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ORIGINAL ARTICLE

# Evaluation of factors affecting the levels of physical activity in patients with rheumatoid arthritis: a cross-sectional study

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## Abstract

Relatively little is known about what motivates or prevents patients with rheumatoid arthritis (RA) from adopting physically active lifestyles. This study aimed to evaluate the levels of physical activity and to identify the factors affecting a physically active lifestyle among Korean patients with RA. In this cross-sectional study, data were collected from a rheumatology outpatient clinic of a university-affiliated hospital in South Korea. The levels of physical activity were self-reported using the International Physical Activity Questionnaire. Participants who engaged in more than 600 metabolic equivalent task-minutes/week of physical activity and moderate activity or walking at least three times per week were considered physically active in this study. Structured questionnaires were used to assess perceived barriers and self-efficacy for exercise. Of 345 patients with RA included in this study, about 22% of patients were classified as physically active. Factors associated with a physically active lifestyle were good physical function (odds ratio [OR] = 0.56; 95% confidence interval [CI]: 0.36–0.87) and high levels of exercise self-efficacy (OR = 1.36; 95% CI: 1.20–1.54). Common barriers identified were fatigue, interference with other responsibilities, and a lack of time. Participants showed the lowest self-efficacy for exercise when they had pain and were busy with other activities. The level of physical function and exercise self-efficacy were predictors of physical activity. Individualized physical activity programs tailored to personal abilities and barriers and increasing exercise self-efficacy are needed to facilitate engagement of physical activity in Korean patients with RA.

## Key Points

- *Factors associated with a physically active lifestyle were good physical function and high levels of exercise self-efficacy.*
- *The levels of exercise self-efficacy in Korean patients with RA are low compared to those in other populations.*
- *Frequently encountered barriers in the subjects were being too tired, interference with other responsibilities, and lack of time.*
- *Individualized physical activity programs tailored to personal abilities and barriers and increasing exercise self-efficacy are needed to facilitate engagement of physical activity in Korean patients with RA.*

**Keywords** Physical activity · Physical function · Rheumatoid arthritis · Self-efficacy

## Introduction

Rheumatoid arthritis (RA) predominantly affects the joints, resulting in stiffness and pain in the joints, and progressive joint destruction. Of important concern to patients with RA is the fact that the effects of RA go well beyond the joints. One of the main comorbidities associated with RA is cardiovascular disease (CVD). Compared to the general population, patients with RA have a 2–3-fold increased risk for developing CVD, which is responsible for about one-third to half of all RA-related deaths [1, 2]. Such risk in patients with RA is comparable with that in patients with diabetes, which is a well-known traditional risk factor for CVD [3, 4]. Therefore, the goal of care for patients with RA should not be limited to controlling RA symptoms and preventing joint damages, as it should also include reducing the risk of CVD.

A clinical guideline emphasized that engagement in regular exercise is an important adjunct to early and effective anti-

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rheumatic treatment in RA management [5]. Regular exercise, either high or low intensity, is a safe, non-pharmacological approach to reducing subjective symptoms and improving perceived quality of life in persons with RA [6–8]. A physically active lifestyle is also associated with less use of glucocorticoids, less disease activity, and lower CVD risk [7, 9–11]. Despite such benefits, the levels of physical activity in patients with RA are suboptimal. An international cross-sectional study reported that 71% of patients with RA are categorized as physically inactive, which is higher than that for the general population [12]. Thus, there is an opportunity to facilitate an effective intervention to motivate patients with RA to be physically active.

