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ORIGINAL ARTICLE

Biopsychosocial exercise model via telerehabilitation in individuals with rheumatic disease

Romatizmal hastalığı olan bireylerde telerehabilitasyon yoluyla biyopsikososyal egzersiz modeli

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Abstract

Purpose: The aim of this study was to investigate the effects of the biopsychosocial exercise model applied via telerehabilitation on individuals with rheumatism during the COVID-19 epidemic.
Methods: Individuals with rheumatic diseases received telerehabilitation 3 times a week for 24 weeks via a social messaging program intervention sessions formed from 10 minutes of dance therapy-authentic movement, 40 minutes of exercises, and 10 minutes of dance therapy. This exercise content was based on the biopsychosocial model, named as Cognitive Exercise Therapy Approach (BETY) which was a method that individuals had already practiced before the pandemic. The Health Assessment Questionnaire (HAQ) was used to assess the level of disability, the Hospital Anxiety and Depression Scale (HADS) was used to assess mood involvement, and the BETY Biopsychosocial Questionnaire (BETY-BQ) was used to assess biopsychosocial involvement level. Evaluations were made at the beginning of the study and repeated at the 12th and 24th weeks.
Results: A total of 28 individuals with rheumatic diseases were included in the study and their mean age was 56.50 ± 5.51 years. There was a significant difference between the first and second assessment of HAQ (p= 0.031), between the first and second assessment of BETY-BQ (p= 0.004) and between the third and first assessment (p= 0.015).
Conclusion: The application of BETY with telerehabilitation helped individuals maintain the level of recovery they had previously achieved in terms of disability, mood level and biopsychosocial. These results indicate that individuals with rheumatic diseases can continue the remote application via telerehabilitation to support their health after experiencing biopsychosocial exercise approaches face-to-face.
Keywords: Telerehabilitation, Biopsychosocial model, Rheumatology, Exercise.

Öz

Amaç: *Bu çalışmanın amacı, COVID-19 salgını sırasında romatizmalı bireylerde telerehabilitasyon yoluyla uygulanan biyopsikososyal egzersiz modelinin etkilerini araştırmaktı.*
Yöntem: *Romatizmal hastalığı olan bireylere sosyal mesajlaşma programı aracılığıyla 24 hafta boyunca haftada 3 seans telerehabilitasyon uygulandı. Müdahale seansları 10 dakikalık dans terapisi-otantik hareket, 40 dakikalık egzersiz ve 10 dakikalık dans terapisinden oluşuyordu. Bu egzersiz içeriği, çalışmada kullanılan Bilişsel Egzersiz Terapi Yaklaşımı (BETY) olarak adlandırılan ve hastaların pandemiden önce de uyguladığı bir yöntem olan biyopsikososyal modele dayanıyordu. Yetiyitimi düzeyini değerlendirmek için Sağlık Değerlendirme Anketi (HAQ), duygudurum etkilenimini değerlendirmek için Hastane Anksiyete ve Depresyon Ölçeği (HADS) ve biyopsikososyal düzey etkilenimini değerlendirmek için BETY Biyopsikososyal Anketi (BETY-BQ) kullanıldı. Değerlendirmeler çalışmanın başında yapıldı ve 12. ve 24. haftalarda tekrarlandı.*
Bulgular: *Çalışmaya toplamda 28 romatizmal hastalığı olan birey dahil edildi ve yaş ortalamaları 56,50 ± 5,51 yıldı. HAQ'nun birinci ve ikinci değerlendirmesi arasında artan (p= 0,031), BETY-BQ'nun birinci ve ikinci değerlendirmesi arasında azalan (p= 0,004) ve üçüncü ve birinci değerlendirmesi arasında artan (p= 0,015) anlamlı fark bulundu.*
Sonuç: *BETY'nin telerehabilitasyon ile uygulanması yetiyitimi, duygudurum düzeyi ve biyopsikososyal açıdan bireylerin daha önce kazanmış oldukları iyileşme düzeyinin korunmasına yardımcı oldu. Bu sonuçlar, biyopsikososyal egzersiz yaklaşımları yüzyüze deneyimlendikten sonra romatizmal hastalığı olan bireyler sağlıklarını desteklemek için telerehabilitasyon yoluyla uzaktan uygulamayı sürdürebileceklerini göstermektedir.*
Anahtar kelimeler: *Telerehabilitasyon, Biyopsikososyal model, Romatoloji, Egzersiz.*

