Enhancingphysicalexerciseadherence

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Original Article

Enhancing physical exercise adherence by promoting self-efficacy in elderly with osteoarthritis knee

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Abstract:
This study introduces a physical exercise education program based on self-efficacy, employing direct and indirect educational approaches to alleviate symptoms of osteoarthritis (OA). The main objectives are to compare physical exercise adherence between group and individual settings and evaluate self-efficacy's influence on exercise adherence among elderly individuals with OA knee. **Methods:** A pre- and post-educational quasi-experimental design was utilized, involving four groups. Group education sessions, facilitated by social support, comprised eight meetings, while individual education was provided via video. The study included 20 districts in a single administrative area and lasted for seven months. Respondents were selected based on a doctor's diagnosis supported by knee X-ray results meeting specified inclusion and exclusion criteria. Data analysis employed univariate, bivariate, and multivariate analysis, incorporating the difference in differences (DID) test to ascertain the impact of physical exercise education on OA physical exercise adherence. The instruments utilized included the McMaster University Osteoarthritis Index (WOMAC) and self-reported physical activity logs. **Results:** The reduction in OA symptoms was observed directly in the self-efficacy and method-based groups, while individuals not grounded in self-efficacy showed a slight increase in symptoms (1%). The intervention's effect in the self-efficacy-based group was higher by 0.6 days compared to the non-self-efficacy-based group (p-value < 0.001; R = 0.32). Behavioral continuity of physical activity demonstrated greater sustainability in both group and individual settings based on self-efficacy (5.8 days). **Conclusion**: Improving adherence to physical exercise among elderly individuals with knee osteoarthritis can alleviate symptoms, a goal achievable through the cultivation of self-efficacy.
Keywords: Adherence; Elderly; Physical exercise; Osteoarthritis; Self-efficacy; Social support

Introduction

Elderly individuals with progressive knee osteoarthritis (OA) often experience knee discomfort, which can hinder their engagement in daily physical activities, particularly sports, owing to pain during movement. Additionally, there is a prevalent concern among the elderly with OA that physical activity may lead to joint injury (Sjögren Forss et al., 2017). Another common assumption is that engaging in strenuous physical activities may accelerate the degeneration process in their joints. Consequently, many elderly individuals with OA tend to adopt a sedentary lifestyle, primarily sitting or lying down, driven by their apprehension of exacerbating pain and symptoms. However, it is important to note that this lack of physical activity can worsen OA symptoms and contribute to its progression (Bieler et al., 2020; Fukutani et al., 2016), potentially increasing the risk of weight gain and obesity. This sedentary behavior leads to an energy imbalance, where energy intake exceeds energy expenditure, further compounding their health concerns.

The National Health Service highlights the numerous benefits of regular physical activity, including an impressive 83% reduction in the risk of osteoarthritis (NHS, 2021). Joint pain, a common symptom of osteoarthritis, can severely limit movement and lead to swelling. However, proper physical activity has been shown to enhance joint function and protect joints from further degeneration (Fukutani et al., 2016; Lazaridou et al., 2019; Osteoarthritis Action Alliance et al., 2020). Despite ongoing research, definitive cures for osteoarthritis remain elusive (Vitaloni et al., 2020). Consequently, the primary goal of current treatments is to alleviate pain through a combination of medication, surgical intervention, physical exercise, and specialized exercise therapy (Chen et al., 2019; Fukutani et al., 2016; Ren et al., 2020). Educating individuals on the importance of physical

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exercise as a non-pharmacological therapy can significantly enhance knee function (Ciolac et al., 2015; Jensen et al., 2013; Rodrigues Da Silva et al., 2017). However, sustaining adherence to physical exercise over time can pose challenges (Östlind et al., 2021). Therefore, there is a pressing need for educational interventions that foster adherence and promote physical exercise as habitual and healthy behavior. Essential to this endeavor is 'self-efficacy,' the central concept in Albert Bandura's social learning theory, which empowers individuals to take control of their behavior (Green, 2005). Studies have demonstrated that combining physical exercise with self-efficacy strategies leads to increased physical activity levels even after 3 and 12 months, potentially mitigating osteoarthritis pain (Degerstedt et al., 2020), which may reduce OA pain (Kolasinski et al., 2020; The Royal Australian College of General Practitioners, 2018). In this study, we aimed to determine whether physical exercise conducted in group settings with a supportive facilitator from the community yielded better results compared to individual exercise sessions. Specifically, our objectives were twofold: first, to compare physical exercise adherence between group and individual settings, and second, to evaluate the impact of self-efficacy on exercise adherence.