In order to design an effective physical activity intervention, an accurate and deep understanding of physical activity in the target population is an important initial step. Previous studies of general adults reported that higher levels of physical activity are associated with (1) sociodemographic factors such as male sex, higher education, and higher income; (2) psychological factors such as perceived good heath, psychological good health, positive attitude toward physical activity, low barriers, and high self-efficacy for physical activity; and (3) social factors such as familial support [13, 14]. In patients with RA, severe symptoms, high disease activity, and psychological distress have been identified as barriers [15, 16], and higher levels of self-efficacy for physical activity are determinants of an active lifestyle [17, 18]. However, most previous studies about correlates of physical activity were conducted in Western countries. Relatively little is known about what motivates or prevents Korean patients with RA from adopting physically active lifestyles. Additionally, levels of physical activity as well as attitudes toward physical activity differ by ethnicity. Asians such as Koreans have reported lower levels of physical activity [19]; they have a negative attitude and lower levels of self-efficacy for physical activity compared to other ethnicities [14]. Therefore, as an effort to gain insight into designing a future intervention program that targets Korean patients with RA, we aimed to evaluate the levels of physical activity and to identify factors affecting a physically active lifestyle among Korean patients with RA.

## Materials and methods

### Study design, sample, and procedure

The sample for this cross-sectional descriptive study was recruited from a rheumatology outpatient clinic of a university-affiliated hospital in South Korea, where over 1000 outpatients with RA were registered. Inclusion criteria were women and men diagnosed with RA by a rheumatologist and aged 20 years old. Eligibility was determined by the first and second authors. Exclusion criteria were those who refused to participate in this study. Trained research assistants approached potential participants while they were waiting for their appointments with their physicians. Participants were informed about the purpose of the research study and the voluntary and anonymous nature of the study. The study protocol and consent form were reviewed and approved by the ethics committee of Ajou University Medical Center in compliance with the Declaration of Helsinki (AJIRB-SBR-SUR-17-122).

### Measures

#### Physical activity level

Physical activity was self-reported using the short form of the Korean version of the International Physical Activity Questionnaire (IPAQ) [20]. Participants were asked to recall the frequency and duration of three intensity levels (vigorous, moderate, and walking) of physical activity they engaged in for at least 10 min in the past 7 days. Examples of vigorous and moderate physical activity were presented, so they could assess their physical activity levels more accurately. Data collected with the IPAQ were scored as metabolic equivalent task scores (MET, min/week) by multiplying the number of minutes of each intensity level and the intensity level's metabolic value [20]. One MET is defined as the amount of oxygen consumed per minute while at rest. A minimum of 150 min of moderate activity per week is suggested to be beneficial for health promotion in the general population [21, 22] as well as in populations with chronic diseases such as RA [23]. This amount of physical activity equates to approximately 600 MET-minutes/week. Subjects with more than 600 MET-minutes/week of physical activity and moderate activity or walking at least three times per week were considered physically active in this study. The Korean version of the IPAQ has acceptable reliability and validity [24].

#### Exercise self-efficacy

The 9-item exercise self-efficacy questionnaire measures the levels of confidence for continuing to regularly exercise in various contexts of diverse barriers [25]. Participants were asked to rate their confidence on a scale from 0 to 10 (0 = not confident to 10 = very confident). The total exercise self-efficacy was expressed as an average of all item scores, with higher scores representing a greater level of confidence in overcoming the barriers. Cronbach's $\alpha$ was reported as 0.92 when the measure was developed and tested with sedentary older adults living in a community setting in the USA [25]. In our study, Cronbach's $\alpha$ was found to be 0.90.

### Perceived barriers to physical activity

The 18-item Barriers to Health Activities Scale (BHAS) was used to explore levels of perceived barriers to physical activity [26]. In contrast to the exercise self-efficacy scale that focuses on the levels of confidence to continue regular exercise regardless of a certain barrier, this scale assesses perceived frequencies of interferences with their regular physical activity due to listed common barriers on a 4-point Likert scale (1 = never to 4 = routinely). Each item score was summed, with a higher score indicating greater barriers. Cronbach's $\alpha$ was 0.86.

### Depressive symptoms

The 20-item Center for Epidemiologic Studies Depression Scale (CES-D) was used to identify participants with a likelihood of having depressive symptoms. The scale measures mood states experienced last week by rating the frequencies of the mood experienced on a 4-point scale (0 = rarely to 3 = most or all of the time). Scores for each item were summed to indicate the probability of depressive disorders. Possible score ranges from 0 to 60, with higher scores indicating a higher likelihood of having a depressive disorder. The CES-D has been commonly used for many years and has excellent psychometric properties for the general population including Koreans [27]. The internal consistency index in this study was 0.86.

