
Systolic blood pressure	123.99±12.91	90.00	161.00
Diastolic blood pressure	80.15±12.15	55.00	166.00

Table (1): Socio-demographic characteristics of the studied participant
Professional staff members (professors, assistant professors, researchers...)
Administrative (managers, secretaries, writers...)

Table (2) shows that 75.0% of the studied participants took treatment for KOA. About half of the participants preferred taking tablets and 56.4% of them took these tablets when needed with mean duration intake was 6.42 ± 5.16 years. Only 19.0% of the participants took intramuscular injections, half of them (50.0%) took it monthly with mean duration intake was 3.67±3.58. Among the participants 40.5% used to take ointment treatment, the majority took the ointment treatment when needed only with 55.9% with mean duration intake was 5.71±5.11. Only 2.4% of the participants received knee injections.

Table (2): Treatment of KOA among the studied participants according to gender

Variables	**Total n=84 n (%)**
KOA Treatment	
Yes	63 (75.0%)
No	21 (25.0%)
KOA oral treatment	
Yes	55 (65.5%)
No	29 (34.5%)
Duration of oral intake (Mean±SD)	6.42±5.16
Frequency of oral intake	
When needed	31 (56.4%)
Monthly	1 (1.8%)
Weekly	0 (0.0%)
Daily	23 (41.8%)
Intramuscular Injection	
Yes	16 (19.0%)
No	68 (81.0%)
Duration of injection (Mean±SD)	3.67±3.58
Frequency of injection	
When needed	8 (50.0%)
Monthly	2 (12.5%)
Weekly	3 (18.8%)
Daily	3 (18.8%)
KOA Ointment treatment:	
Yes	34 (40.5%)
No	50 (59.5%)
Duration of Ointment intake (Mean±SD)	5.71±5.11
Rate of intake	
When needed	19 (55.9%)
Monthly	0 (0.0%)
Weekly	0 (0.0%)
Daily	15 (44.1%)
Knee injection	
Yes	2 (2.4%)
No	82 (97.6%)

Table (3) reveals the studied participants' responses to WOMAC questionnaire and the percentage of each response. Within the pain scale, 33.3% of the participants felt severe pain while going up and down the stairs, 52.4% felt moderate pain while sitting or lying down, 33.3% felt severe pain while standing. Within the stiffness scale, 56.0% of the studied participants felt moderate stiffness when they first woke up in the morning and 57.1% of them felt moderate stiffness after sitting or lying down or while resting later in the day. Regarding the physical function scale, more than half of the studied participants (53.6%) had severe physical difficulty while standing, 31.0%, 39.3% and 35.7% of

them had also severe physical difficulty when going up the stairs, getting up from a standing position and when getting in or out of the bathtub respectively.

Table (3): WOMAC domains responses among the 84 studied participants

Item	None	Mild	Moderate	Severe	Extreme
Pain					
1-when walking in a flat surface?	1.2%	27.4%	52.4%	17.9%	1.2%
2-when going up or down stairs?	3.6%	10.7%	52.4%	33.3%	0.0%
3- At night while in bed?	1.2%	14.3%	54.8%	28.6%	0.0%
4-while sitting or lying down?	1.2%	16.7%	52.4%	27.4%	2.4%
5-while standing?	3.6%	13.1%	45.2%	33.3%	4.8%
Stiffness					
6- How severe has your stiffness been after you first woke up in the morning?	4.8%	27.4%	56.0%	10.7%	1.2%
7- How severe has your stiffness been after sitting or lying down or while resting later in the day?	0.0%	20.2%	57.1%	21.4%	1.2%
Physical Function					
8. - when going down the stairs?	2.4%	11.9%	50.0%	33.3%	2.4%
9. - when going up the stairs?	0.0%	14.3%	50.0%	31.0%	4.8%
10. - when getting up from a sitting position?	0.0%	8.3%	40.5%	39.3%	11.9%
11. - while standing?	3.6%	7.1%	23.8%	53.6%	11.9%
12. - when bending to the floor?	2.4%	7.1%	44.0%	33.3%	13.1%
13. - when walking on a flat surface?	20.2%	19.0%	45.2%	14.3%	1.2%
14. - getting in or out of a car, or getting on or off a bus?	2.4%	13.1%	46.4%	28.6%	9.5%
15. - while going shopping?	1.2%	16.7%	45.2%	29.8%	7.1%
16. - when putting on your socks or stockings?	2.4%	16.7%	44.0%	29.8%	7.1%
17. - when getting out of bed?	1.2%	19.0%	42.9%	29.8%	7.1%
18. - when taking off your socks or stockings?	3.6%	20.2%	40.5%	28.6%	7.1%
19. - when lying in bed?	3.6%	14.3%	40.5%	33.3%	8.3%
20. - when getting in or out of the bathtub?	8.3%	6.0%	44.0%	35.7%	6.0%
21. - while sitting?	2.4%	10.7%	39.3%	41.7%	6.0%
22. - when getting on or off the toilet?	4.8%	15.5%	41.7%	32.1%	6.0%
23. - while doing heavy household chores?	0.0%	10.7%	33.3%	39.3%	16.7%
24. - while doing light household chores?	3.6%	21.4%	33.3%	35.7%	6.0%

