

Effects of Aerobic Exercise on Pain Perception, Affect, and Level of Disability in Individuals With Fibromyalgia

Background and Purpose. The purpose of this study was to evaluate the effect of aerobic walking on the pain, disability, and psychological symptoms of individuals with fibromyalgia. **Subjects.** Nineteen subjects with fibromyalgia (2 men, 17 women), aged 30 to 69 years ($\bar{X}=49.35$, $SD=11.83$), participated. **Methods.** Ten subjects walked 20 minutes, three times per week, for 8 weeks at 60% to 70% of the predicted maximum heart rate for their age. Nine subjects served as sedentary controls. Each subject completed pretests and posttests of the McGill Pain Questionnaire (MPQ), the Sickness Impact Profile (SIP), and the Brief Symptom Inventory (BSI). Due to initial differences on all measures, final scores were adjusted and analyzed by an analysis of covariance. **Results.** The experimental group had lower scores on the MPQ, on two of the three BSI indexes, and on the Psychosocial Dimension scale of the SIP, but higher ratings on the Physical Dimension scale of the SIP than did the control group on final testing. Only the differences on one index of the BSI and the Physical Dimension scale of the SIP were significant. **Conclusion and Discussion.** The results of the study are inconclusive. There were trends suggestive of a beneficial response to aerobic walking (lower psychological and pain ratings) but limited significant findings and higher physical disability ratings, for these individuals with fibromyalgia. [Nichols DS, Glenn TM. Effects of aerobic exercise on pain perception, affect, and level of disability in individuals with fibromyalgia. *Phys Ther.* 1994;74:327-332.]

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Fibromyalgia is a nonarticular rheumatic disease of unknown origin diagnosed by the presence of widespread pain accompanied by tenderness at 11 or more of the 18 specific tender point sites.¹ These tender points are primarily localized to the

musculotendinous junctions.² Symptoms include generalized fatigue; chronic headache; sleep disturbances; patient-reported joint swelling without objective findings of swelling; irritable bowel; neuropsychiatric symptoms; numbness; and modulation of symp-

toms by activity, weather, and stress.¹ This disorder is most common in women between 20 and 50 years of age, with an estimated incidence of 3 to 6 million.³⁻⁵

Standard medical and physical therapy interventions have been relatively ineffective in the treatment of this disorder.³ Some relief of symptoms has been noted from treatment with amitriptyline and cyclobenzaprine.^{6,7} Two recent studies by McCain and colleagues^{8,9} have suggested that cardiovascular training is beneficial in reducing the symptoms of fibromyalgia, including the reduction of pain

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ratings, improvement in the level of the disease activity, and improvement in the psychological profiles of the participants. Subjects in both of these studies participated in a 20-week exercise program, consisting of either cardiovascular training (using bicycle ergometers) or flexibility exercises. The findings of these two studies suggest that both types of exercise may reduce the symptoms of fibromyalgia (pain thresholds, pain ratings, patient reports of disease activity, and physician assessment of disease activity), but cardiovascular training produced slightly greater results.

The finding that cardiovascular fitness could reduce the symptoms of fibromyalgia is not surprising. Aerobic exercise has been reported to decrease pain perception and improve the affects of both patient and nonpatient populations.⁸⁻¹² Running has been found to result in diminished pain ratings during the run¹⁰ and hypoalgesic responses to ischemic and thermal pain following the run in trained runners.¹¹ Additionally, post-run testing on the Mood Visual Analogue Scales has demonstrated affective changes, characterized by elevated scores for joy, euphoria, cooperation, and conscientiousness.¹¹ In a recent study of patients with rheumatoid arthritis, a 6-week aerobic program decreased morning stiffness and joint tenderness but did not change overall pain reports.¹³ Gun,¹² in a case study, found that a 20-minute run relieved migraine headaches in a patient who found no pain relief with standard aspirin treatment. The initial study of patients with fibromyalgia conducted by McCain⁸ revealed that psychological profile improvement was greater in the cardiovascular fitness group; however, the subsequent study by McCain et al⁹ demonstrated no difference between the final psychological profiles of the cardiovascular fitness and flexibility training groups.

McCain¹⁴ hypothesized that cardiovascular fitness might benefit the pain and affective symptoms of fibromyalgia via activation of central or peripheral beta-endorphin systems or re-

lease of adrenocorticotrophic hormone (ACTH) or cortisol. Elevated serum beta-endorphin has been associated with bicycle ergometer training in patients with rheumatoid arthritis.¹³ The patients, however, demonstrated no change in pain ratings. Nonetheless, elevated beta-endorphin levels have been associated with changes in pain and affective ratings in long-distance runners.¹¹ Release of ACTH and cortisol occurs in response to any stressor, of which exercise in excess of 60% of maximal oxygen consumption is one.¹⁵ This release of beta-endorphin, cortisol, or ACTH, therefore, might be responsible for the changes in affect and pain ratings reported by McCain and colleagues.^{8,9}