### Disease features

The Multidimensional Health Assessment Questionnaire (MDHAQ) measures RA-related features [28]. The scale consists of questions related to subjects' physical function (10-item) and psychological distress (3-item) on a 4-point Likert scale, and severity of pain and fatigue on a 10-cm visual analog scale. Higher scores indicate poor physical function and higher psychological distress, pain, and fatigue. The scale was validated for Korean patients with RA, and the Korean version was obtained from the developers and translators [28, 29].

## Statistical analyses

Data were analyzed descriptively using the IBM SPSS software version 23.0 (IBM Corp., Armonk, NY, USA). All study variables were screened for suspected errors, missing data, and outliers. Distributions for continuous variables were examined before analysis. The characteristics of the participants were presented with frequencies and percentages for categorical variables and means (± standard deviations) for continuous variables. Bivariate analyses (i.e., $\chi^2$ tests and $t$ tests) were conducted to examine differences in the characteristics of the participants and the levels of barriers of exercise and exercise self-efficacy by levels of physical activity. Significant variables in the bivariate analyses ($p < 0.05$) were entered into the logistic regression to identify the factors affecting a physically active lifestyle among patients with RA. The level of significance was set at 0.05.

## Results

A total of 349 patients with RA completed an informed consent form and a survey. Among them, four were excluded because several main study variables were missing, yielding a final 345 patients with RA for analysis in this study. Table 1 shows differences in the study variables by the levels of physical activity. Most participants were women (87.5%), and participants' average age was 51.9 years. The average age at diagnosis of RA in these participants was 44.9 years, and the average duration of the disease was 6.9 years. The mean score for physical function was 0.74 of 10, meaning that participants had minimal difficulties in carrying out most activities of daily living. The mean scores for the pain and fatigue related to RA were 3.49 and 4.28 of 10, respectively. Overall, 23.2% of participants ($n = 80$) were classified as being physically active. Those who were physically active were older, not married, and reported better general health perception than their counterparts; they also reported better physical function, lower barriers of exercise, and higher levels of exercise self-efficacy. Symptoms of RA such as pain and fatigue were higher in sedentary participants, but the differences were not statistically significant.

Table 2 presents barriers of exercise by levels of physical activity. The most frequently reported barrier of exercise was being too tired. Barriers that were experienced frequently among the physically inactive group were being too tired, the feeling that exercise does not help, impairment, not interested, embarrassment about their appearance, interference with other responsibilities, and feeling inability to do things correctly.

The levels of self-efficacy for physical activity by physical activity status controlled for fatigue and pain are presented in Table 3. Those who were physically active reported higher levels of confidence in their ability to successfully engage in a physical activity in all situations compared to their counterparts. Overall, participants reported the lowest confidence in overcoming pain, followed by lack of time and fatigue.

To identify factors affecting the levels of physical activity in patients with RA, we performed hierarchical multiple regression analysis using those potential predictors that were found in the previous bivariate analysis to be significantly correlated with levels of physical activity (Table 4). Demographic factors such as age, marital status, and perceived good health were entered into the first block. At this stage, being married and perceiving themselves to have good health increased the likelihood of being physically active. Then, physical function was added in the model, and poor