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INTRODUCTION

The COVID-19 pandemic has placed significant strain on health systems worldwide, limiting access to healthcare services for many individuals with chronic diseases. During this period, both the direct and indirect consequences of service disruptions have adversely affected the mental health (e.g., depression, anxiety, stress), physical function, and biomedical status of individuals with rheumatic diseases.[1-3] Reduced physical activity has led to increased disease activity, worsening symptoms (e.g., pain), and a heightened cardiovascular risk profile, while also contributing to declines in mental health, physical capacity, functionality, and overall quality of life.[3-4] Furthermore, individuals with rheumatic diseases have experienced greater social isolation compared to healthy individuals during this time.[5]

With the onset of the pandemic, physical activity and exercise have gained increased significance due to their numerous health benefits. The importance of participating in structured exercise programs has been emphasized to mitigate the negative effects of the pandemic on individuals with rheumatic diseases, particularly in reducing the risk of fatigue, sarcopenia, and depression during quarantine.[6] During this period, clinicians and other healthcare professionals played a crucial role in promoting physical activity levels.[3] As movement specialists, physiotherapists, in particular, have a key responsibility in maintaining and even enhancing individuals' overall health status.

Telerehabilitation services were recommended as the primary option for individuals receiving treatment at home, primarily due to their role in reducing the risk of transmission.[6] Before the COVID-19 pandemic, several significant barriers hindered the widespread adoption of telerehabilitation, including implementation complexity, cost, lack of urgency for change, resistance to new methods, insufficient participation in planning, challenges in conducting physical assessments, and inadequate information and communication technology infrastructure.[7] However, following the pandemic, its popularity increased due to the necessity of social distancing and the difficulties in accessing in-person treatment. The European Alliance of Associations for Rheumatology (EULAR) has advocated for the integration of digital health services into treatment protocols, emphasizing their role in supporting self-management and empowering individuals to take a more active role in their healthcare.[8]

A systematic review evaluating the effectiveness of real-time telerehabilitation concluded that it may be superior to standard practice in enhancing physical function for various musculoskeletal disorders.[9] Evidence suggests that telerehabilitation effectively reduces pain intensity, pain catastrophizing, and depression levels while improving functionality and quality of life in conditions such as osteoarthritis and fibromyalgia.[10,11] Furthermore, research indicates that the primary determinant of effective recovery in telerehabilitation-based exercise programs is not the delivery method itself but rather the content and structure of the rehabilitation program.[10] EULAR has recommended the integration of telehealth into non-pharmacological interventions, including disease education, guidance on physical activity and exercise, self-management strategies, and psychological treatment for remote care in individuals with rheumatic and musculoskeletal diseases. It has been emphasized that the mode of implementation should be tailored to the individual's prior experience with treatment and the specific nature of the intervention.[12]

EULAR has recommended that healthcare professionals in rheumatology adopt a holistic approach aligned with the biopsychosocial model in disease management and conduct comprehensive assessments.[13] The Cognitive Exercise Therapy Approach (Bilişsel Egzersiz Terapi Yaklaşımı-BETY) is an exercise-based intervention rooted in the biopsychosocial model, specifically developed for individuals with rheumatic diseases, with its effectiveness demonstrated in clinical practice.[14-16] In a study involving individuals with systemic sclerosis, one group participated in BETY training three days a week for three months via telerehabilitation after completing initial BETY stages through face-to-face sessions, while the control group followed a home exercise program. The findings revealed that individuals who engaged in BETY telerehabilitation experienced

significant improvements in functionality, muscle strength, vascularization, inflammation, and overall biopsychosocial status.[17]