Materials and methods

This study employed a quasi-experimental design involving four intervention groups. Each group was randomly assigned to receive a specific intervention to prevent any potential cross-contamination of information. These interventions were implemented in geographically diverse districts to ensure a broad representation. The study was conducted over seven months, from September 2022 to March 2023, encompassing 20 districts within a single administrative area. Participants were selected using cluster random sampling from primary health care centers, focusing on individuals aged 60–79 years experiencing knee pain. Following initial selection, participants were further screened for a diagnosis of knee OA at one of the private hospitals designated by the researcher.

Intervention and Monitoring

The initial step involves identifying physical exercises to enhance knee joint muscle strength without inducing knee stress (The Royal Australian College of General Practitioners, 2018). The elderly are recommended to perform these exercises upon waking each morning. The regimen includes straight leg lifts, bridging, hold–and–relax stretching, knee straightening, sitting-to-standing movements, prayer positions, and walking patterns, with a specific focus on engaging the muscles around the hips and knees (Aras et al., 2020).

According to Bandura's theory, the second stage involves inducing self-efficacy (Juwita et al., 2023). Fourteen self-efficacy induction outcomes have been identified and will be incorporated into the self-efficacy program. A knee OA exercise in group was provided by social workers to facilitate engagement in physical exercise for OA, and OA exercise in individual was provided by videos. The designated social worker is selected from individuals registered as social workers in the healthcare sector who reside in the participants' respective areas. Each group was led by trained social workers who provided eight training sessions to the participants. Each group consisted of two social workers and 9–12 elderly individuals. In Individual, participants watched a video provided by the researcher and attended one meeting to ensure proper practice of the recommended physical exercises. The self-efficacy group received both physical exercise intervention and self-efficacy training, while the non-self-efficacy group received physical exercise intervention alone. Individuals with self-efficacy received physical exercise and self-efficacy video interventions, whereas the individual group received physical exercise videos without self-efficacy components (Figure 1). Communication channels were established through WhatsApp for each group and monitored by researchers. Group communication occurred daily at the social worker's initiative, while the respondents themselves initiated individual communication.

Data collection

Adherence to the recommended OA physical exercises was assessed based on the number of days the exercises were performed as outlined in the intervention. Data on OA physical exercises were collected through self-reporting via a daily activity logbook maintained for three months. OA symptoms, including pain, stiffness, and functional impairment, were evaluated using the McMaster University's Osteoarthritis Index (WOMAC) questionnaire, adapted to the respondent's language and cultural context. The validity of the questionnaire was ensured through translation and back-translation conducted by four experts. Reliability testing of the WOMAC questionnaire involved a trial with 30 respondents, yielding a Cronbach's alpha value of 0.834 (>0.60), indicating strong internal consistency. Measurements of OA symptoms were taken before the intervention and three months after its completion. The assessment of OA physical exercise adherence involved calculating the mean frequency of OA physical exercises performed per week at one, two, and three months after the intervention. OA severity was determined using the Kellgren–Lawrence classification, which categorizes knee OA into four grades based on X-ray findings. Grade 1 indicates joint space narrowing; grade 2 involves osteophyte formation at the joint margin or tibia bone; grade 3 is characterized by subchondral sclerosis; and grade 4 signifies bone-end deformities (Kellgren & Lawrence, 1957). Ethical approval for the study was obtained with clearance number Ket-512/UN2.F10.D11/PPM00.02/2022. Informed consent was obtained from each participant before their involvement in the study.

