Original Research Article
Home-Based Aerobic Conditioning for Management of Symptoms of Fibromyalgia: A Pilot Study

R. Norman Harden, MD,*†§§ Sharon Song, PhD,‡ Jo Fasen, MPT, OCS, CSCS, Cert. MDT,§ Samuel L. Saltz, DO,§ Devi Nampiaparampil, MD,**** Andrew Vo, MD,‡‡ and Gadi Revivo, DO§§

*Center for Pain Studies, Rehabilitation Institute of Chicago, Chicago, Illinois;
†Northwestern University Medical School, Chicago, Illinois;
‡Department of Behavioral Medicine, Midwestern University, Chicago, Illinois;
§Gentiva Health Services, Bellevue, Washington;
§Northern Colorado Medical Center, Surgical Associates of Greeley, Banner Medical Group, Greeley, Colorado;

Departments of **Rehabilitation Medicine and ††Anesthesiology, VA New York Harbor Healthcare System/NYU School of Medicine, New York, New York;

‡‡RHPH Brain and Spine Center, Rockford Health Physicians, Rockford, Illinois;
§§Center for Pain Management, Rehabilitation Institute of Chicago, Chicago, Illinois, USA

Reprint requests to: R. Norman Harden, MD, Center for Pain Studies, Rehabilitation Institute of Chicago, 446 E. Ontario, Suite 1011, Chicago, IL 60611, USA. Tel: 312-238-7878; Fax: 312-238-7624; E-mail: nharden@ric.org.

Conflict of interest/Disclosure: None.

Abstract
Objective. This pilot study was designed to evaluate the impact of a home-based aerobic conditioning program on symptoms of fibromyalgia and determine if changes in symptoms were related to quantitative changes in aerobic conditioning (VO2 max).

Methods. Twenty-six sedentary individuals diagnosed with fibromyalgia syndrome participated in an individualized 12-week home-based aerobic exercise program with the goal of daily aerobic exercise of 30 minutes at 80% of estimated maximum heart rate. The aerobic conditioning took place in the participants’ homes, outdoors, or at local fitness clubs at the discretion of the individual under the supervision of a physical therapist. Patients were evaluated at baseline and completion for physiological level of aerobic conditioning (VO2 max), pain ratings, pain disability, depression, and stress.

Results. In this pilot study subjects who successfully completed the 12-week exercise program demonstrated an increase in aerobic conditioning, a trend toward decrease in pain measured by the McGill Pain Questionnaire—Short Form and a weak trend toward improvements in visual analog scale, depression, and perceived stress. Patients who were unable or unwilling to complete this aerobic conditioning program reported significantly greater pain and perceived disability (and a trend toward more depression) at baseline than those who completed the program.

Conclusions. Patients suffering from fibromyalgia who can participate in an aerobic conditioning program may experience physiological and psychological benefits, perhaps with improvement in symptoms of fibromyalgia, specifically pain ratings. More definitive trials are needed, and this pilot demonstrates the feasibility of the quantitative VO2 max method. Subjects who experience significant
perceived disability and negative affective symptoms are not likely to maintain a home-based conditioning program, and may need a more comprehensive interdisciplinary program offering greater psychological and social support.

Key Words. Fibromyalgia; Exercise Therapy; Aerobic Conditioning; Pain Rating; Pain Pressure Threshold; Psychometric Testing; VO₂ max

Introduction

Fibromyalgia (FM) is a syndrome characterized by widespread pain with point tenderness at defined areas and is often associated with sleep disturbance, fatigue, and morning stiffness as per the 1990 criteria proposed by the American College of Rheumatology (ACR) [1]. A “new” criteria from the ACR is available that does not require a tender point examination, and is based on the subjective symptoms of widespread pain “cognitive symptoms, unrefreshed sleep, fatigue, and [a] number of somatic symptoms” [2]. The Association of the Medical Scientific Societies in Germany (AWMF) has proposed another, somewhat overlapping criteria [3].