In this context, expanding the application of telerehabilitation for individuals with rheumatic diseases who lack access to treatment is crucial for sustaining the therapeutic benefits previously achieved through biopsychosocial exercise models, particularly during periods of restricted healthcare access, such as pandemics. However, no studies in the existing literature have investigated the implementation of a biopsychosocial exercise model via telerehabilitation for various rheumatic diseases. Therefore, this study aimed to evaluate the effectiveness of the BETY exercise model delivered through telerehabilitation in the disease management process of individuals with rheumatic diseases during the pandemic, as well as its long-term sustainability and the maintenance of previously attained treatment outcomes

METHODS

The Declaration of Helsinki's guiding principles were followed when conducting this study. Approval was granted by the Ethics Committee of Hacettepe University (GO-18/1182). Written and verbal informed consent was obtained from the individuals. It was announced that personal information would be protected within the scope of the privacy policy and would not be shared with third parties.

Participants

Individuals with rheumatic diseases who were members of an exercise group at Hacettepe University Faculty of Physical Therapy and Rehabilitation before the pandemic were included to this study. This exercise group gathered to accomplish a biopsychosocial exercise program for 40 minutes, three sessions per week after receiving their diagnosis from the Hacettepe University Rheumatology Department. When face-to-face sessions were discontinued due to pandemic, 51 out of 91 volunteer individuals agreed to join the online exercise group and continue their treatment via telerehabilitation using WhatsApp (Meta Platforms Inc, California). The telerehabilitation exercise sessions began just one week after the onset of the pandemic. However, individuals who had difficulty reading and writing messages or following the exercises in real time were excluded from the study. As a result, 28 individuals consistently attended the exercise sessions and were included in this study.

The sample size of the study was calculated as 34 using the G* Power 3.0 program, assuming effect size (dz) = 0.5, $\alpha = 0.05$, $\beta = 0.20$ and 80% power values according to the 'difference between two dependent means -matched pairs' test to calculate the effect size value.

Telerehabilitation

Telerehabilitation was implemented for the group as 3 weekly sessions over a 24-week period using a social messaging platform. Each intervention sessions consisted of three main components: 10 minutes of dance therapy-authentic movement (including the 3 minutes of walking with small and large steps, followed by dancing to two songs), 40 minutes of exercises (pain management and cognitive restructuring strategy during exercise), and 10 minutes of dance therapy-dramatization (positive thought awareness and positive goal setting maneuver). This exercise program was based on the Cognitive Exercise Therapy Approach (BETY), a biopsychosocial model that individuals were already familiar with from pre-pandemic in-person sessions. which was a method that individuals already practiced before.

The exercises were delivered via text messages on the social messaging platform, without the use of video or voice communication. Instructions were given by the physiotherapist during the sessions, and participants performed the exercises while simultaneously providing feedback through text. For the first 12 sessions, a physiotherapist supervised the exercises. After this period, participants continued the program independently. In previous face-to-face training, some individuals had voluntarily taken on leadership roles within the exercise group. The same approach was adopted for telerehabilitation, with 12 individuals volunteering as session leaders These individuals alternated in leading the sessions, using text-based instructions similar to those provided by the physiotherapist during the initial 12 weeks.

BETY is an exercise approach grounded in the biopsychosocial model, designed to treat the individuals with rheumatic diseases holistically.

It integrates components that promote mind-body connection, pain management, mood regulation and education on disease-related topics including sexual health. BETY ensures mind-body connection through function-oriented body stabilization exercises incorporating core stabilization movements combined with extremity exercises. It employs positive thinking as a precursor to movement and utilizes distraction strategies for pain management. Mood regulation and pain distraction are further supported through positive thinking, authentic movement, and dance therapy. Additionally, BETY aims to inform the individuals about their disease mechanisms and progression, enhance body awareness empower individuals by fostering autonomy in disease management, and provide social support through group-based exercise sessionss.[14-17]

Outcomes

Sociodemographic information of the individuals such as age, height, body weight, body mass index, disease duration, and diagnoses was recorded. Evaluations were made at the beginning of the study and the 12th and 24th weeks with the Health Assessment Questionnaire (HAQ), Hospital Anxiety and Depression Scale (HADS), and BETY Biopsychosocial Questionnaire (BETY-BQ).

