



ARAŞTIRMA / RESEARCH

Effect of aerobic exercise on quality of life in patients with fibromyalgia

Fibromiyalji hastalarında aerobik egzersizin yaşam kalitesi üzerine etkisi

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Abstract

Purpose: The present study aimed to analyze the relationship between aerobic exercise and life quality in fibromyalgia patients.

Materials and Methods: The study included patients who were followed up at the Physical Medicine and Rehabilitation outpatient clinic of Zonguldak Bulent Ecevit University Faculty of Medicine and were diagnosed with Fibromyalgia Syndrome (FS) according to the criteria of the American Society of Rheumatology. The quality of life and functional levels of the patients included in the study were evaluated with the short form-36, which they filled out before and after the treatment.

Results: The mean age of the 22 female patients included in the study was 48.09±7.42(33-64) years, and the follow-up period was 35.50±22.26 (9-84) months. Six of the patients were included in the treadmill and 16 of them were included in the bicycle exercise program. The duration of the exercise program of the patients varied between 7 and 24. Post-treatment SF-36 Scale's physical functioning, limitation in physical role, limitation in emotional role, vitality, mental health, bodily pain and general health scores were statistically significant. There was no statistically significant improvement in social functioning.

Conclusion: According to the outcomes of this study; aerobic exercises should be born in mind to elevate life quality in treatment and follow-up of the FS patients.

Keywords: Fibromyalgia, quality of life, exercise, pain

Öz

Amaç: Bu çalışmada fibromiyalji hastalarında aerobik egzersiz ile yaşam kalitesi arasındaki ilişkinin incelenmesi amaçlanmıştır.

Gereç ve Yöntem: Çalışmaya Zonguldak Bulent Ecevit Üniversitesi Tıp Fakültesi Fiziksel Tıp ve Rehabilitasyon polikliniğinde takip edilen ve Amerikan Romatoloji Derneği kriterlerine göre Fibromiyalji Sendromu(FS) tanısı alan hastalar dahil edilmiştir. Çalışmaya dahil edilen hastaların yaşam kalitesi ve fonksiyonel düzeyleri tedavi öncesi ve tedavi sonrası doldurdıkları kısa form-36 ile değerlendirilmiştir.

Bulgular: Çalışmaya alınan toplam 22 kadın hastanın yaş ortalaması 48,09±7,42(33-64) yıl, takip süreleri 35,50±22,26 (9-84) ay idi. Hastaların 6 tanesi koşu bandı, 16 tanesi bisiklet egzersiz programına alınmıştı. Hastaların egzersiz programı süresi 7 ile 24 arasında değişmekteydi. Tedavi sonrası SF-36 Ölçeğinin fiziksel fonksiyon, fiziksel rol güçlüğü, emosyonel rol güçlüğü, enerji, ruhsal sağlık, ağrı ve genel sağlık skorlarında istatistiksel açıdan anlamlı iyileşme saptandı. Yalnızca sosyal işlevsellik puanlarında istatistiksel olarak anlamlı bir iyileşme olmadığı görüldü.

Sonuç: Bu çalışma sonucuna göre FS'li hastaların takibinde yaşam kalitelerini arttırmaları amacıyla aerobik egzersizler hastalığın tedavi ve takibi boyunca unutulmamalıdır.

Anahtar kelimeler: Ağrı, egzersiz, fibromiyalji, yaşam kalitesi

INTRODUCTION

Fibromyalgia Syndrome (FS) is a chronic pain syndrome accompanied by widespread body pain,

pain sensitivity, fatigue, sleep disturbance, and cognitive dysfunction¹. Besides these, some symptoms such as mood disorders, headache, restless leg syndrome, and irritable bowel syndrome also may

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be monitored². In the literature, the prevalence of fibromyalgia was reported to be 0.2-66% and 2.4-6.8% in males and females in the general population, respectively³. The etiology and pathogenesis of fibromyalgia have not yet been exactly clarified. It is considered that dysfunction of central and peripheral nervous systems, neurotransmitters, hormones, immune system, external stressors, psychiatric aspects, and many various factors play a role in its etiology⁴.