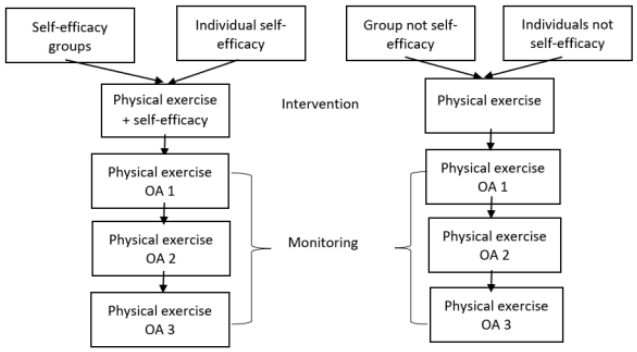

Figure 1. Intervention

Data Management and Statistical Analysis

The data analysis comprised three stages: univariate, bivariate, and multivariate analyses, utilizing IBM Corp.'s SPSS Statistics version 21.0 and STATA version 17 for Windows. Significance tests for differences and similarities within each group were determined based on a p-value < 0.05 threshold. The multivariate analysis employed the difference in differences (DiD) test to assess the delta difference in the educational impact of physical exercise and the effect of time on OA physical exercise adherence. The DiD analysis elucidated the delta difference in physical exercise education between the intervention and control groups in terms of the mean number of days of OA physical exercise in the first, second, and third months.

Results

The equality test results revealed homogeneity among all four groups in terms of gender, marital status, number of comorbidities, education, and body mass index (BMI). However, discrepancies were observed in employment status and education (Table 1).

Table 1. Characteristics of the Research Subject

Variable	KE (%)	IE (%)	KN (%)	IN (%)	Sig
Gender					0.244
Man	14.6	14	18.9	11.8	
Woman	85.4	86	81.1	88.2	
Marital status					0.630
Marry	60.4	67.4	43.4	56.9	
Unmarried/widowed/	39.6	32.6	56.6	43.1	
Comorbid					0.104
none	29.1	25.6	28.3	23.5	
1 comorbid	31.3	34.9	41.5	51	
> 1 comorbid	39.6	39.5	30.2	25.5	
Working status					**0.016**
Not Work	72.9	81.4	71.7	82.4	
Work	27.1	18.6	28.3	17.6	
Education					0.099
Low	27.1	9.3	39.7	19.6	
Intermediate	64.6	58.1	52.8	66.7	
High	8.3	32.6	7.5	13.7	
Grade					**0.016**
1	27	4.7	17	27.5	
2	50	44.2	60.4	37.3	
3	18.8	48.8	22.6	29.3	
4	4.2	2.3	0	5.9	
BMI (*mean*)	25.3	26.6	25.3	26.7	0.782

Note: KE = group self-efficacy; IE = individual self-efficacy; KN = group non-self-efficacy; IN = individual non-self-efficacy; BMI = body mass index; n = number of respondents

Table 2 Differences in *Mean* of Osteoarthritis Symptoms Based on Intervention Group Before and After Intervention

Intervention	n	Before		After		Change Mean (%)	Sig
		Mean	SD	Mean	SD		
KE	48	104	9,6	112.3	9.4	8.3 (8%)	<0.001
IE	43	101.7	11	110.7	9.2	9 (9%)	<0.001
KN	53	101	13,4	104.1	16.1	3.1 (3%)	0.166
IN	51	100	14,5	99.3	14.3	-0.7 (-1%)	0.531

Note: KE = group self-efficacy; IE = individual self-efficacy; KN = group non-self-efficacy; IN = individual non-self-efficacy; n = number of respondents

After three months of intervention, symptoms were reduced across three intervention groups (Table 2), namely the self-efficacy group, self-efficacy individuals, and non-self-efficacy groups. However, in the group of individuals not equipped with self-efficacy, there was a symptom increase of 0.7 points. Notably, the decrease in OA symptoms was most pronounced in self-efficacy individuals, with a reduction of 9 points, followed by the self-efficacy group, with a decrease of 8.3 points after the intervention.