BETY-BQ was developed by feedback received from individuals with rheumatic diseases who had attended BETY sessions over many years. It is an assessment tool that evaluates the biopsychosocial involvement; pain, function, sexual behavior, and social and psychological aspects. Scoring of the questionnaire was made using the 5-point Likert system. Each question is scored as "0 = No never, 1 = Yes rarely, 2 = Yes sometimes, 3 = Yes often 4 = Yes always". A high score indicates a low biopsychosocial status.[16] Validity, reliability, and responsiveness of the questionnaire were shown in fibromyalgia, psoriatic arthritis, ankylosing spondylitis, primary Sjögren's syndrome, systemic lupus erythematosus and osteoarthritis.[19-24]

HAQ, which can be used in the evaluation of all rheumatic diseases, includes twenty questions and 8 subtitles including dressing, sitting, eating, walking, hygiene, reaching out, comprehending, and daily life activities. Each answer is rated between 0 and 3 points ("0 = No difficulty, 1 = Somewhat difficult, 2 = Very difficult, and 3 = I can never do"). Higher scores indicate lower functionality.[25] HAQ scores greater than one were regarded as proof of a disability.[26]

The purpose of the HADS was to show the depression and anxiety levels that had occurred because of the diseases. It is a 14-item scale that consisted of sub-scales; Anxiety (HADS-A) and Depression (HADS-D). The answer to each question is scored between 0-3 using the four-point Likert scale, and both sub-parameters can take a value between 0 and 21. The anxiety subscale has a cut-off score of 10/11, whereas the depression subscale has a cut-off score of 7/8. Scores beyond this threshold are associated with an increased risk of anxiety and.[27,28]

Statistical analysis

Statistical analysis was performed using SPSS software version 23 (SPSS Inc., Armonk, New York, USA). Data were expressed as mean (standard deviation) and minimum-maximum values. Wilcoxon Signed Ranks Test was used for investigating the difference between questionnaire results before and after telerehabilitation. The statistical significance level was considered as $p<0.05$.

RESULTS

Demographic characteristics of participants are given in Table 1. The majority of participants were individuals who were diagnosed with fibromyalgia (28.6%) and rheumatoid arthritis (25%).

The mean scores of questionnaires that were applied at the beginning, in the middle (12th week), and at the end (24th week) were given in Table 2. It was determined that all scores of questionnaires decreased at the second evaluation (12th week) and increased at the third evaluation (24th week) except HAQ. The questionnaires' score change in all evaluations is shown in Figure 1.

The statistical analysis of alteration in mean scores of questionnaires in assessments is shown in Table 3. A significant increasing difference was found between the 1st and 2nd assessment of HAQ, a decreasing difference between the 1st and 2nd assessment of BETY-BQ, and an increasing difference between the 1st and 3rd assessment of BETY-BQ.

Table 1. Demographic characteristics of participants (N=28).

	X±SD
Age (year)	56.5±5.5
Body Mass Index (kg/m^2)	25.6±3.1
Disease duration (year)	12.5±1.2
	n (%)
Rheumatic diagnosis	
Fibromyalgia	8 (28.6)
Rheumatoid arthritis	7 (25)
Ankylosing spondylitis	5 (17.9)
Osteoarthritis	2 (7.1)
Systemic lupus erythematosus	2 (7.1)
Polymyalgia rheumatica	2 (7.1)
Sjogren's syndrome	1 (3.6)
Vasculitis	1 (3.6)

Table 2. Mean scores of questionnaires from assessments (N=28).