It is known that life quality remarkably decreases due to chronic pain⁵. It has been demonstrated that the females with FS had either lower pain threshold and also a worse life quality level than the healthy females⁶. A statistically significant relationship was found between chronic pain, quality of life, and depression⁵.

Although there is no gold standard treatment method for treating the disease, individual-specific treatment methods are recommended. It is stated that treatment regimens should involve pharmacological and non-pharmacological treatment methods. It is known that treatment methods such as cognitive-behavioral therapies and physical exercises have a positive impact on achievement and continuation of functional therapy^{1,7,8}. In recent years, many studies have been conducted on aerobic, strengthening, and flexibility exercises in combination with pharmacological therapy⁹. It has been detected that particularly aerobic exercise among exercise methods has an important place in the treatment of the disease. Indeed, another article that evaluated the recommendations presented in Germany, Israel, and Canada have recommended aerobic exercise with a high evidence level¹⁰. It is stated that aerobic exercise is one of the effective treatment methods in reducing pain and increasing general well-being in patients with fibromyalgia¹¹.

Fibromyalgia is a syndrome that causes reduced quality of life significantly. In order to achieve the most effective treatment for fibromyalgia patients, many exercise methods are being investigated. Our aim with this study is to define the benefits of the aerobic exercise method. For this purpose, the change in the quality of life of patients who were followed up with a diagnosis of FS in the Physical Medicine and Rehabilitation Outpatient Clinic of the Faculty of Medicine of Zonguldak Bulent Ecevit University and enrolled in the aerobic exercise therapy program was examined.

MATERIALS AND METHODS

The study included 23 patients who were followed up in the Zonguldak Bülent Ecevit University Health Practice Research Hospital, Physical Medicine and Rehabilitation Clinic. 2013 diagnostic criteria of the American Rheumatology Association were used to define fibromyalgia¹². One patient was excluded given the inability to access the medical records. The patients with thyroid and parathyroid disorders, generalized osteoarthritis, neurological and cardiac diseases, malignancy, and pregnancy were excluded from the study. It was observed that the patients who received medical support before the exercise program have continued with the same drug treatment during the exercise process. The study protocol was approved by the Clinical Research Ethics Committee of Zonguldak Bülent Ecevit University (tarih:02.12.2020 sayı:23). The study was conducted following the principles of the Declaration of Helsinki.

Intermittent heart rate controlled aerobic exercises program is routinely applied in our clinic for fibromyalgia patients who do not have any additional disease or drug use. In this protocol, the target heart rate is calculated by using the Karvonen method. According to this method, the maximum heart rate of the patient is calculated by calculating the 220-age formula. From the found value, the resting heart rate is subtracted and multiplied by 60%, and the result is summed up by the resting heart rate. All data such as load, work, and MET are automatically saved when patient data is entered into the system to which all exercise devices are connected and the patient starts exercising. A totally 16-minute exercise program were arranged for the patients to include 3-minute warming up, a 3-minute cooling down, and a 10-minute training protocol. Five sessions per week were planned to be at least 2 weeks. In the patients' program, exercise progression was performed as "3 sessions of 16 minutes, 3 sessions of 20 minutes, 3 sessions of load increase (10% of the maximum load), 3 sessions of 24 minutes, 3 sessions of load increase, 3 sessions of 28 minutes" respectively.

Target heart rate(Karvonen Method):[[(220-age)-resting heart rate]x60%+resting heart rate]

Aerobic exercises:

Treadmill running and cycle ergometer were used for aerobic exercise program (Ergoselect GmbH

Ergoline; Germany). The previous exercise experience was questioned and the exercise preference of each patient with treadmill running or cycle ergometer was determined. A routine exercise program with intermittent heart rate control was used in both devices. Our study was carried out with treadmill and bicycle ergometer exercises, which are one of the types of aerobic exercise in which the large muscles contract rhythmically and dynamically, and cardiovascular endurance increases. Treadmills are stationary devices that allow the practice of aerobic exercise, where different protocols and methods of exercise can be applied, vital data such as heart rhythm, heart rate, blood pressure can be monitored during exercise. A bicycle ergometer is another type of aerobic exercise in which the same data can be monitored during exercise.

