

## Adherence to Home Exercise Programs: The Impact of Demographic and Clinical Factors

### Evde Egzersiz Programlarına Uyum: Demografik ve Klinik Faktörlerin Etkisi

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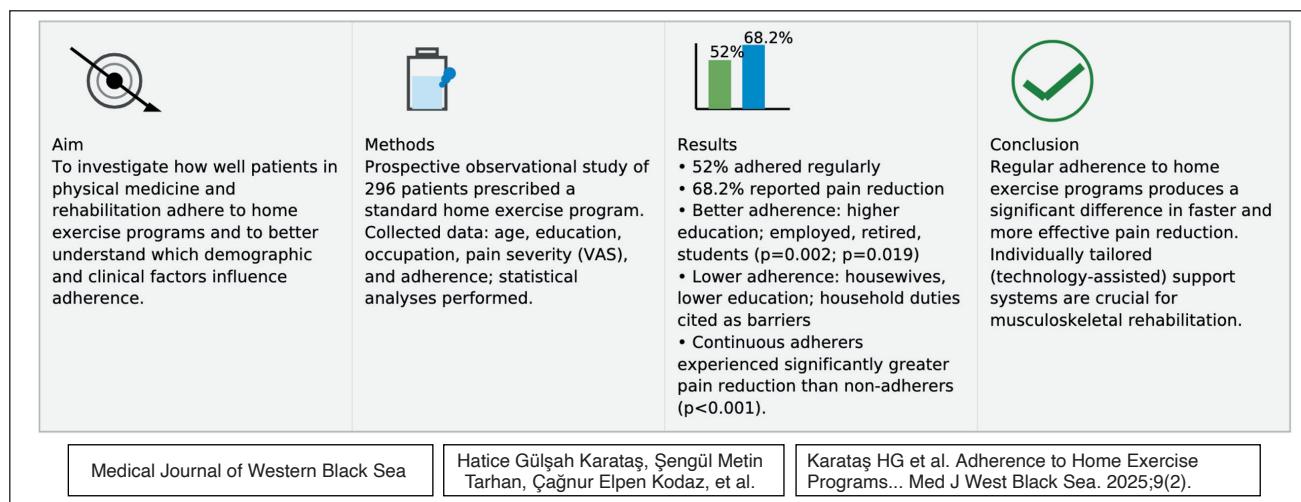
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#### GRAPHICAL ABSTRACT



#### ABSTRACT

**Aim:** This study aimed to explore how well patients receiving physical medicine and rehabilitation adhered to home-based exercise programs, and to better understand which demographic and clinical factors might influence their level of adherence.

**Material and Methods:** In this prospective observational study, 296 patients who had been prescribed a standardized home exercise program were followed. Information on age, education, occupation, pain severity (measured by VAS), and adherence to the exercise plan was collected and statistically analyzed.

**Results:** Among the participants, 154 individuals (52%) were regularly following their prescribed home exercise routines. Overall, 68.2% of patients reported a noticeable reduction in pain levels. Notably, those who consistently adhered to the program experienced significantly more pain relief compared to those who were non-adherent ( $p < 0.001$ ). Adherence appeared to be influenced by both education level and occupation. Patients with higher levels of education were more likely to follow their exercise routines, while individuals such as workers, retirees, and students demonstrated stronger adherence patterns ( $p = 0.002$  and  $p = 0.019$ , respectively). In contrast, housewives and individuals with lower educational attainment were less likely to stay committed—often citing household responsibilities as a barrier to regular participation.

**Conclusion:** Sticking to home-based exercise programs seems to make a real difference in outcomes, especially when it comes to reducing pain more quickly and effectively. These findings emphasize the importance of designing support systems that are tailored to the individual—possibly using technology to help patients stay on track, particularly in musculoskeletal rehabilitation.