	X±SD
BETY-BQ	
First assessment	44.36±19.05
12th week	36.61±16.31
24th week (a)	44.27±17.82
Health Assessment Questionnaire	
First assessment (b)	0.55±0.40
12th week(c)	0.61±0.41
24th week (a)	0.69±0.43
HADS-Anxiety	
First assessment	7.71±4.12
12th week	7.21±4.37
24th week (a)	7.88±4.11
HADS-Depression	
First assessment	5.68±4.44
12th week	5.04±3.28
24th week (a)	5.73±3.80

BETY-BQ: Cognitive Exercise Therapy Approach- Biopsychosocial Questionnaire. HADS: Hospital Anxiety and Depression Scale.

Table 3. The statistical analysis of alteration in mean scores of questionnaires in assessments.

	p
BETY-BQ	
First assessment-12th week	0.004*
First assessment-24th week	0.864
12th week-24th week	0.015*
Health Assessment Questionnaire	
First assessment-12th week	0.031*
First assessment-24th week	0.162
12th week-24th week	0.798
HADS-Anxiety	
First assessment-12th week	0.371
First assessment-24th week	0.600
12th week-24th week	0.090
HADS-Depression	
First assessment-12th week	0.362
First assessment-24th week	0.861
12th week-24th week	0.288

* p<0.05. BETY-BQ: Cognitive Exercise Therapy Approach-Biopsychosocial Questionnaire. HADS: Hospital Anxiety and Depression Scale. HADS: Hospital Anxiety and Depression Scale.

DISCUSSION

This study investigated the effects of a biopsychosocial exercise program delivered via telerehabilitation in individuals with rheumatic diseases who had previously practiced the same model through face-to-face sessions before the pandemic. The program's impact on biopsychosocial status, functionality, anxiety, and depression was evaluated. The findings indicated changes in biopsychosocial status and functionality within this patient group during the pandemic. During the initial 12-week telerehabilitation period, which was supervised by a physiotherapist, biopsychosocial status improved, whereas functionality declined. In the subsequent 12-week period, during which the sessions were led by group members under minimal physiotherapist supervision, biopsychosocial status was negatively affected. However, considering all measured parameters, individuals-whether supervised by a physiotherapist or not- were able to maintain their mental health and functional status, keeping their scores below the cut-off values of the applied questionnaires. This suggests that, despite limited access to healthcare services during the first six months of the pandemic, participants successfully preserved their overall well-being.

In this study, individuals with rheumatic diseases who participated in biopsychosocial based group exercise sessions were able to sustain their exercise habits under pandemic conditions. A review of the literature revealed no prior studies that combined both group-based exercise session and a biopsychosocial approach for these individuals during the COVID-19 pandemic. In this regard the present study