Table (4) Table 2 shows baseline total WOMAC score and its domains among the studied participants. Females had worse total WOMAC score and its domains with highly statistically significance $p<0.05$.

Less than secondary education had the highest WOMAC scores but only shows statistical significance in the stiffness domain, p<0.001. Participants working in administrative jobs had also worse WOMAC score and its domains with statistical significance p<0.001.

Table (4): The relation between different risk factors and WOMAC total and subscales scores among the 84 studied participants at baseline

Variables	**Pain**		**Stiffness**		**Physical Function**		**Total score**	
	Median (IQR)	**P value**	**Median (IQR)**	**P value**	**Median (IQR)**	**P value**	**Median (IQR)**	**P value**
Total	12.0 (10.0-15.0)		5.0 (4.0-6.0)		42.0 (34.0-48.0)		58.0 (50.0-67.75)	
Age categories ≤ 50	12.0 (9.0-14.0)	0.440	5.0 (3.0-5.25)	0.063	40.0 (32.25-43.75)	0.271	56.5 (46.75-63.25)	0.257
51-60	13.0 (10.0-16.0)		5.0 (4.0-6.0)		44.0 (34.5-49.0)		64.0 (50.5-69.5)	
≥ 61	12.0 (11.0-14.0)		4.0 (3.0-5.0)		42.0 (34.0-46.5)		57.0 (48.5-63.5)	
Gender Males	9.5 (6.75-12.5)	**0.014**	4.0 (2.0-5.0)	**0.021**	34.0 (24.75-45.5)	0.072	47.0 (36.25-64.0)	**0.032**
Females	13.0 (11.0-15.0)		5.0 (4.0-6.0)		42.0 (35.75-48.0)		59.0 (51.0-69.0)	
Education Less than secondary	20.0 (20.0-20.0)	**<0.001**	8.0 (8.0-8.0)	**<0.001**	67.5 (67.0-67.5)	**<0.001**	95.5 (95.0-95.5)	**<0.001**
Secondary	14.0 (11.75-16.25)		5.0 (4.0-7.25)		46.5 (38.75-58.0)		64.5 (54.0-79.5)	
University	13.0 (11.0-15.0)		5.0 (4.0-6.0)		42.0 (34.25-48.0)		58.0 (51.25-67.75)	
Postgraduate	11.0 (9.25-12.75)		4.0 (2.25-5.0)		38.5 (30.75-43.0)		53.0 (46.25-60.0)	
Occupation Professional Staff member	12.5 (9.25-13.75)	**0.017**	4.0 (3.0-5.0)	**0.018**	38.5 (30.75-43.75)	**<0.001**	53.0 (46.25-61.5)	**<0.001**
Administrativ	13.0		5.0		44.0		62.0	

e	(11.0-15.0)		(4.0-6.0)		(37.75-50.75)		(52.75-70.75)	

Table (5) shows comparison between WOMAC score and its domains at baseline and after intervention. It reveals highly significant decrease in the WOMAC score and its domains in the post intervention phase (p<0.001).