**Keywords:** Home-based exercise programs, Adherence, Pain, Physical medicine

#### GRAFİKSEL ÖZET

			
<b>Amaç</b> Fiziksel tıp ve rehabilitasyon alan hastaların evde egzersiz programlarına ne kadar iyi uyduklarını ve uyumu etkileyen demografik/klinik faktörleri incelemek.	<b>Yöntem</b> Prospektif gözlemsel tasarım; standart ev egzersiz programı reçete edilen 296 hasta takip edildi. Toplanan veriler: yaş, eğitim, meslek, ağrı şiddeti (VAS), egzersiz uyumu; istatistiksel analiz yapıldı.	<b>Bulgular</b> <ul style="list-style-type: none"> <li>%52 düzenli uyum</li> <li>%68,2 ağrı düzeyinde azalma bildirildi</li> <li>Daha yüksek uyum: daha yüksek eğitim; çalışan, emekli, öğrenci (<math>p=0,002</math>; <math>p=0,019</math>)</li> <li>Daha düşük uyum: ev hanımları, düşük eğitim; ev içi sorumluluklar engel olarak belirtildi</li> <li>Sürekli uyanlar, uymayanlara göre anlamlı derecede daha fazla ağrı azalması yaşadı (<math>p&lt;0,001</math>).</li> </ul>	<b>Sonuç</b> Ev egzersizlerine düzenli uyum, özellikle ağrının hızlı ve etkili azalmasında belirgin fark yaratır. Kas-iskelet rehabilitasyonunda bireye özel (teknoloji destekli) destek sistemleri önerilir.
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#### ÖZ

**Amaç:** Bu çalışmanın amacı, fiziksel tıp ve rehabilitasyon alan hastaların evde egzersiz programlarına ne kadar iyi uyduklarını araştırmak ve hangi demografik ve klinik faktörlerin uyum düzeylerini etkileyebileceğini daha iyi anlamaktır.

**Gereç ve Yöntemler:** Bu prospektif gözlemsel çalışmada, standart bir ev egzersiz programı reçete edilen 296 hasta takip edilmiştir. Yaş, eğitim, meslek, ağrı şiddeti (VAS ile ölçülmüştür) ve egzersiz planına uyum hakkında bilgiler toplanmış ve istatistiksel olarak analiz edilmiştir.

**Bulgular:** Katılımcılar arasında 154 kişi (%52) reçete edilen ev egzersiz rutinlerini düzenli olarak takip etmiştir. Genel olarak, hastaların %68,2'si ağrı düzeylerinde gözle görülür bir azalma olduğunu bildirmiştir. Programa sürekli uyanlar, uymayanlara kıyasla önemli ölçüde daha fazla ağrı kesici deneyimlemiştir ( $p < 0.001$ ). Uyumun hem eğitim düzeyinden hem de meslekten etkilendiği görülmektedir. Daha yüksek eğitim düzeyine sahip hastaların egzersiz rutinlerini takip etme olasılığı daha yüksekken, çalışanlar, emekliler ve öğrenciler gibi bireyler daha güçlü uyum kalıpları göstermiştir (sırasıyla  $p = 0.002$  ve  $p = 0.019$ ). Buna karşılık, ev hanımları ve daha düşük eğitim düzeyine sahip bireylerin egzersiz programlarına bağlı kalma olasılıkları daha düşüktü; genellikle ev sorumluluklarını düzenli katılımın önünde bir engel olarak göstermişlerdir.

**Sonuç:** Evde uygulanan egzersiz programlarına bağlı kalmak, özellikle ağrıyi daha hızlı ve etkili bir şekilde azaltma söz konusu olduğunda, sonuçlarda gerçek bir fark yaratıyor gibi görülmektedir. Bu bulgular, özellikle kas-iskelet sistemi rehabilitasyonunda hastaların programa bağlı kalmasına yardımcı olmak için, muhtemelen teknolojiyi kullanarak, bireye özel destek sistemleri tasarlamanın önemini vurgulamaktadır.

**Anahtar Sözcükler:** Evde uygulanan egzersiz programları, Uyum, Ağrı, Fiziksel tıp

## INTRODUCTION

Home-based exercise programs are widely used in the treatment of musculoskeletal disorders to help reduce pain and improve physical function. These programs are supported by international clinical guidelines, and their effectiveness has been confirmed in numerous studies. However, patients often do not follow these programs as recommended. Research shows that adherence rates range between 30% and 70% (1-4). Low adherence can delay recovery, prolong symptoms, and increase healthcare costs.

Several studies have shown that factors such as age, gender, education level, type of diagnosis, and social support can influence how well patients adhere to their prescribed exercises in physical medicine and rehabilitation settings (5-7). More recent research highlights that adherence is a complex and dynamic process. For instance, the use of technology, self-efficacy (the belief in one's ability to complete tasks), and social support have been identified as key factors. Tools such as mobile applications and remote monitoring systems have been found to significantly improve short-term adherence (8,9). Motivation to follow an exercise program can also change over time. While some individuals start with high motivation but lose it later, others may become more consistent over time. This suggests that long-term adherence depends not only on initial motivation but also on continuous support, personalized exercise plans, technological tools, and behavioral strategies (10,11). The aim of our study is to identify the demographic and clinical factors that influence adherence to home-based exercise programs and to explore the elements that either support or hinder patient engagement.