Measures

The quality of life and functional levels of the patients included in the study were evaluated using the Short Form-36 test, which has proven Turkish validity and reliability^{13,14}.

Short form-36 (SF-36) Life Quality Scale

Short form-36 (SF-36) Life Quality Scale is an assessment with proven reliability in musculoskeletal system diseases. It is composed of 36 items and evaluates life quality with 8 subparameters. These 8 subparameters include physical functioning (10 items), limitation in physical role (4 items), limitation in emotional role (3 items), vitality (4 items), mental health (5 items), social functioning (2 items), bodily pain (2 items) and general health (general perspective (5 items) +change in health status (1 item)). The scoring of the subscales ranges between 0-100 scores. Although SF-36 is collected in 8 subheadings, it is also evaluated with the results of physical and mental component summary scores in itself. Physical component summary scores are derived from physical functioning, limitation in the physical role, bodily pain, and general health scores. Mental component summary scores are derived from social functioning, limitation in the emotional role, mental health, and vitality. The life quality and functional status of totally 22 female patients with FS included in the study were evaluated by SF-36 scale before and after the treatment. Data of the patients such as resting heart rate, maximum work, maximum load, exercise duration, and metabolic equivalent (MET) were recorded before and at the end of the treatment

Demographic data form

Demographic data of the patients were obtained retrospectively using the hospital data registry system. The resting heart rate, maximum work, load, MET were obtained using the exercise device system, in which data were automatically recorded during each exercise. The cardiac rehabilitation unit nurse performed and recorded quality of life scale interrogations before and after treatment.

Statistical analysis

Statistical analysis of the study data was performed using the software PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc. The distribution normality of the quantitative variables was tested by the Shapiro-Wilk test, Skewness-Kurtosis, and coefficients of variation and other charting methods. The descriptive statistics for quantitative variables were expressed as arithmetic mean \pm standard deviation and median (minimum-maximum) while numbers and percentages were used to present the descriptive statistics of the verbal data. Paired Sample T- Test was used for the parametric analysis and Wilcoxon test was used for the nonparametric analysis of the dependent variables at the statistical significance level of $p < 0.05$. Paired Sample T-test was used to compare physical functioning, vitality, mental health, general health, resting heart rate, maximum work, MET. Wilcoxon test was applied to compare limitation in the physical role, limitation in the role, social functioning, bodily pain, load, and exercise duration data. The power of our study was calculated as 86% with an effect size of 0.7.

RESULTS

All of 22 study patients were female in the study and their mean age was 48.09 ± 7.42 years (min:33 years and max:64 years). The mean follow-up duration was found 36.50 ± 22.26 months (min:9 months and max:84 months). Comorbidity and previous surgery in the medical history were present in 15 (68%) and 9 (40%), respectively. Of the patients; 6 (27%) and 16 (72%) were assigned to treadmill running and cycle ergometer programs, respectively. The mean number of the sessions completed by the patients included in the aerobic exercise program was determined to be 15,27 (min:7-max:24 sessions). Table 1 shows resting heart rate, maximum work, maximum load, exercise duration, and MET values of the patients measured before and after the treatment.

Table 1. Aerobic exercise programs of the patients

	Onset of treatment	End of treatment	P value
Resting heart rate (beat/min)	89.40±12.35*	87.68±14.23*	0.795
Maximum work (watt/kg)	142.81±17.16*	135.54±16.04*	0.006
Load (watt)	75 (5-141)**	80 (5.8-131)**	0.008
Exercise duration (min)	16 (16-20)**	24 (18-36)**	<0.001
MET	5.30±1.31*	5.85±1.65*	0.011

MET: Metabolic equivalent of task, *: mean ± standard deviation, **: median (min–max)

Table 2. The scores of the patients for life quality scales of Short Form-36 before and after treatment