Table 3 Mean *Differences* in Number of Days of OA Physical Exercise Adherence in Self-Efficacy-Based and Non-Self-Based Group and Individuals

Intervention	1st month		2nd Month		3rd month		DiD		R Square
	Mean	Sig	*Mean*	Sig	*Mean*	Sig	*Mean*	Sig	
IE	6.2	<0.001	5.9	<0.001	5.8	<0.001	1,1	<0.001	0.52
IN	4.1		3.1		1.5				
KE	6.2	0.003	6.3	<0.001	5.8	<0.001	0,3	0.366	0.24
KN	4.9		4		4				

Note: KE = group self-efficacy; IE = individual self-efficacy; KN = group non-self-efficacy; IN = individual non-self-efficacy

In the individual educational method (Table 3), a significant difference in the mean number of days of OA physical exercise adherence was observed at one, two, and three months after the intervention (p-value < 0.001). Results from the DiD test indicated that the effect of self-efficacy-based physical exercise education on individual methods accounted for 52% of the observed variance. Specifically, the intervention effect in the self-efficacy-based group was 1.1 days higher compared to the non-self-efficacy-based group. Regarding the group education method, differences in mean adherence days were noted between the self-efficacy and non-self-efficacy groups each month. However, the self-efficacy-based group exhibited a mean number of days of OA physical exercise adherence only 0.3 days higher than the non-self-efficacy-based group, with an insignificant relationship (p-value = 0.366).

Figure 2 shows the mean number of OA physical exercise adherence days one, two, and three months after the intervention. It is evident that following the intervention, a significant difference was observed (p-value < 0.001). Notably, adherence to OA physical exercise each month was higher in the self-efficacy groups, whether group or individual, compared to the non-self-efficacy groups (group and individual). Upon controlling for covariate variables, the DiD test revealed that self-efficacy-based physical exercise education had a 32% effect on physical exercise adherence. Specifically, the intervention effect in the self-efficacy-based group was 0.6 days higher than in the non-self-efficacy-based group.

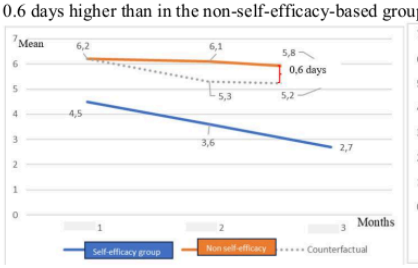

Figure 2 OA physical exercise adherence on Self-Efficacy-Based Group with Non-Self-Efficacy-Based Group

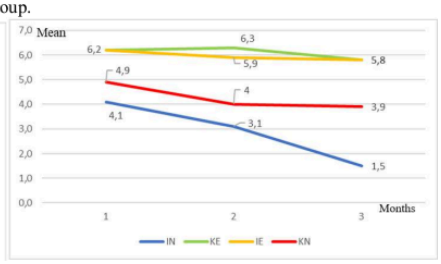

Figure 3 Mean difference in number of days of OA physical exercise adherence after intervention

Note: IN= Individual not self-efficacy; KE= Group Self-efficacy; IE= Individual self-efficacy; KN=Group not self-efficacy

The mean number of days of adherence to OA physical exercise among groups and individuals based on self-efficacy was higher (5.8 days) compared to groups (3.9 days) and individuals without self-efficacy (Figure 3). Interestingly, it was observed that the mean number of adherence days in groups and individuals with self-efficacy remained consistent in the third month after the intervention (Figure 2). This consistency suggests that adherence to OA physical exercise behavior tends to be more enduring among groups and individuals grounded in self-efficacy.