## MATERIALS and METHODS

This study was designed as a single-center, prospective, observational, and descriptive cohort study, conducted at the Physical Medicine and Rehabilitation (PMR) outpatient clinic of Karabük University Faculty of Medicine Training and Research Hospital. All participants provided written informed consent after being informed about the study's purpose, duration, procedures, data confidentiality, and their right to withdraw at any time. The study sample included patients who visited the PMR outpatient clinic during the study period, were prescribed a home-based exercise program by a physician, and agreed to participate. Inclusion criteria were as follows: being between the ages of 15 and 75, having a musculoskeletal diagnosis and a prescribed exercise program by a PMR physician, having sufficient cognitive and physical ability to understand and perform the exercises, voluntarily agreeing to participate, signing the informed consent form, and being reachable by phone.

Exclusion criteria included: having a serious neurological, cardiovascular, or systemic disease that would prevent ex-

ercise participation; a history of acute trauma; cognitive or cooperation difficulties (e.g., severe cognitive impairment or psychiatric illness); pregnancy; and refusal of telephone follow-up. Demographic information, comorbidities, smoking status, and pain intensity (measured by Visual Analog Scale [VAS], 0-10 cm) were recorded for each patient. The exercise program was explained, and each patient received a standardized exercise brochure. During the one-month follow-up via telephone, patients were asked how often and how long they had performed the exercises. In this study, patients who performed home exercises at least three times per week were considered adherent to the prescribed program. Pain levels were reassessed at the end of this period.

Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences), version 22. Descriptive statistics (mean, standard deviation, median, minimum, maximum, frequency, and percentage) were used to summarize participants' demographic and clinical characteristics, as well as exercise adherence levels. The normality of continuous variables was assessed using the Kolmogorov-Smirnov or Shapiro-Wilk tests. To examine the relationship between adherence and demographic or clinical variables, the chi-square test or Fisher's exact test was used for categorical data, the independent samples t-test for normally distributed continuous variables, and the Mann-Whitney U test for non-normally distributed variables. A p-value of  $<0.05$  was considered statistically significant. The study was approved by the Non-Interventional Clinical Research Ethics Committee of Karabük University (Approval No: 2025/2356).

## RESULTS

A total of 296 patients were included in the study, comprising 230 females and 66 males. The median age was 45 years (15-76), and the median baseline VAS score was 7 (1-10). The median Body Mass Index (BMI) was 27.77 (15.35-51.20). Regarding smoking status, 74.3% of the participants were non-smokers, while 25.7% had a history of smoking. In terms of educational background, most patients were either university graduates (34.8%) or primary school graduates (34.5%), followed by those who completed high school and middle school. The most common occupation was housewife, accounting for 46.6% of the participants. Among the clinical diagnoses, neck pain was the most frequent (44.9%), followed by low back pain (26.4%).

At the four-week follow-up, the median VAS score decreased to 4 (0-10), and the median change in VAS was 2 points (0-9). A positive change in VAS scores was observed in 68.2% of the patients. Exercise adherence was as follows: 48% of patients did not follow the prescribed exercise program, 33.8% adhered to the program occasionally, and 18.2% reported exercising daily. Overall, 154 patients (52%) were found to have regularly adhered to their pre-

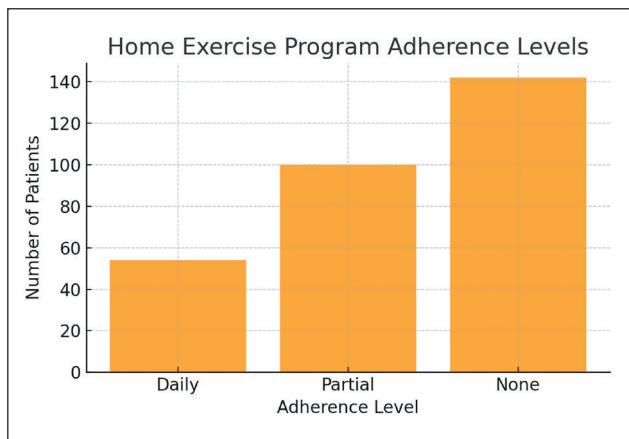


Figure 1: Home exercise program adherence levels

scribed exercise programs (Figure 1). No statistically significant differences were found between exercise adherence and gender, BMI, or diagnosis ( $p > 0.05$ ). However, both educational level and occupational status were significantly associated with exercise adherence. Higher levels of education were linked to greater adherence to the exercise program. In addition, workers, retirees, and students were more likely to follow the program regularly ( $p = 0.002$  and  $p = 0.019$ , respectively).