Table (5): Comparison between WOMAC score and its domains at baseline and after intervention

WOMAC score		**Pre - intervention**	**Post - intervention**	**Difference**	**P value**
Pain	Median (IQR)	12.00 (10.00-15.00)	11.00 (9.00-12.75)	-2.00 (-3.00-1.00)	<**0.001**
Stiffness	Median (IQR)	5.00 (4.00-6.00)	4.00 (3.00-4.00)	-1.00(-2.00-0.00)	<**0.001**
Physical Function	Median (IQR)	42.00 (34.00-48.00)	39.00 (33.00-45.00)	-2.00 (4.00-0.00)	<**0.001**
Total	Median (IQR)	58.00 (50.00-67.75)	53.00 (44.25-62.00)	-5.00 (-7.00-2.00)	<**0.001**

Pre &post comparison was done for 84 participants who completed the intervention program
Test of significance: Wilcoxon test

Table (5) represents pre and post intervention knowledge comparison, it shows that the baseline knowledge scores among the studied participants had statistically significantly increased after intervention, p<0.001.

Discussion

KOA is a chronic degenerative pathology representing one of the leading causes of disability, it is easily observed that its prevalence has doubled since the middle of the 20th century. The current study tries to assess the severity of knee osteoarthritis and knowledge. In the current study, the mean age of the participants was 55.8±7.7 years old, nearly three quarters of them were females (88.1%).

KOA is a common joint disease in elderly people, which causes pain, loss of function and disability and reduces quality of life. Exercise therapy, which is one of the most important non-pharmacological treatments, is a safe and low-cost method for treating KOA that has been shown to delay disease progression, relieve pain, and improve knee function (Kostic et al., 2022).

In the current study, the WOMAC scores of osteoarthritis was increased with increasing the age of the studied participants but with no statistical significance, p<0.05. However, Salama et al (2023) addressed in a cross-sectional study a positive direct relation between effect of age and knee pain and function using WOMAC scale among Egyptian KOA patients (r=0.38, p=0.015). Sadoski et al (2019) mentioned that the severity of KOA increases among older population. It was also observed increased WOMAC pain scores, poorer health outcome and a greater rate of overall work disability because of KOA. Moreover, Gorial et al (2018) and Agar et al (2017) found a positive significant correlation between age of the patients and severity of KOA symptoms measured by total WOMAC score (p<0.05). Similarly, Georgiev et al (2019) observed that total WOMAC scores correlated with age (r= 0.257; p =0.003). Sharma et al (2018) revealed a highly significant positive correlation between

WOMAC scores and age (r=0.570, p<0.001). The lack of a significance association between age and WOMAC scores in the current study may be because that the predominant age group was 51-60 years old with mean age 55.8±7.7 years and those middle-aged people with knee pain related to OA keep working and doing their activities. This may be a particular feature of Egyptian population who have many life burdens that enforce them to do their functions in the presence of knee pain.

The outcome of the present study showed that females had a significant worse total WOMAC score with median 59.0 (51.0-69.0) and its domains [pain: 13.0(11.0-15.0), stiffness: 5.0(4.0-6.0) and physical function: 42.0(35.75-48.0)], p<0.05. Similarly, Raza et al (6) concluded that there was a statistical difference in severity of pain and physical function limitation and that females with KOA had significantly worse mean WOMAC scores and more severe symptoms than males with KOA (physical function for females: 37.16 ± 7.98, males: 34.09 ± 8.65 and pain severity for females: 9.877 ± 2.90, males: 9.08 ± 3.04, p<0.001).

More or less, Fang et al (8) found that the mean WOMAC scores of males' participants with KOA were much better than females' participants with KOA (females: 11.97±15.79, males: 10.61±14.97, p<0.05). Furthermore, Georgiev et al (9) detected that woman and men had significantly different WOMAC pain scores: 45 (6- 92) and 33 (7- 64) respectively, p<0.001.

The current study showed that the studied participants with lower education levels had worst WOMAC scores as secondary education had the highest WOMAC scores showing high statistical significance in all WOMAC domains (pain: 20.0(20.0-20.0), stiffness: 8.0(8.0-8.0), physical activity: 67.5(67.0-67.5), total scores: 95.5(95.0-95.5), p<0.001). These results were generally consistent with Callahan et al (10) in Mexico who reported that the level of education is inversely correlated with total WOMAC scores (in lower education, the pain mean was 9.72±3.6and physical function mean was 37.6±13.0, while in higher education, pain mean was 8.6±3.5and physical function mean was 31.8±11.1, p<0.001) and concluded that lower socio-economic status with lower educational level was associated with more disability and severe KOA symptoms.

