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Relation of physical activity level with quality of life, sleep and depression in patients with knee osteoarthritis

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ABSTRACT

OBJECTIVE: In the present study, we aimed to investigate the effects of physical activity level on the quality of life, depression, sleep quality and functional capacity in elderly patients with knee osteoarthritis (OA).

METHODS: Fifty-five patients over 65 years of age (age range: 65–84 years) with knee osteoarthritis were enrolled in the study. Patients were divided into two groups including Insufficient Activity Group (IAG) and Physically Active Group (PAG) according to their responses to the International Physical Activity Questionnaire. Radiological OA grading was performed using Kellgren-Lawrence classification system. Patients were evaluated using Short-Form 36 (SF-36) questionnaire, Beck Depression Inventory (BDI), Pittsburgh Sleep Quality Index (PSQI) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).

RESULTS: Mean age, body mass indices, mean pain scores and gender distribution were comparable between the two groups. WOMAC physical function scores were lower in the Physically Active Group (p=0.01). Mean PSQI scores did not differ statistically significantly between the two groups (p=0.242). Mean BDI score of PAG was significantly lower compared to that of IAG (p=0.015). Mean SF-36 physical function (p=0.044), physical role (p=0.008) and physical component (p=0.016) scores of the Physically Active Group were significantly higher vs Insufficient Activity Group.

CONCLUSION: Maintaining a high physical activity level reduces the possibility of depression and improves the quality of life and functional capacity in geriatric patients with knee osteoarthritis.

Keywords: Knee osteoarthritis; physical activity; quality of life.

Knee osteoarthritis (OA) is one of the most common musculoskeletal diseases with a lifetime prevalence of 44.7 percent [1]. In addition to pain and disability, knee OA may cause significant morbidity and even mortality as a result of secondary obesity, osteoporosis and cardiovascular risks

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associated with reduced mobility. Encouraging increased physical activity (PA) level as a priority during treatment of patients with osteoarthritis has been previously reported for effective protection against cardiovascular risks and comorbidities [2].

It is known that OA patients have often depression, lower physical activity levels and diminished quality of life associated with poor physical activity which progressively worsen disability in a vicious circle [3]. Up to 49.3% of the patients with knee OA suffer from depression [4].

Several studies including systematic reviews have shown favorable effects of exercise in patients with osteoarthritis [5, 6]. Although, results of these studies have demonstrated that exercises are usually effective only for a short term, exercises are still the mainstay of conservative treatment [7]. For knee osteoarthritis, regular physical activity is known to have beneficial effects on the quality of life [8, 9] and physical functions of the affected patients [10, 11]. However, the level of activity in relation to depression and particularly sleep quality has not been investigated adequately. So far, studies on the effects of physical activity level on the aforementioned parameters have included osteoarthritis patients from all age groups. There seems to be a need to investigate the effects of regular physical activity in geriatric patients with knee osteoarthritis. On the other hand, differential data are found in the literature on the association of physical activity level with a number of factors such as age, body mass index and pain [12].

In the present study, our first aim was to explore the effects of physical activity level on the quality of life, depression, sleep quality and functional capacity in knee OA patients over 65 years of age. Secondly, we sought to determine the relation between physical activity level and age, body mass index, radiological grade of osteoarthritis and pain severity of the patients.

MATERIALS AND METHODS

The study was conducted in patients over 65 years of age who were diagnosed with knee osteoarthritis at our outpatient clinics of the department of physical therapy and rehabilitation according to the American College of Rheumatology (ACR) criteria. Approval for the conduct of the study was obtained from the institutional ethics committee prior to initiation of the study. Patients who agreed to participate and gave their written informed consent were enrolled in the study.

Elderly patients with chronic knee osteoarthritis were enrolled if the duration of the disease was at least six months and they had no signs suggestive of acute inflammation or acute pain and/or joint contracture that would restrict activity. Patients with any inflammatory, infectious or malignant conditions, central or peripheral nervous system disorder(s) restricting physical activity and a severe cardiac, pulmonary or psychiatric illness were excluded form the study. Fifty-five patients (33 females and 22 males) who met the inclusion criteria were enrolled in the study.

Radiological grading

Kellgren-Lawrence (KL) classification system was utilized for radiological grading of the patients. In this system, KL Grade 1 is doubtful osteophyte, Grade 2 is definite osteophyte, without narrowing of joint space, Grade 3 is definite osteophyte with narrowing of joint space and Grade 4 is definite osteophyte with marked narrowing of joint space [13]. For radiological grading, standard anteroposterior radiograms of the weight-bearing knee were used. Radiological grading of knee OA was performed by the same person for all patients and those patients considered to have grade 2–4 knee OA were enrolled in the study.