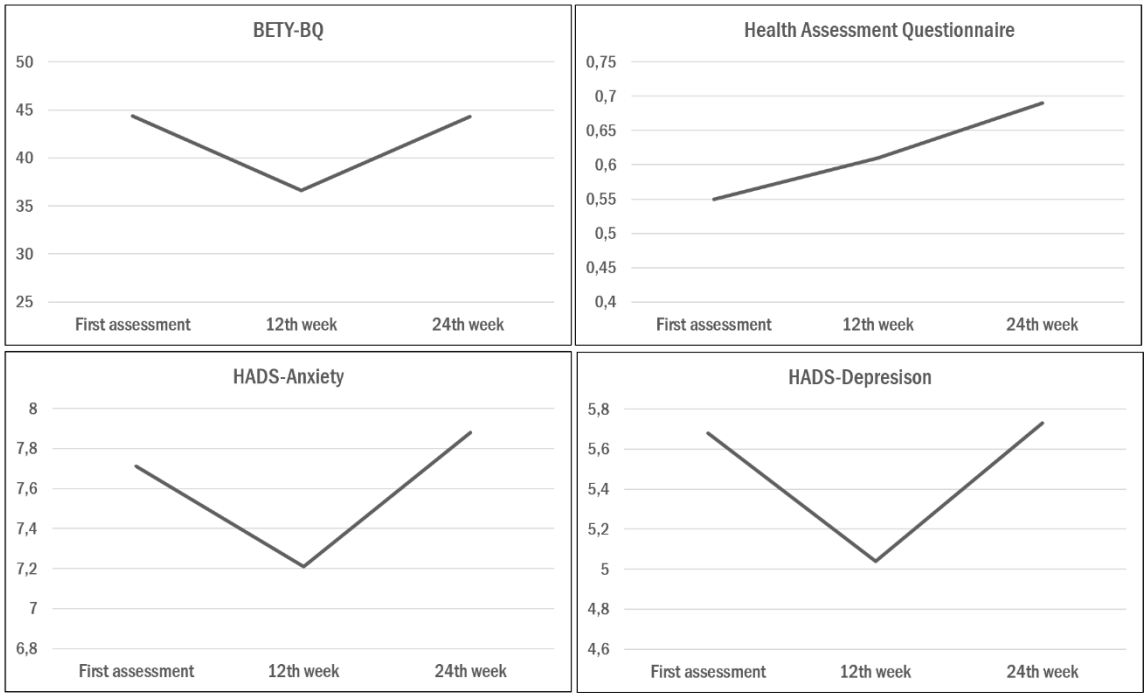

Figure 1. Change of scores of questionnaires during all assessments. BETY-BQ: Cognitive Exercise Therapy Approach-Biopsychosocial Questionnaire. HADS: Hospital Anxiety and Depression Scale.

highlights the significance of rheumatic individuals developing exercise habits as recommended by clinical guidelines to ensure the sustainability of physical activity and exercise during such periods. A study summarizing the available evidence on telerehabilitation in physical therapy reviewed systematic reviews in this field.[29] Among 53 systematic reviews, there was considerable diversity in the patient populations examined; however, only one review focused on rheumatic diseases, osteoarthritis. Although findings on telerehabilitation remain inconsistent and sometimes contradictory, it has been emphasized that higher-quality studies in this field could contribute to improved clinical outcomes both during the COVID-19 pandemic and in the future. Moreover, studies incorporating telemedicine-based interventions-such as medication management, exercise training, and cognitive, behavioral therapy-have been increasingly emphasizing holistic approaches in patient care. [30] However, given that the management of rheumatic diseases requires lifelong behavioral changes, it is evident that further research is needed to establish effective and sustainable exercise interventions for this population.

In our study a significant improvement in the biopsychosocial status of participants with various rheumatic diseases was observed during the first 12 weeks of telerehabilitation followed by a decline in the subsequent 12 weeks. In a study conducted by Çağlayan et al., the BETY-BQ was used to assess the biopsychosocial status of women with fibromyalgia. This study compared the effects of face-to-face clinical Pilates exercises performed in group and individual settings, demonstrating that BETY-BQ scores improved in both groups.[31] It was suggested that the greater improvements observed might be attributed to the need for individuals to feel a sense of supervision and support from a physiotherapist, even if they were already familiar with the training program.

In our study functional level of individuals did not change significantly, and no disability was detected in all three measurements. A recent systematic review and meta-analysis,

which included six randomized controlled trials examining the effects of internet-based rehabilitation programs on pain and physical function in individuals with knee osteoarthritis, concluded that these programs improved pain but did not significantly enhance physical function, highlighting the limited number of available studies.[32] In another study involving individuals with knee osteoarthritis, the control group was granted access to a specially designed website providing information about the disease and the importance of exercise and physical activity.[33] In contrast, the intervention group was received additional support, including a 24-week self-administered strengthening program and automated behavior change text messages aimed at promoting that promoted exercise adherence and increasing physical activity levels. The intervention group demonstrated greater improvement in overall knee pain and physical function compared to the control group.