The pathophysiology of FM is now thought to be based in the central nervous system, in addition to the peripheral manifestations, and involves augmented central pain processing (i.e., allodynia and hyperalgesia) [4–10]. Although a variety of therapies have been proposed, randomized controlled trials indicate that the most effective pharmacotherapies may be the alpha-2-delta ligands (e.g., pregabalin) or neuroamine reuptake blockers (e.g., tricyclic/heterocyclic “antidepressants” or the so called “serotonin, norepinephrine re-uptake inhibitors”) [7–13]. Non-drug therapies have also been emphasized, such as patient education [7–9,11–14] and aerobic exercise [8,10,13,15,16]. Mechanisms accounting for the effectiveness of aerobic conditioning are unclear, although several speculative mechanisms have been proposed [1,17–19]. For example, one known effect of aerobic exercise is an increase in endogenous opioid activity [9,20]. Enhanced opioid activity in some cases is associated with analgesia [21], and it is possible that enhanced opioid-related analgesia may account for reduced FM symptoms after aerobic training [16,22]. Other authors have proposed that aerobic conditioning may result in symptom improvements by increasing the resistance of muscles to potentially painful micro trauma from daily activity [23]. Aerobic conditioning has been shown to improve affective symptoms such as depression and anxiety (frequent comorbidities in FM), presumably due to changes in endorphin [24–26] and/or monoamine levels [17,18].

Although studies have documented that FM patients are deconditioned relative to control subjects [27–29] few prospective studies have examined treatment-related changes in objective indices of aerobic conditioning as they relate to changes in FM symptoms. One study found that aerobic conditioning led to improvements in amount of oxygen uptake per heart rate (HR), pain threshold at tender points by algometry and subject pain measures in patients with FM compared with controls [30]. Other studies incorporated objective measurements of exercise but focused on study goals other than the evaluation of aerobic conditioning as a treatment regimen for FM [12]. While direct aerobic conditioning-related changes would appear to be the most parsimonious explanation for the effectiveness of conditioning-based treatment, an empirical test of this assumption is necessary to rule out the possibility that a factor other than conditioning may account for the observed changes [17,18,31].

Apart from uncertainties regarding the mechanisms underlying the conditioning approach to FM management, existing studies in this area raise questions regarding possible barriers to broad and successful application of this type of treatment approach. Home-based treatment interventions have received wider attention but the one home-based study that also quantified aerobic fitness compared a 30-minute protocol to two 20-minute exercise sessions [6]. The majority of conditioning programs that have been reported to date have been highly supervised, and require multiple clinic visits per week for scheduled group exercise sessions. Substantial problems with patient attrition have been reported (ranging from 10% to 39%) in structured clinic-based conditioning programs and these problems are frequently due to scheduling conflicts with group exercise times [19,23,32,33]. It has also been noted that FM patients may have difficulty altering their sedentary activity levels due to increased symptoms that occur when exercise is paced at too high a level [34–36]. The structure of group-based exercise programs, in which patients are paced according to group norms rather than individual feedback, would appear to have more potential to push some patients beyond their perceived physical limits. Thus, patients’ perceptions that group-paced programs exceed their exercise tolerance might be one contributor to treatment attrition. A self-paced program that allows patients to start at a comfortable level, but which provides structured assistance and motivation for increasing exercise tolerance, may increase patient acceptance of aerobic conditioning for FM symptom management. A home-based approach to aerobic conditioning may address the barriers associated with clinic-based programs because exercise times are determined solely by patient convenience, and because patients are allowed to pace themselves according to their perceived individual tolerances.

In addition to the potential advantages described previously, a home-based treatment approach requires less intensive use of medical resources. Traditional treatment approaches for FM involve regular medical appointments, extensively supervised aerobic conditioning sessions multiple times per week, in addition to other therapies. Because of the number of appointments required, traditional interdisciplinary programs can be quite expensive. Thus, a home-based program that emphasizes a self-management approach with limited
but structured supervision may provide a more cost-effective approach for FM.

In a prior systematic review of the effectiveness of non-pharmacological interventions for FM, aerobic exercise has been favorably endorsed; although a lack of standardization of treatment duration and intensity has been noted [37]. The current pilot study was designed to examine the impact of a home-based aerobic conditioning program on FM symptoms and determine whether changes in symptoms were related to quantitatively assessed changes in aerobic conditioning (VO2 max measurement). Further, an analysis of volunteers at baseline may allow for identification of predictors of patients likely to benefit from such a home-based aerobic conditioning program.

Methods

This study received Institutional Review Board (IRB) approval from the Northwestern University IRB. This pilot study incorporated before and after measurements of aerobic capacity and treatment outcome variables in subjects volunteering to participate in a home-based aerobic conditioning program for 12 weeks. Treatment effectiveness and attrition were also assessed.