Bennett¹⁶ has hypothesized that the chronic fatigue reported by individuals with fibromyalgia results in a relatively sedentary lifestyle and, thereby, a decrease in the fitness level of skeletal muscles. Consequently, the muscles may be more susceptible to microtrauma from any exercise activity, which then produces the pain associated with this syndrome.¹⁶ Similarly, a disturbance of the microcirculation of the involved muscles in individuals with fibromyalgia has been identified.¹⁷ Aerobic exercise may (1) increase the resistance of a trained muscle to microtrauma, (2) improve the individual's sense of being in control of his or her body, and (3) improve circulation within muscles.^{16,17} These changes may be responsible for the improvements in pain ratings and psychological scores reported by McCain and colleagues.^{8,9}

The studies by McCain and coauthors^{8,9} demonstrated that bicycle ergometry for progressively longer bouts and at a level sufficient to raise each subject's heart rate to greater than 150 beats per minute reduced the symptoms of fibromyalgia. This is a relatively high level of aerobic activity and may not be appropriate for all individuals with fibromyalgia. Bicycle ergometry is also only one means of achieving cardiovascular fitness. As is suggested by Klug et al,¹⁸ further research is needed to determine what other types of exercise, as well as the

duration and intensity of that exercise, are necessary to produce similar results. The studies by McCain and colleagues^{8,9} both used a 20-week exercise protocol. This is a fairly long program, making recruitment and retainment of subjects difficult.

The purpose of our study was to evaluate the role of an 8-week aerobic walking program, as an alternative aerobic activity, on the pain ratings, affective components, and level of disability ratings of individuals with fibromyalgia. An increase in heart rate to 60% to 70% of the predicted maximum heart rate for age for a period of 20 minutes was used to define the activity as aerobic. The American College of Sports Medicine has identified this level of activity as sufficient for the development or maintenance of cardiorespiratory fitness in healthy adults.¹⁹ Walking is an inexpensive and convenient form of exercise, easily performed without equipment in almost any setting. Furthermore, walking can be easily maintained at a constant intensity and demonstrates minimal interindividual variability in energy expenditure.¹⁹ We hypothesized that subjects participating in the aerobic walking program would demonstrate a greater decrease in pain and disability ratings and a greater improvement in affective ratings than sedentary subjects.

Method

Subjects

Twenty-four subjects were recruited from the Central Ohio Fibromyalgia Association (Columbus, Ohio), a support group for patients with fibromyalgia. Diagnosis of primary fibromyalgia, according to the American College of Rheumatology criteria,¹ was confirmed by each subject's own rheumatologist or physiatrist. If this could not be done, the subject was reevaluated by a physiatrist as part of this study. Persons with a history of heart disease, lung disease, uncontrolled hypertension, or orthopedic disorders that would preclude aerobic activity were excluded from the study. Individuals who were participating in

have contributed to the findings of our study.

The exercise program in our study was designed to elevate the participants' heart rate to 60% to 70% of the predicted maximum heart rate for their age for 20 minutes, which has been found to produce cardiovascular fitness in nondisabled subjects.¹⁹ All subjects were able to achieve their designated level by the end of the second week of the program, and they were able to maintain a pace at which this rate was achieved for 20 minutes during each of the sessions in the remaining 6 weeks. Because no specific test of cardiovascular fitness was conducted, the reported changes cannot be attributed solely to changes in cardiovascular fitness levels. Furthermore, beta-endorphin, ACTH, and cortisol are reported to be released in response to exercise at aerobic levels (60% of maximal oxygen consumption). Exercising at a level sufficient to increase a subject's heart rates to 60% to 70% of the predicted maximum heart rate for his or her age, however, should yield an increase in oxygen consumption of only 42% to 56% of maximum capacity.²⁴

No research is available to suggest that exercising at this lower level will activate the release of beta-endorphin, ACTH, or cortisol. Therefore, it is unlikely that the release of these substances can explain the pain and affective scores obtained in our study. This level of exercise may be sufficient to increase the individual's fitness level as well as to improve the microcirculation to the involved muscles, and thus decrease the occurrence of microtrauma and pain. Bennett also suggests that this effect of exercise is

associated with a sense of "being in control of one's body,"¹⁶ which could be associated with the improved psychological scores obtained for the experimental group subjects in our study.

The inconclusive findings of our study necessitate further evaluation of this type of program for use as a treatment for individuals with fibromyalgia. Future research should ensure (1) social interaction for sedentary subjects or isolation of exercising subjects; (2) a greater number of subjects to minimize the effects of initial group differences and maximize experimental variance; (3) evaluation of any cardiovascular fitness changes obtained through the exercise program; (4) evaluation of beta-endorphin, ACTH, and cortisol levels; and (5) evaluation of other types of aerobic exercise for use with this patient population.

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