	Onset of treatment	End of treatment	P value
Physical functioning	47.72±18.23*	61.13±21.20*	<0.001
Limitation in physical role	0 (0-100)**	37,5 (0-100)**	0.028
Limitation in emotional role	0 (0-66,7)**	50 (0-100)**	0.008
Vitality	24.54±17.17	43.86±23.29	0.001
Mental health	42.95±16.66*	58.90±19.25*	<0.001
Social functioning	37,5 (0-75)**	56,25 (3,5-75)**	0.068
Bodily pain	22,5 (0-45)**	45 (0-100)**	<0.001
General health	63.63±31.40*	97.72±42.89*	<0.001

*: mean ± standard deviation, **: median (min–max)

Table 2 shows the scores of the patients for subscales of SF-36 in terms of life quality were separately compared as before and after treatment. An improvement indicating a statistically significant difference in physical functioning, limitation in the physical role, limitation in the emotional role, vitality, mental health, bodily pain, and general health were found after the treatment whereas no significant difference was detected in only social functioning.

When the physical component summary scores pre-treatment and post-treatment changes were evaluated, it was seen that the p-value was 0.001. The change demonstrated a statistically significant difference.

If the change in mental component summary scores is examined, it is seen that the p-value is below 0.001. The difference between the mental component summary scores before and after treatment was found statistically significant.

DISCUSSION

Fibromyalgia is a chronic disease characterized by widespread pain accompanied by complaints such as usually fatigue, stiffness, and sleep disturbance. These symptoms usually reduce health-associated life quality and capability of daily life activities¹⁵. Many pharmacological and non-pharmacological methods are implemented in the treatment of the disease. A

recent study has stated that an increased number of the drugs introduced to pharmacological treatment is not associated with a reduction in the complaints, whereas it is contrarily associated with increased side effects¹⁶. In the last decade, many clinical studies have been carried out to determine the efficacy of exercise treatment¹⁷. Aerobic exercises have been introduced to the treatment guidelines of FS published in the countries such as Canada and Germany with a strong recommendation level^{8,18}. A review has evaluated the different types of aerobic exercise methods in 2010 and recommended arranging an exercise program composed of mild-moderate degree land-based or water-based aerobic exercises for twice or three times weekly¹⁹. However, there is no consensus was established on the details such as type, intensity, and duration of the aerobic exercise. We evaluated a meta-analysis that has reviewed the efficacy of the therapeutic exercises in FS. In these studies, aerobic training, coordination and balance training, posture stabilization, body mechanics, flexibility exercises, gait training, relaxation techniques, and muscle strengthening exercises were applied. Stretching and aerobic exercises were found to have the highest impact on life quality in FS. On the other hand, muscle strengthening and aerobic exercises were found to be the most effective types of exercise in reducing the severity of the disease and pain¹¹.

In our study, life quality was evaluated in total of 22 female patients by SF-36 scale before and after the

aerobic exercise treatment implemented by cycle ergometer and treadmill running. The life quality of our patients by SF-36 scale was found very low according to their current age and gender²⁰. Although; this assessment method is comprised of totally 8 subscales, it also consists of subunits such as physical and mental component summary scores. When the benefit rates of our patients from aerobic exercise were evaluated in terms of 8 subheadings, it was observed that there was a significant improvement in all subheadings except social function. When the physical and mental component summary scores were evaluated, it was found that well-being made a statistically significant difference. Two separate types of researches that evaluated the relationship between physical activity level and life quality in FS have detected a positive correlation between this two aspects^{21,22}. In also our study, a significant increase was obtained in the life quality level of the patients that received aerobic exercise treatment similarly with those researches.