In a study conducted by van den Berg et al., the effectiveness of two different internet-based physical activity interventions in individuals with rheumatoid arthritis were compared. One group participated in a structured physical activity program that included exercise equipment, group communication, and an individualized exercise program (strengthening, range of motion exercises, and bicycle ergometry). The other group had access to a website, providing general information about exercises and physical activity. The study found improvements in functional levels in both groups, with the most significant gains observed in the individualized exercise group.[34] The heterogeneity in study methodologies may have contributed to these differences. Additionally, these studies were not conducted during the COVID-19 pandemic. The primary distinction of our study was that it was carried out during the first six months of the pandemic, a period when rehabilitation services were largely unavailable. The ability of participants in our study to maintain their functional levels may be attributed to the exercises performed through telerehabilitation.

In our study, the anxiety and depression levels of the participants remained unchanged, with baseline values already indicating no signs of depression or anxiety at the onset of the pandemic. In a randomized controlled trial investigating the effects of an aerobic exercise-based telerehabilitation program in women with fibromyalgia during the COVID-19 quarantine period, the intervention group participated in individual exercise sessions twice a week for 15 weeks, while the control group received no additional intervention. The study results demonstrated a statistically significant improvement in both the depression and anxiety subscales of the HADS in the exercise group compared to baseline and the control group. Notably, the initial anxiety and depression levels of the individuals in that study were reported to be above the cut-off value of the scale.[35] In this study, written messages were used to deliver exercise instructions; however, these messages provided real-time explanations of a BETY session, replicating the format of in face-to-face training. This suggests that individuals were protected from the expected negative effects of social isolation and prolonged home confinement during the pandemic through this exercise. The sustainability of this effect may be attributed to the fact that the participants, who had been exercising regularly, had already developed adaptive coping mechanisms through prior engagement in the program. Notably, during the period of social isolation, which was associated with increased rates of depression and anxiety, individuals who had maintained regular face-to-face exercises in the pre-pandemic period and had achieved a certain level of physical and psychological well-being were able to preserve these benefits when given the opportunity to continue exercising with or without supervision. It is suggested that the group-based nature of BETY, even when applied via telerehabilitation, played a crucial role in supporting emotional well-being and preventing feelings of loneliness, reinforcing the importance of social support in home-based exercise interventions.

Limitations

Although a large number of individuals had participated in the face-to-face training sessions, some were unable to adapt to simultaneously reading the exercise messages and pain management instructions on WhatsApp while performing the exercises. Consequently, they were not included in this study and a control group could not be established. Furthermore, although these individuals did not participate in the telerehabilitation sessions, they could not be

considered a non-intervention control group, as they reported continuing the exercises at home based on their previous training. Another important limitation was the inability to include new participants in the exercise group. Individuals eligible for inclusion needed to have previously attended face-to-face exercise sessions and learned the method beforehand. With a pragmatic approach, our primary objective was to first evaluate the feasibility of applying the existing exercise model through telerehabilitation with individuals who had prior experience with it. Additionally, since this study aimed to assess the sustainability and effectiveness of the exercise program, and all the participants were under medical supervision, their medication use and comorbidities were not evaluated, representing another limitation. Future research should build upon these findings by conducting randomized controlled studies with a sufficiently large sample size, including individuals without prior exercise habits, to enhance the generalizability and effectiveness of this approach.

Conclusion

In this study, the six-month sustainability of BETY, a biopsychosocial exercise model initially implemented as a face-to-face group exercise program for individuals with rheumatic diseases, through telerehabilitation during the COVID-19 pandemic. Our study was unique in several aspects, including the use of a biopsychosocial exercise model in a group training format, and its application to individuals with rheumatic diseases during the pandemic. Since teaching and implementing biopsychosocial models remotely is challenging, it is recommended that these models be introduced through face-to-face training under normal circumstances. Notably, this study, which presents a novel approach not previously reported in the literature for individuals with rheumatic diseases, found that the only source enabling participants to continue exercising during the pandemic was the biopsychosocial exercise habits they had acquired through in-person, group-based training. These findings highlight the need to promote the widespread adoption of biopsychosocial exercise approaches, recognize the potential for individuals to sustain previously established exercise habits through remote care, and support this exercise model with comparative studies to further validate its effectiveness.

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Conflicts of Interest: *None*

Ethical Approval: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Hacettepe University (GO-18/1182).

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