Although initial pain levels were similar across all groups, patients who regularly performed the exercises reported a significantly greater reduction in pain compared to those who did not adhere to the program ( $p = 0.00$ ) (Table 1; Figure 2).

## DISCUSSION

This study evaluated adherence to home-based exercise programs among patients in a physical medicine and rehabilitation outpatient and explored the demographic and clinical factors influencing adherence. Our findings revealed that over half of the patients followed the prescribed program consistently, and this group experienced significantly greater pain reduction compared to those who did not adhere. This underscores a key clinical message: patients who adhered to exercise routines showed a more favorable and accelerated response to treatment. The clear association between exercise adherence and treatment efficacy highlights the critical role of home-based exercise in the management of musculoskeletal disorders. These results are in line with previous literature demonstrating the therapeutic value of home exercise. Fransen et al. emphasized the role of exercise in relieving pain and improving function in patients with knee osteoarthritis, while Hayden et al. confirmed its effectiveness in managing low back pain (1,2). Education level and occupational status were found to be significantly associated with adherence. As education increased, so did patients' engagement in health behaviors, which likely

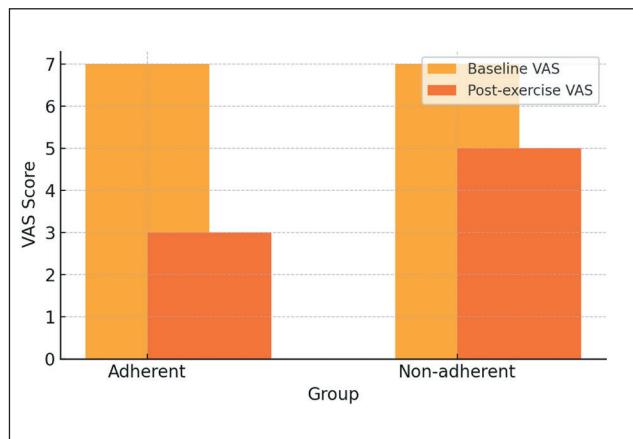


Figure 2: Vas score changes by exercise adherence

contributed to improved adherence. This is supported by a systematic review by Peek et al., noting that individuals with higher education levels tend to exhibit better treatment compliance, greater access to information, and higher health literacy (3). A recent systematic review confirmed that low health literacy is a major barrier to adherence in patients with musculoskeletal conditions (12). Occupational status also played a role. Students, retirees, and laborers were more likely to follow the exercise program, possibly due to more flexible schedules or heightened awareness of health. Conversely, housewives demonstrated lower adherence rates, often due to time constraints, domestic responsibilities, and limited social support. Pinelli et al. reported that 50% of non-adherence cases among postmenopausal women in a home-based exercise program were due to household obligations (4). Similarly, Macías-Hernández et al. found that factors such as postural instability, balance issues, and polypharmacy contributed to poor adherence in women with osteoporosis (13). In patients with neck pain, adherence to home exercises is especially vital for successful outcomes. Yet, literature reports low adherence rates in this group. Himler et al. showed that only about 30% of patients with chronic non-specific neck pain maintained their prescribed exercise routines. Barriers included pain during exercise, previous negative experiences with physiotherapy, and delayed treatment effects (14). Escalar-Reina et al. noted that communication skills of healthcare providers and the quality of patient education also influence adherence in individuals with neck and back pain (15). Consistent with these findings, studies in Turkey have shown that regular adherence to home exercises leads to meaningful improvements in pain and function (16). Moreover, a study on individuals with non-specific low back pain demonstrated that those who consistently adhered to exercise programs experienced faster recovery and greater reductions in pain and functional limitations. In contrast, low adherence was linked with prolonged treatment durations and persistent symptoms (17). These observations reinforce the notion

**Table 1.** Demographic and Clinical Characteristics of Patients According to Their Adherence to the Home Exercise Program.