The outcomes of in-water exercise, gymnastic, and home exercise programs were compared in FS in a study, and a statistically significant difference was found in favor of the gymnastic group regarding the subscales of such as physical and social functioning, role limitations due to physical problems and bodily pain. The in-water exercise group revealed better scores in the subscales of role limitations due to emotional problems, mental health, vitality, and general health than the other groups. The home exercise group demonstrated a statistically significant difference in none of the subscales²³. The researchers have noted that exercises performed in the house may be miserable and provide no improvement in life quality level. In our study, the implementation of exercises in the hospital may have increased the patient compliance to the exercise treatment. However, considering that fibromyalgia is a disease with very heterogeneous symptoms, quality of life scales can be evaluated during patients' applications and a subdivision can be determined where the patient complains more. The scores gained from the subscales reported indicating more complaints may be analyzed. The exercise method can be designed specifically for the patient based on the subscales related to the higher rate of complaints. Our study has manifested that the aerobic exercise method is insufficient for patients with higher complaints of social functionality. It is thought that there is a need for additional studies with more patient participation on this subject. Another article investigating the

effectiveness of an aerobic exercise program in fibromyalgia patients observed statistically significant improvements in both physical and mental component summary scores, similar to our study. Nevertheless, an improvement was detected in the scores for all subscales compared with pretreatment scores except general health²⁴.

This research has some limitations. The first limitation is the absence of the control group composed of fibromyalgia patients that do not perform aerobic exercise, the second limitation is the small sampling size and the third limitation is the fact that lack of the long-term evaluation of post-treatment efficacy after implementation of aerobic exercise.

In conclusion, significant improvement was observed in all sub-parameters of quality of life except for social function in the aerobic exercise method. It appears possible that reduce pain and achieve an increase in the life quality of fibromyalgia patients by aerobic exercise as a treatment method. By the application of these exercises, the patients can be protected from the side effects of the drugs while not only bodily pain but also many other symptoms that decrease life quality resulting from the nature of the disease can be recovered. Our study demonstrated that the aerobic exercise method is crucial in the treatment of fibromyalgia patients.

Yazar Katkıları: Çalışma konsepti/Tasarımı: AKÖ, SS; Veri toplama: AKÖ; Veri analizi ve yorumlama: AKÖ; Yazı taslağı: AKÖ; İçerğin eleştirilme: SS; Son onay ve sorumluluk: AKÖ, SS; Teknik ve malzeme desteği: AKÖ; Süpervizyon: SS; Fon sağlama (mevcut ise): yok.

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REFERENCES

- Şendur ÖF, Bozbaş GT. Fibromyalgia syndrome. Türkiye Klinikleri J PM&R-Special Topics. 2017;10:252-8.