Subjects

Participants included 26 FM patients, aged 25–59, who were not involved in any aerobic conditioning programs within 60 days prior to beginning the treatment protocol. A study physician confirmed FM diagnoses using the original ACR criteria [1]. These criteria include at least a 3-month history of pain above and below the waist bilaterally, and pain in at least 11 of 18 standard tender point sites. Exclusion criteria included a known history of active cardiac or peripheral vascular disease, uncontrolled diabetes, inflammatory joint disease, pregnancy, an abnormal exercise test, or use of medications that would alter response to exercise (including nitrates, beta blockers, and calcium channel blockers).

Participants were solicited from a variety of sources in order to ensure patient diversity. These sources included: 1) an urban academic rheumatology practice; 2) an academic rehabilitation hospital’s outpatient arthritis clinic; 3) an outpatient pain treatment program; and 4) FM support groups associated with the Arthritis Foundation. All participants were asked to refrain from making any treatment changes (including medications) during the course of study.

Psychometric Questionnaires

Psychological and functional status was assessed throughout the study using a set of well-validated psychometric instruments commonly used in FM and pain-related research. The Pain Disability Index (PDI) [38] provided an assessment of the level of perceived current disability resulting from pain. Visual analog pain ratings (visual analog scale [VAS]; [39]) anchored with “No Pain” and “Worst Possible Pain” were used to assess overall pain intensity. The McGill Pain Questionnaire—Short Form (MPQ-SF) was used to assess sensory (MPQ-S), and affective (MPQ-A) aspects of the pain [40]. Patients were also asked to keep an exercise log recording type of exercise(s) performed, duration, and HR immediately after exercise to facilitate program adjustments and goal-planning during weekly contacts.

Procedures

Patients who met the initial screening criteria underwent symptom-limited maximal exercise testing performed using a Vmax 29® metabolic cart (SensorMedics, Inc., Yorba Linda, CA, USA) and a Life Fitness® recumbent bicycle. Emergency cardiac medications, a defibrillator, and a physician certified in advanced cardiac life support were available during all testing. The exercise testing followed a modified Bruce protocol [41] that involves a change in speed and resistance every 3 minutes. There was continuous four-lead electrocardiogram (EKG) monitoring at baseline and throughout the exercise testing and recovery phases using EKG equipment integrated with the Vmax 29® metabolic cart. Expired gases were collected continuously during testing using an open circuit spirometer, and were analyzed by breath to determine oxygen uptake (VO2), minute ventilation (Ve), carbon dioxide production (VCO2), respiratory exchange ratio, and maximal oxygen uptake (VO2 max). For patients unable to sustain activity sufficient to observe VO2 max, this value was calculated according to the Bruce protocol [41]. Testing was terminated in accordance with criteria outlined by the American College of Sports Medicine (ACSM) [42].

After the baseline exercise test, patients participated in 12 weeks of conditioning. The home-based aerobic conditioning program, based on ACSM recommendations [42] and previously published clinic-based conditioning programs best exemplified in the work by Burckhardt et al. and Nichols and Glenn [23,31], consisted of the following:

1. During an initial supervised instructional session, target HRs were calculated based on 70–80% of estimated maximal HR. Patients were provided with a Polar Vantage XL heart rate monitor (Polar CIC, Inc., Port Washington, NY, USA), which recorded HR throughout each home exercise session, and saved these data for problem-solving sessions with the physical therapist (JF) once every 3 weeks. Instruction in how to use the monitors to record HR during exercise was provided. Patients were instructed to pace their initial exercise level within their perceived limits, but were assisted in setting realistic but increasing goals each week with regard to duration and intensity of exercise.

2. During the initial session, patients were assisted in identifying a set of activities that they could perform that were adequate for aerobic conditioning, such as walking, cycling, and swimming. Subjects were permitted free choice in the type of aerobic activity used to
attain conditioning, and they engaged in multiple types of activities.

3. Participants were taught a simple regimen of warm up and stretching exercises during this initial session for use prior to and after each workout [42].

4. Subjects were asked to engage in the aerobic activity regularly (frequency/intensity based initially upon their perceived capabilities) with the ultimate goal of exercising at target HR for a 30-minute period, 7 days per week. Subjects were asked to wear the HR monitor during exercise and to have the goal of achieving their target HR for at least 30 minutes during each exercise episode. Subjects were asked to record the date, type of exercise, exercise duration, and HR at the end of each exercise session in an exercise log. The recorded data from the HR monitors served as confirmation of the subjects’ self-reports regarding their level of participation in home-based exercise. The instructions were supplemented by written instructional materials.