**Table 1** Characteristics of participants ($N = 345$)

| Characteristics | $N$ (%) or M ± SD | | | $x^2$ or $t$ | $p$ |
|---|---|---|---|---|---|
| | Total ($n = 345$) | Physically active life style | | | |
| | | Yes ($n = 80$) | No ($n = 265$) | | |
| Gender (female) | 302 (87.5) | 72 (90.0) | 230 (86.8) | .579 | .447 |
| Age (years) | 51.86 ± 9.43 | 53.55 ± 7.97 | 51.35 ± 9.79 | 2.05 | .042 |
| Education (high school or above) | 195 (56.5) | 49 (61.3) | 146 (55.3) | .884 | .347 |
| Marital status (married) | 298 (86.4) | 76 (95.0) | 222 (83.8) | 6.581 | .010 |
| Employment (yes) | 166 (48.1) | 34 (42.5) | 132 (49.8) | 1.316 | .251 |
| Income (< 3000,000 won) | 101 (29.3) | 18 (22.5) | 83 (31.7) | 2.481 | .115 |
| Perceived good health | 165 (47.8) | 51 (63.7) | 114 (43.0) | 10.584 | .001 |
| Disease duration (years) | 6.93 ± 6.94 | 6.60 ± 6.76 | 7.03 ± 7.01 | − .485 | .628 |
| < 1 | 75 (21.7) | 16 (21.3) | 59 (78.7) | 3.606 | .307 |
| 2–4 | 93 (27.0) | 28 (30.1) | 65 (69.9) | | |
| 5–7 | 54 (15.7) | 12 (22.2) | 42 (77.8) | | |
| ≥ 8 | 123 (35.7) | 24 (19.5) | 99 (80.5) | | |
| Age at diagnosis of RA | 44.93 ± 11.00 | 46.95 ± 10.24 | 44.32 ± 11.16 | 1.884 | .060 |
| RF positivity | 274 79.4 | 63 (78.8) | 211 (79.6) | .029 | .866 |
| Function (range: 0~10) | 0.74 ± 1.12 | 0.35 ± 0.74 | 0.87 ± 1.18 | − 3.711 | < .0001 |
| Pain (range: 0~10) | 3.49 2.46 | 3.08 ± 2.31 | 3.61 ± 2.50 | − 1.713 | .088 |
| Fatigue (range: 0~10) | 4.28 ± 2.58 | 3.88 ± 2.40 | 4.40 ± 2.62 | − 1.594 | .112 |
| Morning stiffness (yes) | 225 (67.8) | 51 (64.6) | 182 (68.7) | .473 | .492 |
| History of HTN | 64 (18.6) | 18 (24.3) | 46 (20.2) | .576 | .448 |
| History of DM | 18 (5.2) | 4 (5.6) | 14 (6.3 | 0.039 | .844 |
| History of CVD | 12 (3.5) | 1 (1.3) | 11(4.2) | | .309 |
| BMI ≥25 kg/$m^2$ | 77 (22.3) | 15 (18.8) | 62 (23.4) | .765 | .382 |
| Current smoker | 27 (7.8) | 3 (3.8) | 24 (9.1) | 2.399 | .121 |
| Parental history of CVD | 48 13.9 | 11 (13.8) | 37 (14.0) | .002 | .962 |
| Depression | 12.78 ± 9.54 | 11.11 ± 9.07 | 13.29 ± 9.64 | − 1.796 | .073 |
| Barrier for exercise | 25.18 ± 6.87 | 23.38 ± 5.60 | 25.72 ± 7.16 | − 2.667 | .008 |
| Exercise self-efficacy | 4.20 ± 2.41 | 5.59 ± 2.30 | 3.78 ± 2.29 | 6.186 | < .0001 |

*M* mean, *SD* standard deviation, *RA* rheumatoid arthritis, *RF* rheumatoid factor, *HTN* hypertension, *DM* diabetes mellitus, *CVD* cardiovascular disease, *BMI* body mass index

physical function was the only variable that significantly lowered the chance of being physically active after adjustment for all other variables in the model. In the third block, perceived barriers for exercise and exercise self-efficacy were entered. One point increase in exercise self-efficacy increased the likelihood of engaging in regular physical activity by 1.36 times (OR = 1.36; 95% CI: 1.2–1.54). However, a one-point decrease in physical function lowered the likelihood of engaging in regular physical activity by 44% (OR = 0.56; 95% CI: 0.36–0.87) after controlling for other variables in the model.