Discussion

Consistent engagement in regular physical exercise can contribute to stabilizing the knee joint by increasing the strength of its muscles. This process facilitates the gradual restoration of ligaments to their physiological properties, thus reinforcing the joint's stability. Adherence to OA physical exercise has been shown to alleviate OA symptoms. Therefore, the primary goal of this educational program is to instill the habit of OA physical exercise as a behavior. However, it's common for individuals to initially exhibit heightened adherence following an intervention, only for this behavior to gradually wane over time (Östlind et al., 2021), as illustrated in Figure 3. Various factors contribute to this decline in adherence among the elderly. These factors include individual motivations, the presence or absence of social support, insufficient awareness (El Haddad et al., 2023), personal experiences, beliefs, attitudes, emotions, social environments, and access to healthcare (Kanavaki et al., 2017). Some studies even suggest that psychological disorders play a significant role in adherence (Kampshoff et al., 2016). Non-adherence to OA physical exercise can lead to the recurrence or exacerbation of OA symptoms.

In the group education method, social workers utilize daily reminders via WhatsApp groups to encourage respondents to engage in regular physical exercise, thereby enhancing adherence. This approach aims to leverage various factors influencing physical exercise adherence among the elderly. A literature review of 20 articles underscores the significance of several key elements for successful physical exercise adherence in chronic diseases. These include the design of the exercise program tailored to the individual's needs and program duration, providing social support, fostering self-efficacy, and integrating into daily life. Additionally, ten articles emphasize factors such as the presence of professionals, supervised sessions, technological aids, recent educational background, the balance between positive and negative experiences, effective communication and feedback mechanisms, active participant involvement, and goal-setting strategies (Collado-Mateo et al., 2021).

The findings of this study underscore that adherence to physical exercise is more lasting among groups and individuals grounded in self-efficacy. In contrast, adherence tends to decrease among those lacking self-efficacy. Adherence to OA physical exercise has effectively reduced OA symptoms, whereas non-compliance or non-engagement may exacerbate symptoms. The success observed in groups and individuals serves as valuable insight for future interventions, highlighting the importance of integrating self-efficacy into health behavior changes. Group and individual approaches supported by self-efficacy yield comparable adherence to physical exercise. In contrast, approaches lacking self-efficacy exhibit different results. Furthermore, these results confirm the utility of individual-based interventions, such as video-based approaches, in promoting health behavior in communities. Such approaches are particularly relevant during pandemics, catering to elderly individuals who may withdraw from social interactions and communities with limited social worker engagement.

Enhanced adherence to OA physical exercise is facilitated by ongoing social support promoting regular physical activity. Social support for elderly individuals with OA extends from the family, which holds the broadest rights and opportunities in society to contribute to the well-being of the elderly. Beyond familial support, community involvement can take various forms, including individual efforts, group activities, community initiatives, social organizations, and community-based programs (Cicih, 2019; Ibrahim, 2020). An additional approach involves modifying physical exercises to maintain interest and prevent exercise fatigue among the elderly (Goldchmit et al., 2021). This modification can entail adjusting exercise techniques or educational methods to make them more engaging and enjoyable for participants.

Conclusions

The impact of physical exercise education on OA physical exercise adherence revealed that the self-efficacy-based group exhibited higher adherence than the non-self-efficacy-based group after three months of the intervention. Direct education in group settings proved more effective than individual education in cases where self-efficacy was not provided. Moreover, the effect of OA physical exercise education on physical activity behavior was more pronounced in group settings than in individuals.

Consequently, a decrease in OA symptoms was observed in the group, whereas symptoms increased among individuals after three months of the intervention. Given that the research subjects are elderly individuals who commonly contend with comorbidities and memory loss, there is a possibility of inaccuracies in logbook entries or recall bias. To mitigate this, researchers continuously reminded participants via WhatsApp and engaged social support and enumerators to verify evidence of daily physical activity. Without ongoing intervention, physical activity behavior is prone to decline over time. Notably, the self-efficacy-based group

exhibited a gradual decline, whereas the non-self-efficacy-based group experienced a faster decline. Therefore, behavioral adherence to physical activity is more likely to endure with self-efficacy-based education.

Conflicts of interest

No conflict interest.

Authors' Contributions

Conceptualization: CPJ, RD, JM; Supervision: DA, BN; Data curation and software: B; Writing–review & editing: all authors.

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