Pain assessment

For all patients 10-cm long visual analogue scale (VAS) was used to evaluate current pain associated with knee osteoarthritis. Left end of the 10-cm line was labeled as "no pain" and right end as "worst imaginable pain". Patients were asked to rate the intensity of their pain at rest and during activity.

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain subscale (WOMAC-P) was used as a secondary measure for pain assessment. WOMAC pain score is obtained by summing the scores for the intensity of pain ex-

perienced by the patient during five different activities marked on a Likert scale [14].

Assessment of functional state

WOMAC physical function subscale (WOMAC-PF) consisting of 17 questions was used to evaluate physical functions. In this subscale, the difficulty experienced during various physical activities is rated by the patient on a Likert scale and higher scores indicate increased disability [14].

Assessment of joint stiffness

WOMAC joint stiffness subscale (WOMAC-S) was used for this purpose. Patients rate their intensity of joint stiffness using a Likert scale and a score is obtained. Total score is obtained by summing the scores after first walking in the morning and later during the day [14].

Physical activity level

The International Physical Activity Questionnaire-Short Form (IPAQ-SF) was used to determine physical activity level of the patients. IPAQ is a scale used to measure physical activity level of individuals which is expressed in units of metabolic equivalent of task (MET) by evaluating physical activities performed within one week. The frequency and duration of physical activities (walking, moderate activity and vigorous activity) performed within the last seven days are questioned.

MET score for walking is calculated by multiplying the time spent for walking per day by the number of walking days per week and 3.3 METs. MET score for moderate activity is calculated by multiplying the time spent for moderate activity per day by the number of moderate activity days per week and 4 METs. MET score for vigorous activity is calculated by multiplying the time spent for vigorous activity per day by the number of vigorous activity days per week and 8 METs. Total physical activity score is obtained by summing these three scores. For the present study, total physical activity scores of patients were included in the analysis. Patients with a physical activity level below 600 METs per week were included in the insufficient activity group (IAG) and those exceeding this level in the physically active group (PAG) [15].

Assessment of depression

Current depressive state of patients was assessed using Turkish version of Beck Depression Inventory (BDI) [16]. In BDI, higher scores indicate an increased tendency for depression.

Quality of life assessment

Turkish version of Short Form-36 (SF-36) questionnaire was used for assessment of quality of life (QoL) in study patients. SF-36 is a brief questionnaire that is widely used to evaluate multiple aspects of QoL based on the subscores for eight different domains [17].

Assessment of sleep quality

Sleep quality assessments were performed using Turkish version of the Pittsburgh Sleep Quality Index (PSQI) and total PSQI scores were included in the analysis. In PSQI, higher scores indicate impaired sleep quality [18].

Statistical analyses

Study findings were statistically analyzed using SPSS (Statistical Package for Social Sciences) for Windows version 19.0. For analysis of study data, descriptive statistical methods (mean, median, standard deviation, minimum-maximum) were used as well as Student-t test for between-group comparisons of normally distributed quantitative data and Mann-Whitney U test for between-group comparisons of non-normally distributed quantitative data. Correlations between physical activity level and other parameters were explored using Spearman's correlation analysis. Results were interpreted at 95% confidence interval with significance level set at $p<0.05$.

RESULTS

There were 27 patients (age range: 65–81) in the physically active group and 28 patients (age range: 65–84) in the insufficient activity group who were enrolled on the basis of their physical activity levels. Both groups did not differ in mean age (Table 1). Fe-

Table 1. Characteristics of study groups

Characteristics	Physically active group (n=27)	Insufficient activity group (n=28)	p
Age, (mean ± SD), years	69.8±4.6	72.7±5.9	0.076
Sex (female), n (%)	15 (56%)	18 (64%)	0.509
BMI, (mean ± SD), kg/m^2	27.2±4.1	28.8±4.3	0.155
Duration of OA, mean (SD), years	10.5±3.9	11.6±4.2	0.294
Radiological grade,			0.410
Grade 2 (n)	10	12	
Grade 3 (n)	9	5	
Grade 4 (n)	8	11	
VAS-R, (mean ± SD)	5.2±3.1	4.6±2.8	0.472
VAS-A, (mean ± SD)	6.6±2.3	7.2±1.9	0.338
WOMAC pain	11.8±4.5	12.3±3.9	0.793
WOMAC stiffness	4.4±2.1	4.9±1.9	0.453
WOMAC physical function	38.1±7.5	42.9±8.2	0.010*
BDI, (mean ± SD)	10.2±5.0	15.6±9.8	0.015*
PSQI, (mean ± SD)	5.5±3.5	7.0±4.5	0.242
IPAQ, (mean ± SD)	1091.9±403.7	276.7±171.7	0.000**