In the present study, participants who worked in administrative jobs had statistically worst WOMAC scores in all domains (pain: 13.0(11.0-15.0), stiffness: 5.0(4.0-6.0), physical activity: 44.0 (37.75-50.75), total: 62.0(52.75-70.75), p<0.05 and p<0.001). However, Knight et al (2011) found that non managerial occupation is significantly associated with all WOMAC scores (p<0.05).

In the current study, a highly significant decrease in the mean WOMAC score and its domains after the health education and home-based exercise intervention (pain: from 12.4±3.4 to 10.5±2.7, stiffness: from 5.0(4.0-6.0) to 4.0(3.0-4.0), physical function: from 41.7±11.2 to 38.7±9.8, total score: from 58.8±15.1 to 53.1±12.4), p<0.001which was similar to the study done by Elshaarawy et al [48.0 (39.0-63.0)]. These findings were also in line with the study done by Ayat et al (2022) who also reported a significant reduction in mean WOMAC scores of KOA patients from 53.9 ±12.2 to 43.7 ±16.9 after patient education and home exercise intervention for 6 weeks (p<0.001). Similarly, Sadiq et al (2023) engaged KOA patients in a 2-month home based exercise program and detected a statistically significant reduction in WOMAC mean scores (pain: from 13.16 to 1.88, stiffness: 4.88 to 0.38, physical function: 38.38 to 5.72, total WOMAC score: 56.44 to 8.33, p<0.001). Siju et al (2020) found as well that mean WOMAC score showed a significant difference between before and after home-based exercise program intervention (from 66.3 ± 8.6 to 50.7 ± 4.0, p<0.001). Moreover, Chen et al (2019) evaluated the effectiveness of a home-based exercise intervention and found that mean WOMAC scores

were statistically decreased after intervention (pain: from 7.34 ± 3.36 to 4.28 ± 3.30 and stiffness: from 2 (0-3) to 1 (0-3), p<0.001). Furthermore, Alasfour et al (2020) studied the effect of home exercise program encouraged by daily emails or smartphone notifications and detected that there was a significant reduction in WOMAC pain scores at the end of the 6 weeks, p<0.001. In addition, Jing et al (2021) compared the outcomes of patient education and home exercise rehabilitation with that of treatment with NSAIDs using WOMAC scale and QoL scales. The baseline means of WOMAC scores before exercise rehabilitation and treatment using just NSAIDs were 113.6 ± 2.9 and 112.9 ± 3.0 respectively which significantly reduced to 84.4 ± 15.2, 108.3 ± 3.9 after exercise rehabilitation and NSAIDs respectively (p<0.001).

Conclusion

KOA is an age-related disorder, with over half of participants (44.0%) aged 51-60, women were more affected than men, experiencing more severe symptoms. Home-based exercise interventions significantly improved KOA symptoms and WOMAC scores while health education increased participants' knowledge about KOA. The home-based exercise program proved to be a valuable, low-cost, and safe treatment option for enhancing knee function, delaying KOA progression and improving QoL.

Strengths of the Study

The study emphasizes the importance of health education programs in raising patients' awareness of their condition, promoting behavioral changes, and highlighting the role of exercise programs in managing knee osteoarthritis. A home-based exercise program was designed, monitored weekly, improved pain relief, functional ability, adherence and positive behavioral changes among patients.

Limitations of the Study

Some limitations of the study include the potential for recall bias, as some participants struggled to accurately recall their symptoms and treatments retrospectively. Additionally, the lack of post-program weight assessments prevented the researcher from evaluating the program's impact on weight reduction and its subsequent effects on WOMAC scores and quality of life (QOL). Furthermore, the results may not be representative or generalizable due to the small sample size and the fact that the sample was drawn from a single center (National Research Centre).

Recommendation

The study recommends integrating health education and home-based exercise programs into the management plan for patients with KOA. Patient education is a sustainable low-cost intervention, while home-exercise programs can strengthen muscles, manage pain, and reduce disability. Adherence to these programs require continuous monitoring and support from healthcare providers. Regular service training and educational programs can improve knowledge and practice. Lifestyle changes increased public awareness, and the development of relaxation and coping skills can help to maintain body balance and control KOA.

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