## Discussion

RA affects about 2% of the Korean population [30]. Despite the relatively low prevalence, careful attention to improve outcomes in patients with RA is needed because of a rapid increase in the number of patients with RA and the related medical cost in South Korea [31].

Although advances in anti-rheumatic medication may make it possible for patients with RA to lead an active and better quality life, engaging in regular physical activity should be a crucial adjunct to the medication for the long-term management of RA. Unfortunately, 76.8% in this study were sedentary or underactive, which is higher than that previously reported in Western countries [17, 32]. Certain barriers may reduce the engagement of this population in physical activity. A tailored intervention that considers correlates of physical activity should be developed to facilitate the incorporation of physical activity into patients' routine daily life. Potential predictors considered in this study were factors previously reported as correlates of physical activity in either the general

**Table 2** Barriers of exercise by levels of physical activity

| How much each of these problems keeps you from taking care of your health promoting activities | M ± SD | | | | |
|---|---|---|---|---|---|
| | Total ($n = 345$) | Physically active life style | | $t$ | $p$ |
| | | Yes ($n = 80$) | No ($n = 265$) | | |
| Lack of convenient facilities | 1.32 ± 0.69 | 1.28± 0.62 | 1.34± 0.71 | − .662 | .509 |
| Too tired | 2.07 ± 0.88 | 1.88± 0.77 | 2.12± 0.90 | −2.240 | .026 |
| Lack of transportation | 1.25 ± 0.61 | 1.19± 0.45 | 1.27± 0.65 | −1.251 | .213 |
| Feeling what I do does not help | 1.21 ± 0.57 | 1.09± 0.33 | 1.25± 0.62 | −3.148 | .002 |
| Lack of money | 1.29 ± 0.67 | 1.28± 0.64 | 1.29± 0.68 | − .227 | .821 |
| Impairment | 1.44 ± 0.82 | 1.23± 0.48 | 1.51± 0.89 | −3.729 | .000 |
| No one to help me | 1.18 ± 0.57 | 1.16± 0.54 | 1.18± 0.58 | − .309 | .758 |
| Not interested | 1.56 ± 0.80 | 1.39± 0.67 | 1.62± 0.84 | −2.517 | .013 |
| Lack of information | 1.30 ± 0.64 | 1.25± 0.52 | 1.32± 0.67 | − .872 | .384 |
| Embarrassment about my appearance | 1.35 ± 0.63 | 1.23± 0.50 | 1.39± 0.66 | −2.416 | .017 |
| Concern about safety | 1.26 ± 0.60 | 1.21± 0.52 | 1.27± 0.62 | − .779 | .437 |
| Lack of support from family/friends | 1.20 ± 0.56 | 1.18± 0.52 | 1.21± 0.58 | − .452 | .651 |
| Interferes with other responsibilities | 1.86 ± 1.00 | 1.64± 0.86 | 1.92± 1.03 | −2.237 | .026 |
| Lack of time | 1.70 ± 0.96 | 1.56± 0.78 | 1.74± 1.00 | −1.700 | .091 |
| Feeling I cannot do things correctly | 1.54 ± 0.78 | 1.35± 0.62 | 1.59± 0.81 | −2.844 | .005 |
| Difficulty with communication | 1.12 ± 0.43 | 1.06± 0.24 | 1.14± 0.47 | −1.947 | .053 |
| Bad weather | 1.34 ± 0.67 | 1.30± 0.58 | 1.36± 0.69 | − .685 | .494 |
| Lack of help from health care professionals | 1.16 ± 0.44 | 1.14± 0.41 | 1.16± 0.45 | − .438 | .662 |