Brief individual problem-solving sessions were conducted at the clinic site on a scheduled basis (~10–15 minutes). These sessions were scheduled 1 week into treatment, and once every 3 weeks for the remainder of the program. Patients were also contacted by the physical therapist weekly, either by telephone or in person during the clinic visit, for progress reports and goal adjustment. The purpose of these sessions was to monitor patients’ progress, identify barriers to meeting conditioning goals, and generate ways of overcoming the identified barriers. At baseline (BL) and week 12 (EX), patients completed a packet of psychometric questionnaires including the PDI and VAS. The maximal exercise testing protocol was performed at BL and EX to monitor changes in level of aerobic conditioning.

A digital pressure algometer (Pain Diagnostics and Thermography, Greatneck, NY, USA) was used to obtain quantitative pressure pain thresholds in the 18 tender point sites described by Wolfe et al. [1]. A “myalgic score” [43,44] representing the sum of the average pressures required to elicit pain in these 18 sites was determined. The details and results of the tender point assessment and the myalgic score have been reported elsewhere [5].

**Statistical Analysis**

Data were analyzed using Statistical Package for the Social Sciences (SPSS) 19.0 for Windows (SPSS, Inc., Chicago, IL, USA). Primary analyses of changes in FM outcome variables (e.g., pain, activity, myalgic score) over the 12-week period were conducted using paired samples t-tests to compare pre- and post-measurements. Degree of relatedness of the outcomes before and after the aerobic conditioning intervention was computed using Pearson correlations. Independent samples t-test were computed to compare the participants who completed the study to those who did not. Findings associated with an alpha level \( P < 0.05 \) were interpreted as significant.

**Results**

Twenty-six participants met inclusion criteria to initiate the treatment protocol. Average age was 46 years. There were 20 female and six male participants. Nine participants completed the 12-week exercise program (COMP) and 17 did not (DROP). Five participants were terminated from the study due to medical complications that included worsening diabetes, subjective exacerbation of a preexisting cardiac condition, and increased complaints of hip and knee pain secondary to earlier injuries. The other 12 individuals withdrew their participation because they were unwilling or unable to maintain the aerobic exercise protocol.

Among those who completed the 12-week regimen, mean aerobic conditioning improved significantly from a baseline level of 19.23 (6.31) mL of \( O_2/kg/min \) to a level of 22.39 (6.74) mL of \( O_2/kg/min \) at the completion of the study \( (t[8]=-3.32, P=0.01) \) (Figure 1). The majority of participants (and all completers) chose walking or cycling as exercise activities. Water aerobics, Pilates, and resistance training were selected by three DROP subjects. The decrease in MPQ-affective subscore (MPQ-A) approached significance \( (t[8]=2.12, P=0.08) \), as did MPQ-total score (MPQ-T) \( (t[8]=2.30, P=0.06) \). Pain disability, VAS scores, MPQ sensory (MPQ-S) subscore, perceived stress and depression decreased during the study but the changes were not statistically significant (PDI: \( t[8]=1.47, P=0.19 \); MPQ-S: \( t[8]=1.65, P=0.15 \); PSS: \( t[8]=1.92, P=0.10 \); CES-D: \( t[8]=-1.79, P=0.12 \)). These outcomes are summarized in Table 1.

A comparison of baseline values between the COMP and DROP groups revealed fundamental differences in FM

![Figure 1](https://example.com/figure1.png)
symptoms (Table 2 and Figure 2). The DROP group reported greater pain on the VAS ($t[19] = 2.19, P = 0.02$) and scored higher on the MPQ-total score ($t[18] = 2.36, P = 0.03$) and MPQ-affective subscale ($t[18] = 3.51, P < 0.0001$). Furthermore, the DROP group indicated greater baseline perceived disability resulting from the pain as measured by the PDI ($t[19] = 3.67, P < 0.0001$) (Table 2 and Figure 2). Differences in baseline depression approached significance ($t[18] = 2.01, P = 0.06$) whereas sensory pain symptoms and perceived stress between the COMP and DROP groups were not significant (MPQ-S: $t[18] = 1.50, P = 0.15$; PSS: $t[18] = 1.43, P = 0.17$). Variances in the outcome measures were homogeneous between groups.