Variables	Non-Adherent to Exercise Program	Adherent to Exercise Program	p
<b>Age, years (median, min-max)</b>	47 (15-71)	44 (18-76)	0.06
<b>Gender, n (%)</b>			0.11
Female	116	114	
Male	26	40	
<b>BMI</b>			0.80
Normal	42	48	
Overweight	100	105	
<b>Smoking</b>			0.35
Smoker	33	43	
Non-smoker	109	111	
<b>Education Level</b>			2
Literate (no formal education)	3	3	
Primary school	63	29	
Secondary school	11	10	
High school	19	45	
University	46	57	
<b>Occupation</b>			19
Housewife	76	62	
Laborer	24	36	
Officer	26	19	
Retired	7	15	
Unemployed	3	4	
Student	6	18	
<b>Diagnosis</b>			0.72
Neck pain	65	68	
Low back pain	41	37	
Shoulder pain	16	25	
Knee pain	17	21	
Hip pain	2	1	
Fibromyalgia	1	2	
<b>VAS (0-10)</b>	7 (1-10)	7 (1-10)	378
<b>VAS Change</b>	0 (0-8)	3 (0-9)	0.00
<b>Post-Exercise VAS</b>	5 (0-10)	3 (0-10)	0.00

**BMI:** body mass index; **VAS:** visual analogue scale.

that exercise adherence not only aids symptom relief but also directly accelerates clinical recovery. Psychosocial factors have increasingly been recognized as important determinants of adherence. Self-efficacy, intrinsic motivation, social support, and trust in treatment are now understood as essential components. Essery et al. highlighted how individual beliefs and social systems enhance adherence, while Ainsworth et al. reported that behavioral change interventions significantly improve exercise engagement (5,6). Technology has also emerged as a powerful tool to enhance adherence. Mobile app-supported exercise programs have shown promise in reducing pain and improving motivation. Features such as reminders, video guides, digital tracking, and tele-rehabilitation services are often more engaging than traditional methods (7). Collado-Mateo et al. identified 14 key factors in an umbrella review, including

personalized feedback, enjoyable formats, goal setting, and social support (8). For example, a gamified, sensor-based app developed for knee osteoarthritis significantly improved exercise accuracy and motivation (18). Personalized approaches are also critical. Programs tailored to individual goals and limitations are more effective than generic protocols. Doherty et al. found that reinforcement learning-based AI platforms improved both exercise intensity and user satisfaction. These systems adapt to user feedback, reported pain levels, and prior activity to offer dynamic, personalized guidance (9,19). Finally, hybrid care models combining in-person therapy with remote monitoring have gained traction. A recent systematic review showed that hybrid models improve patient satisfaction and yield clinical outcomes that are equal or superior to traditional care (20). For patients with limited education or support, strategies such as simpli-

fied instructions, digital tools, group sessions, and motivational interviewing may help boost adherence.

In a conclusion, adherence to home-based exercise programs among patients in physical medicine and rehabilitation (PMR) outpatient is still below the desired level. However, our findings clearly show that patients who regularly performed the prescribed exercises experienced significantly better treatment outcomes, including greater reductions in pain intensity. This highlights the critical role of adherence in maximizing the therapeutic benefits of exercise interventions. Moreover, educational level and occupational status were found to be important factors influencing adherence. These results suggest that individualized, digitally supported, and motivation-enhancing strategies have strong potential to improve patient engagement and treatment effectiveness.

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#### Author Contributions

Concept: Hatice Gülsah Karataş, Design: Hatice Gülsah Karataş, Şengül Metin Tarhan, Data collection or processing: Hatice Gülsah Karataş, Şengül Metin Tarhan, Analysis: Hatice Gülsah Karataş, Rifat Tarhan, Fatih Karataş, Çağnur Elpen Kodaz, Literature search: Hatice Gülsah Karataş, Rifat Tarhan, Çağnur Elpen Kodaz, Fatih Karataş, Writing: Hatice Gülsah Karataş, Şengül Metin Tarhan, Approval: Hatice Gülsah Karataş, Şengül Metin Tarhan, Rifat Tarhan, Çağnur Elpen Kodaz, Fatih Karataş.

#### Conflicts of Interest

The authors have no conflict of interest to declare.

#### Financial Support

The authors declared that this study has received no financial support.

#### Ethical Approval

This study was completed.

#### Review Process

Extremely and externally peer-reviewed.

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