**Table 3** Exercise self-efficacy by levels of physical activity

| How confident are you right now that you could exercise three times per week for 20 min? | M ± SD | | | *t* | *p* |
|---|---|---|---|---|---|
| | Total (*n* = 345) | Physically active life style | | | |
| | | Yes (*n* = 80) | No (*n* = 265) | | |
| 1) the weather was bothering you | 4.58 ± 3.52 | 6.58 ± 3.33 | 3.98 ± 3.36 | 6.075 | .000 |
| 2) you were bored by the program or activity | 4.34 ± 3.12 | 5.58 ± 2.97 | 3.97 ± 3.08 | 4.123 | .000 |
| 3) you felt pain | 3.15 ± 2.86 | 4.43 ± 3.01 | 2.76 ± 2.70 | 4.702 | .000 |
| 4) you had to exercise alone | 5.53 ± 3.28 | 6.63 ± 3.04 | 5.20 ± 3.29 | 3.448 | .001 |
| 5) you did not enjoy it | 4.52 ± 3.17 | 5.95 ± 3.07 | 4.09 ± 3.08 | 4.728 | .000 |
| 6) you were too busy with other activities | 3.18 ± 2.96 | 4.41 ± 3.10 | 2.81 ± 2.82 | 4.363 | .000 |
| 7) you felt tired | 3.30 ± 2.95 | 4.30 ± 3.02 | 3.00 ± 2.87 | 3.513 | .001 |
| 8) you felt stressed | 4.61 ± 3.43 | 6.20 ± 3.29 | 4.13 ± 3.33 | 4.885 | .000 |
| 9) you felt depressed | 4.54 ± 3.53 | 6.20 ± 3.44 | 4.04 ± 3.40 | 4.966 | .000 |

population or patients with RA and included symptoms of RA, psychological health, perceived barriers to physical activity, and self-efficacy for physical activity.

Among the variables, physical function and exercise self-efficacy were significant correlates of physical activity in this study. Physical symptoms of RA such as pain, fatigue, and decreased physical function are most commonly identified as disease-specific barriers of physical activity in patients with RA [16, 32–34]. Those who were sedentary in this study reported higher levels of pain and fatigue than their counterparts, but the differences were not statistically significant. This is consistent with a study of over 3000 patients with RA (78% were women) who reported that pain and fatigue were not correlates of adherence to physical activity [17].

In order to identify detailed barriers that participants encounter, this study assessed the perceived frequencies of interferences with their regular physical activity using the BHAS. The most commonly recognized barrier among the participants was fatigue. Interestingly, the levels of fatigue between participants who were physically active and those who were inactive were not statistically different, but the perceived frequency of fatigue that interfered with physical activity measured with BHAS was higher among the physically inactive group than among the physically active group. This finding suggests that the physically active group appeared to be more capable of overcoming the barriers. Cognitive control may play an important role in healthy behavior such as engaging in physical activity.

RA limits physical function, and functional limitation negatively affects engagement in physical activity [15]. Active persons reported better physical function in this study, and those with decreased physical function were less likely to engage in physical activity. Because of the cross-sectional study design, we could not conclude whether there was causal relationship between physical function and the levels of physical activity, but previous studies showed that regular physical activity improves physical function in patients with RA [9, 35–37]. This evidence suggests that physical function can be improved through regular physical activity and vice versa. The average function score, however, was less than 1 of 10 in the physically active and inactive groups, which indicates minimal difficulty of conducting most daily activities. The level is lower than that for individuals who participated in the exercise programs [9, 37]. Importantly, physically inactive

**Table 4** Factors affecting physical activities among patients with rheumatoid arthritis (*N* = 345)

| Variables | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | OR | 95% CI | OR | 95% CI | OR | 95% CI |
| Age | 1.02 | (0.99, 1.05) | 1.02 | (0.99, 1.06) | 1.02 | (0.99, 1.06) |
| Marital status (married) | 3.20 | (1.09, 9.39) | 2.88 | (0.97, 8.54) | 2.99 | (0.97, 9.19) |
| Perceived health (good) | 2.05 | (1.20, 3.51) | 1.61 | (0.92, 2.81) | 1.35 | (0.74, 2.45) |
| Physical function | | | 0.53 | (0.35, 0.81) | 0.56 | (0.36, 0.87) |
| Barrier for exercise | | | | | 1.01 | (0.96, 1.06) |
| Exercise self-efficacy | | | | | 1.36 | (1.20, 1.54) |

*CI* confidence interval, *OR* odds ratio

participants reported significantly higher frequencies of interferences with their physical activity due to impairment and embarrassment about their appearance than their counterparts. An individualized physical activity program specifically tailored to one's personal abilities and barriers should be developed to facilitate engagement of physical activity.