**Discussion**

The effects of exercise on FM symptoms were first described in a seminal empirical study by McCain et al. [32]. Predictably, the physiological reasons for the benefits of aerobic exercise in FM are unclear (as is the specific pathophysiology of the syndrome). Physical activity has been reported to reduce affective symptoms [17], perhaps due to changes in endorphin [24–26] and/or monoamine levels [17,18]. A serotonin dysregulation hypothesis of FM

---

**Table 1** Summary comparisons before and after exercise (COMP group)

<table>
<thead>
<tr>
<th>Description</th>
<th>Week 0</th>
<th>Week 12</th>
<th>t</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic conditioning (VO₂ max)</td>
<td>19.23 (6.31)</td>
<td>22.39 (6.74)</td>
<td>-3.32</td>
<td>0.01</td>
</tr>
<tr>
<td>Pain disability (PDI)</td>
<td>20.57 (6.63)</td>
<td>14.83 (11.77)</td>
<td>1.47</td>
<td>0.19</td>
</tr>
<tr>
<td>Affective pain symptoms (MPQ-A)</td>
<td>0.61 (0.20)</td>
<td>0.29 (0.30)</td>
<td>2.12</td>
<td>0.08</td>
</tr>
<tr>
<td>Sensory pain symptoms (MPQ-S)</td>
<td>1.23 (0.34)</td>
<td>0.87 (0.65)</td>
<td>1.65</td>
<td>0.15</td>
</tr>
<tr>
<td>Total pain symptoms (MPQ-T)</td>
<td>0.92 (0.19)</td>
<td>0.58 (0.41)</td>
<td>2.30</td>
<td>0.06</td>
</tr>
<tr>
<td>VAS</td>
<td>51.76 (9.59)</td>
<td>45.66 (9.65)</td>
<td>1.64</td>
<td>0.12</td>
</tr>
<tr>
<td>PSS</td>
<td>33.80 (8.70)</td>
<td>27.73 (9.07)</td>
<td>1.92</td>
<td>0.10</td>
</tr>
<tr>
<td>Depression CES-D</td>
<td>15.71 (9.86)</td>
<td>9.71 (8.54)</td>
<td>-1.79</td>
<td>0.12</td>
</tr>
</tbody>
</table>

**Table 2** Comparison of dropout (DROP) vs completed (COMP) groups at baseline

<table>
<thead>
<tr>
<th>Description</th>
<th>DROP</th>
<th>COMP</th>
<th>t</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-aerobic conditioning VO₂ max</td>
<td>19.14 (5.31)</td>
<td>19.23 (6.31)</td>
<td>-0.39</td>
<td>0.97</td>
</tr>
<tr>
<td>Pain disability (PDI)</td>
<td>36.84 (11.49)</td>
<td>21.59 (6.63)</td>
<td>3.67</td>
<td>0.00</td>
</tr>
<tr>
<td>Affective pain symptoms (MPQ-A)</td>
<td>1.29 (0.71)</td>
<td>0.64 (0.22)</td>
<td>3.51</td>
<td>0.00</td>
</tr>
<tr>
<td>Sensory pain symptoms (MPQ-S)</td>
<td>1.56 (0.57)</td>
<td>1.25 (0.33)</td>
<td>1.50</td>
<td>0.15</td>
</tr>
<tr>
<td>Total pain symptoms (MPQ-T)</td>
<td>1.14 (0.57)</td>
<td>0.95 (0.21)</td>
<td>2.36</td>
<td>0.03</td>
</tr>
<tr>
<td>VAS</td>
<td>56.33 (8.58)</td>
<td>43.44 (7.14)</td>
<td>-2.82</td>
<td>0.02</td>
</tr>
<tr>
<td>PSS</td>
<td>35.24 (8.43)</td>
<td>29.50 (8.74)</td>
<td>1.43</td>
<td>0.17</td>
</tr>
<tr>
<td>Depression CES-D</td>
<td>20.78 (11.43)</td>
<td>12.22 (7.87)</td>
<td>2.01</td>
<td>0.06</td>
</tr>
</tbody>
</table>

PDI = Pain Disability Index; MPQ-A = McGill Pain Questionnaire-Affective; MPQ-S = McGill Pain Questionnaire-Sensory; MPQ-T = McGill Pain Questionnaire-Total; VAS = visual analog scale; PSS = Perceived Stress Scale; CES-D = Center for Epidemiological Studies-Depression Scale.
Harden et al.
is compelling [45–47], and this may be a key neurotransmitter that is impacted by exercise [17,18]. Since McCain et al., several studies have corroborated the benefit of aerobic conditioning in FM [4,6,8,15,30,48,49].