SD: Standard deviation; BMI: Body mass index; OA: Osteoarthritis; VAS-R: Visuel analog scale-rest; VAS-A: Visuel analog scale-activity; WOMAC: Western ontario and McMaster Universities osteoarthritis index; BDI: Beck depression index; PSQI: Pittsburgh sleep quality index; IPAQ: International physical activity questionary; *p<0.05; **p<0.001.

male/male ratio was comparable between the study groups (PAG: 15 females, 12 males; IAG: 18 females, 10 males) (p=0.509). Mean body mass index (BMI) and disease duration were also comparable between the two groups. VAS results for the intensity of knee pain during activity and at rest did not show any difference between the study groups (Table 1).

There was no statistically significant difference between the groups with respect to mean WOMAC-P and WOMAC-S scores (Table 1). However, WOMAC-PF scores were significantly lower in the physically active group compared to those found in the insufficient activity group (p=0.01). Statistically, there was a highly significant difference between the groups as for physical activity levels (Table 1).

PAG had a significantly lower (10.2±5.0) mean Beck Depression Inventory score versus IAG (15.6±9.8) (p=0.015). PAG also had a lower PSQI score compared to IAG but the difference was not statistically significant (p=0.242) (Table 1).

Comparison of SF-36 scores between the groups is shown in Table 2. Physically active group had a mean physical function subscale score of 61.5±28.4 which was significantly higher versus insufficient activity group (46.6±25.0) (p=0.044). Similarly, mean physical role score of the physically active group (63.9±47.2) was higher compared to the insufficient activity group (27.7±43.8) (p=0.008). Physically active group had a mean physical component summary score of 42.0±13.3 which was significantly higher compared to insufficient activity group (33.7±11.3) (p=0.016). However, no difference was found between study groups in bodily pain, vitality, general health, social functioning, emotional role, mental health and mental component summary scores (Table 2).

The results of correlation analyses conducted for 55 patients in aggregate without considering their physical activity levels are shown in Table 3. These analyses did not show a correlation between physical activity levels and age, BMI, Kellgren-Lawrence radiological grades and WOMAC-pain and WOMAC-stiffness scores (Table 3).

TABLE 2. Comparison of SF-36 scores between groups

SF-36 subscale	PAG	IAG	p
	Mean±SD	Mean±SD	
Physical functioning	61.5±28.4	46.6±25.0	0.044*
Role physical	63.9±47.2	27.7±43.8	0.008**
Physical component	42.0±13.3	33.7±11.3	0.016*
Bodily pain	54.4±30.4	41.8±25.7	0.100
Vitality	57.8±21.1	47.9±22.3	0.096
General health	62.1±20.1	53.9±21.1	0.140
Social functioning	82.4±23.8	76.3±26.0	0.286
Role emotional	75.3±42.9	66.7±45.4	0.363
Mental health	60.0±9.1	55.3±12.6	0.118
Mental component	48.6±7.3	47.7±9.6	0.716

SF-36: Short form-36; PAG: Physical activity group; IAG: Insufficient activity group; SD: Standard deviation; *p<0.05; **p<0.01.

TABLE 3. Relations between physical activity level and other parameters

	IPAQ Spearman Rho	p
Age	-.245	0.071
BMI	-.250	0.065
WOMAC-P	-.171	0.211
WOMAC-S	-.205	0.133
K-L scale	-.120	0.381

BMI: body mass index; IPAQ: International Physical Activity Questionary; K-L scale: Kellgren-Lawrence scale; Spearman Rho: Correlation coefficient; WOMAC-P: WOMAC-pain; WOMAC-S: WOMAC stiffness.

DISCUSSION

Our results showed that elderly patients with knee osteoarthritis who are physically more active had better quality of life and low depression scores in comparison to their less active counterparts despite experiencing similar pain severity. However, no difference was found in sleep quality in favor of the physically active group. Greater SF-36 subscale scores found in the PAG, particularly for those associated with physical functions demonstrate beneficial effects of adequate physical activity on physical capacity. Systematic reviews have shown the presence of a positive correlation between regular physical activity and health-related quality of life [8, 9].

In one study, Dunlop et al. divided patients in four groups based on their physical activity levels and showed an increase in functional performance in relation to increased activity level in patients with knee OA [10]. Similarly, we also observed that functional state as measured by WOMAC physical function subscale was much better in patients with adequate physical activity. Quadriceps muscle strength was shown to be greater in patients performing regular PA in comparison to those with insufficient activity [19]. Low PA level is known to be associated with reduced functional capacity both in patients with hip and knee osteoarthritis [12]. Follow-up of the patients with different PA levels for one year showed that at the end of one year, those patients with adequate PA had better functional capacity [11].