Interestingly, those physically inactive in this study reported higher frequencies of barriers to engaging in physical activity in the univariate analysis, but barriers to exercise did not show a significant impact on engagement of physical activity in multivariate analysis. Previous studies emphasized that arthritis-specific barriers such as pain and fatigue are more commonly reported than general barriers were associated with reduced levels of physical activities [33, 34]. However, this study found that general and non-arthritis-specific barriers such as lack of time and interference with other responsibilities seem to have a higher effect on engagement in physical activities in this population. Since these barriers are commonly reported barriers for the general population and other disease groups, confidence or efficacy to overcome these barriers might be an important issue for regular engagement of physical activity for patients with RA.

Exercise self-efficacy is the level of confidence to continue physical activity through cognitive processing even in the midst of barriers. As indicated, barriers to exercise may be a general perception for patients with RA, so it is not a predictor of physical activity when levels of exercise self-efficacy are controlled. Participants with a high level of exercise self-efficacy possibly have a different perception and attitudes of the effects of barriers on their physical activity. This result is consistent with that of a previous study, which showed that self-efficacy is the most salient and consistent factor for initiating as well as adhering to physical activity for over 6 months [17, 18].

Regrettably, the levels of exercise self-efficacy in this population are low compared to those in other populations [25, 38]. The level is lower than that of Swedish patients with RA (5.3; 81% of women with an average age of 59 years) [38] or older adults living in a continuing care retirement community of 5.5 (average age of 85) [25]. One reason for this finding may be in part due to a lack of knowledge about healthy levels of physical activity. About two in three of Korean patients with RA perceive that only working out in the gym or in an exercise class is beneficial for their health [39]. Efforts to raise awareness about healthy levels of physical activity may be a prerequisite for improving confidence or efficacy of adopting a healthy lifestyle in this population.

Additionally, the subjects in this study showed least self-efficacy for exercise when they were in pain and fatigued and busy with other activities. Given that self-efficacy is a significant predictor of physical activity, cognitive behavioral intervention that improves self-efficacy for exercise should be considered. One way to foster levels of self-efficacy would be setting realistic and attainable physical activity goals and providing individual feedback on the participant's progress. Intervention should also be designed to guide action plans to support patients with RA in overcoming barriers to physical activity and to help sustain healthy levels of physical activity. Starting with exercise with light stretching as well as dividing the exercise time to fill the desired amount of exercise—for example, three brisk 10-min exercises rather than a 30-min exercise—would be a way of maintaining healthy levels of physical activity.

This study measured physical activity levels during the past week, but this may not be an indicator of the maintenance of physical activity. A study showed that even though 70% of participants engaged in physical activity in the past week, only about 10% of them maintained the physical activity over 6 months [17]. In addition, sedentary time was not measured, but it has been associated with numerous poor outcomes including mortality, diabetes, and cardiovascular events [40]. Further study is needed to evaluate the pattern of physical activity in this population. Qualitative research is also needed to explore the barriers according to patient's own words, benefits of exercise, and characteristics of high and low exercise self-efficacy in patients with RA in the socio-cultural context of South Korea.

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**Data availability** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Compliance with ethical standards

**Conflict of interest** The authors have no conflicts of interest to disclose, have full control of all primary data, and agree to allow the journal to review their data, if requested.

**Ethical standards** The study protocol and consent form were reviewed and approved by the ethics committee of Ajou University Medical Center in compliance with the Declaration of Helsinki (AJIRB-SBR-SUR-17-122). All study participants provided written informed consent prior to their inclusion in the study.

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