In this study, we assessed before- and after-exercise program VO2 max measurements looking for associations with successful conditioning and outcome. Prior studies were conducted in a group or class setting that incorporated the theoretical added benefit of social interaction and peer support; or were home-based but focused on outcomes other than treatment efficacy itself. This study was designed to provide an individualized assessment of aerobic conditioning on the symptoms of FM by assigning a home-based exercise program to subjects and providing only limited interaction with the research team (our proxy of health care utilization). A home-based exercise program offers the additional benefit of flexibility in scheduling. In this pilot, we show that those subjects who completed the course of aerobic conditioning showed improved VO2 max (aerobic state) and a trend toward improvements in pain, depression, and stress scores. Larger, more definitive trials are needed to prove these trends. Importantly, the potential utility of the quantitative, quasi-objective VO2 max test to assess aerobic status and change in this type trial is demonstrated (Table 1).

A comparison of the baseline (BL) values between the COMP and DROP groups revealed significant differences. Subjects in the DROP group suffered from greater BL levels of pain on the VAS, MPQ-total score and MPQ-affective subscore than those who were able to complete the exercise program. They also reported greater perceived disability (PDI) from their pain with a trend toward greater reported depression (CES-D; Table 2). This suggests that despite improvements in the symptoms of FM that group training provides, as demonstrated in previous studies [8,35], patients with severe symptoms and/or perceived disability may need more intensive interdisciplinary/group settings to achieve improvement.

The rather large DROP group was indicative of the difficulty many FM subjects experience in maintaining an exercise program. High subject dropout rates in exercise studies permeate the literature on FM, with earlier studies reaching dropout rates as high as 40% [4,31,32,48,49]. However, the dropout rate of 57% reached in this study is of concern. A possible factor contributing to this high number in our study is the lack of social support and encouragement that is found in group exercise therapy, a key difference in this design suggesting that the attrition in this study may be related to the severity of patients’ FM symptoms and/or to the lack of the “motivating” social effect of group exercise seen in earlier exercise studies [8,35]. The presumed advantage of subject convenience in home-based scheduling of exercise sessions in this study may not have provided as much benefit as hypothesized. The study with a considerably lower dropout rate (10%) employed a more traditional intensive group exercise protocol. It is interesting and important to note that only 33% of the subjects continued their exercise program independently at 19 months post-completion [32]. Another possible cause of the high dropout in this pilot was the intensity or the aerobic conditioning program employed (30 minutes of target HR daily).

Choice of exercise activity was primarily walking or cycling (open kinetic chain). Closed kinetic chain activities may be better tolerated. Different duration and intensity regimens should be analyzed.

These effects may be the result of both natural physiological and neurochemical changes that occur with optimizing cardiovascular fitness levels and the psychological benefit of participation in a structured but self-guided exercise program. Although prior research raises questions about the relative contributions of the psychological and physiological benefits derived from group aerobic conditioning, this pilot suggests that at least empirically home-based programs can help some patients become aerobically conditioned, and that this conditioning is concurrent with a decrease in pain symptoms. These results also suggest patients who experience the greatest degree of pain and perceived disability from FM might need the supportive framework of group exercise programs, cognitive behavioral psychotherapy or even an interdisciplinary program. Future research might focus on identifying medical, psychological, and psychological predictor variables of treatment outcomes that will lead to identification of patient profiles best suited for simple, low-cost, home-based programs vs those that may require more intensive treatment.

The results of this study suggest that certain patients suffering from FM may experience an improvement in symptoms by participating in a home-based aerobic conditioning program; that aerobic state can be assessed in this target sample by VO2 max (primarily in the research arena); and that exercise trials lead to an improved physiological level of aerobic conditioning; all corroborating our hypothesis that pain and affective relief in FM may be associated with an improved aerobic state. Definitive trials should be conducted.

Acknowledgments

The authors would like to thank members of the research team whose efforts made this work possible. Corey Nagel and Cathy Manno provided the technical skills necessary for accurate VO2 max testing. Many thanks to the Northwestern Memorial Faculty Foundation, Department of Rheumatology and the Center for Pain Studies at the Rehabilitation Institute of Chicago for their subject referrals that made completion of the study possible. Also, we are grateful to the Center for Health and Fitness for the use of their equipment, office space, and staff. This work was funded in part by the Nancy and Lawrence E. Glick Pain Fund.

References

Aerobic Conditioning for Fibromyalgia


15 Yousefi P, Coffey J. Clinical inquiries. For fibromyalgia, which treatments are the most effective? J Fam Pract 2005;54:1094–5.