2. Şaş S, Koçak F, Tuncay F. Fibromiyalji sendromunda yaşam kalitesinin değerlendirilmesi. *Ahi Evran Med J.* 2019;3:48-53.
3. Marques AP, Sonto ASdE, Berssane AA, Matsutani LA, Yuan SLK. Prevalence of fibromyalgia: literature review update. *Rev Bras Reumatol.* 2017;57:356-63.
4. Bellato E, Marini E, Castoldi F, Barbasetti N, Mattei L, Bonasia DE et al. Fibromyalgia syndrome: etiology, pathogenesis, diagnosis, and treatment. *Pain Rest Treat.* 2012;2012:426130.
5. Sivas FA, Başkan BM, Aktekin LA, Çınar NK, Yurdakul FG, Özoran K. Fibromiyalji hastalarında depresyon, uyku bozukluğu ve yaşam kalitesinin değerlendirilmesi. *Türkiye Fiziksel Tıp ve Rehabilitasyon Dergisi.* 2009;55:8-12.
6. Marques AP, Ferreira EA, Matsutani LA, Pereira CA, Assumpção A. Quantifying pain threshold and quality of life of fibromyalgia patients. *Clin Rheumatol.* 2005;24:266-71.
7. Macfarlane GJ, Kronisch C, Dean LE, Atzeni F, Fluß E, Choy E et al. EULAR revised recommendations for the management of fibromyalgia. *Ann Rheum Dis.* 2017;76:318-28.
8. Fitzcharles MA, Ste-Marie PA, Goldenberg DL, Pereira JX, Abbey S, Choinière M et al. Canadian Guidelines for the diagnosis and management of fibromyalgia syndrome: executive summary. *Pain Res Manag.* 2012;18:119-26.
9. Sonel Tur B. Exercise treatment in fibromyalgia syndrome. *Türkiye Klinikleri J PM&R-Special Topics.* 2015;8:45-9.
10. Ablin J, Fitzcharles MA, Buskila D, Shir Y, Sommer C, Häuser W. Treatment of fibromyalgia syndrome: recommendations of recent evidence-based interdisciplinary guidelines with special emphasis on complementary and alternative therapies. *Evid Based Complement Alternat Med.* 2013;2013:485272.
11. Sosa-Reina MD, Nunez-Nagy S, Gallego-Izquierdo T, Pecos-Martín D, Monserrat J, Álvarez-Mon M. Effectiveness of therapeutic exercise in fibromyalgia syndrome: A systematic review and meta-analysis of randomized clinical trials. *Biomed Res Int.* 2017;2017:2356346.
12. Bennett RM, Friend R, Marcus D, Bernstein C, Han BK, Yachoui R et al. Criteria for the diagnosis of fibromyalgia: validation of the modified 2010 preliminary American College of Rheumatology criteria and the development of alternative criteria. *Arthritis Care Res.* 2014;66:1364-73.
13. Kocyigit H. Reliability and validity of the Turkish version of Short Form 36 (SF-36): a study in a group of patients with rheumatic diseases. *Turk J Drugs Ther* 1999;12:102-6
14. Pinar R. Reliability and construct validity of the SF-36 in Turkish cancer patients. *Qual Life Res.* 2005;14:259-64.
15. Villafaina S, Collado-Mateo D, Domínguez-Muñoz FJ, Fuentes-García JP, Gusi N. Benefits of 24-week exergame intervention on health-related quality of life and pain in women with fibromyalgia: A single-blind, randomized controlled trial. *Games Health J.* 2019;8:380-86.
16. Rico-Villademoros F, Postigo-Martin P, Garcia-Leiva JM, Ordoñez-Carrasco JL, Calandre EP. Patterns of pharmacologic and non-pharmacologic treatment, treatment satisfaction and perceived tolerability in patients with fibromyalgia: a patients' survey. *Clin Exp Rheumatol.* 2020;123:72-8.
17. Bidonde J, Busch AJ, Schachter CL, Webber SC, Musselman KE, Overend TJ et al. Mixed exercise training for adults with fibromyalgia. *Cochrane Database Syst Rev.* 2019; 5(5):CD013340..
18. Häuser W, Arnold B, Eich W, Felde E, Flügge C, Henningsen P et al. Management of fibromyalgia syndrome--an interdisciplinary evidence-based guideline. *Ger Med Sci.* 2008;6:14.
19. Häuser W, Klose P, Langhorst J, Moradi B, Steinbach M, Schiltenswolf M et al. Efficacy of different types of aerobic exercise in fibromyalgia syndrome: a systematic review and meta-analysis of randomized controlled trials. *Arthritis Res Ther.* 2010;12:1-14.
20. Demiral Y, Ergor G, Unal B, Semin S, Akvardar Y, Kivircik B et al. Normative data and discriminative properties of short form 36 (SF-36) in Turkish urban population. *BMC Public Health.* 2006;6:247.
21. Gavilán-Carrera B, Segura-Jiménez V, Estévez-López F, Álvarez-Gallardo IC, Soriano-Maldonado A, Borges-Cosic M et al. Association of objectively measured physical activity and sedentary time with health-related quality of life in women with fibromyalgia: The al-Andalus project. *J Sport Health Sci.* 2019;8:258-66.
22. Valim V, Oliveira L, Suda A, Silva L, de Assis M, Barros Neto T et al. Aerobic fitness effects in fibromyalgia. *J Rheumatol.* 2003;30:1060-9.
23. Sevimli D. Fibromiyalji sendromlu hastalarda egzersiz ve SF-36 yaşam kalitesi ilişkisinin incelenmesi. *Sport Sciences.* 2012;7:18-26.
24. García-Martínez AM, De Paz JA, Márquez S. Effects of an exercise programme on self-esteem, self-concept and quality of life in women with fibromyalgia: a randomized controlled trial. *Rheumatol Int.* 2012;32:1869-76.