Our results are consistent with those of White et al. who reported lower depression scores in physically more active patients [20]. Depression has been shown to be associated with higher WOMAC scores in patients with knee osteoarthritis [4]. Consistently, we found low BDI scores as well as low WOMAC-PF scores in the PAG.

It is known that insufficient PA increases the risk for functional loss and healthcare costs in patients with arthritis [21]. Dunlop et al. reported a difference in functional performance between level 1 and level 2 patients although both groups had a PA level lower than the average which suggests that activity encouraged at every level will contribute to physical functioning of the patients even when it is suboptimal [10].

According to Veenhof et al., increased PA and specific exercise programs are equally effective for pain and functional capacity. In that study, increasing the level of PA was found to be more effective in preventing disability over the long-term. The same study also showed better compliance to assigned exercises among patients with enhanced PA levels [22]. De Vreede et al. found that functional task exercise programs are superior versus strengthening exercises in achieving increased functional capacity [23].

The effectiveness of specific exercise programs was shown to decline in long-term in osteoarthritis patients. However, effectiveness is maintained over long-term when booster sessions are added into the exercise programs or exercises integrated into daily activities are assigned to patients [24]. A shift in exercise programs was seen in recent years from exercises directed at restoring impaired body functions such as muscle strength and joint range of motion (ROM) towards exercises to increase functional activity level including walking and climbing stairs [23].

A major finding of our study was that patient groups with comparable body mass index, radiological grade and pain intensity had markedly different levels of PA. In line with this finding, our correlation analyses did not show an association of PA level with age, BMI, degree of pain, severity of joint stiffness and radiological grade. Dunlop et al. failed to determine a relation between PA level and radiological grade, body mass index and pain severity [10]. Groot et al. reported that pain severity and joint stiffness did not have an impact on the level of PA but advanced age and greater BMI was associated with lower PA levels. That study was conducted in patients with end-stage knee or hip osteoarthritis who were scheduled to undergo joint replacement surgery [25]. In one study, only 30% of OA patients have been shown to perform PA at an intensity recommended by the guidelines. In the same study, radiological OA grade was not associated with the level of PA [26].

Rosemann et al. reported that PA level was affected by advanced age and greater BMI. The same authors did not find an association between radiological OA grade and activity level [27]. Contradictory results were obtained in studies on factors associated with PA level in patients with osteoarthritis. Data from a systematic review showed that limited evidence exists to suggest that age and BMI have an impact on PA level in hip OA, while no such evidence is found for knee OA [12].

Interestingly, Murphy et al. concluded that pain severity is increased with an increase in the level of physical activity. In the same study, PA level was not effected by BMI and age [28]. According to White et al., there is no difference between knee OA patients with or without pain regarding the level of PA. Moreover, they failed to find a difference between patients with or without knee OA radiographically. The same authors reported that the primary barrier to PA among patients with knee OA was not the disease itself or pain and drew attention to factors associated with lack of PA in the general population including time constraints, non-prioritization of physical activity, use of motor vehicles for transports and design-related problems of the cities [20].

Studies have shown that pain-related fear that evolves following initial exacerbation of pain with movement becomes the major cause of immobility in the later stages. Subsequently patients avoid movement due to fear of pain even if they do not experience a significant amount of pain. Inactive patients were shown to avoid some of the daily living activities because of low self-esteem although there is no real physical cause for pain [29]. Indeed, actual PA levels of the patients with end-stage knee or hip osteoarthritis measured by activity monitor were demonstrated to be better than what is expected from patients' self-reported assessments of impaired physical function [25].

The major limitation of our study is the small sample size. As a second limitation, we relied on self-reports of the patients for evaluating their level of physical activity. Further studies are needed in a larger number of geriatric subjects using activity monitors.

In conclusion, increased physical activity has beneficial effects on the quality of life, depression and functional capacity in patients with knee osteoarthritis. For management of knee osteoarthritis, it is essential to employ programs directed at increasing overall physical activity through more patient-friendly exercises integrated into daily activities in addition to specific exercises directed at strengthening of muscles and improvement of ROM. In this way, improved adherence to exercise programs and sustained participation in exercises might be achieved in the long-term. When tailoring physical activity programs, fear of pain, lack of motivation, loss of self-confidence, social preferences and environmental factors that could affect an individual's activity level should all be considered.

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