ORIGINAL ARTICLE

The Effects of 12 Weeks of Resistance Exercise Training on Disease Severity and Autonomic Modulation at Rest and After Acute Leg Resistance Exercise in Women with Fibromyalgia

J. Derek Kingsley, PhD, Victor McMillan, MD, Arturo Figueroa, MD, PhD

ABSTRACT. Kingsley JD, McMillan V, Figueroa A. The effects of 12 weeks of resistance exercise training on disease severity and autonomic modulation at rest and after acute leg resistance exercise in women with fibromyalgia. Arch Phys Med Rehabil 2010;91:1551-7.

Objective: To determine the effects of 12 weeks of resistance exercise training (RET) on disease severity and autonomic modulation at rest and after acute leg resistance exercise in women with fibromyalgia (FM) and healthy controls (HCs).

Design: Before-after trial.

Setting: Testing and training occurred in a university setting.

Participants: Women with FM (n=9; mean age ± SD, 42±5y) and HCs (n=15; mean age, 45±5y).

Intervention: Both groups underwent testing before and after 12 weeks of whole-body RET consisting of 3 sets of 8 to 12 repetitions on 5 different exercises.

Main Outcome Measures: Disease severity was assessed using the number of active tender points, myalgic score, and the Fibromyalgia Impact Questionnaire (FIQ). Heart rate and autonomic modulation using power spectral analysis of heart rate variability (HRV) were measured at rest and 20 minutes after 5 sets of leg-press exercise.

Results: There was no group-by-time interaction for any variable. Women with FM and HCs had similar increases in maximal strength ($P<.05$) after RET. Number of active tender points, myalgic score, and FIQ score were decreased ($P<.05$) after RET in women with FM. Heart rate and natural log (Ln) high frequency (LnHF) were recovered, whereas Ln low frequency (LnLF) and LnLF/LnHF ratio were increased ($P<.05$) 20 minutes after acute leg resistance exercise. There were no significant effects of RET on HRV at rest or postexercise.

Conclusions: These findings indicate that cardiovagal modulation of heart rate recovers early after leg resistance exercise in women with FM and HCs. It is concluded that RET reduces the severity of FM, but it has no impact on autonomic modulation of heart rate.

Key Words: Fibromyalgia; Rehabilitation; Vagus nerve.

FIBROMYALGIA IS AN idiopathic disease characterized by widespread diffuse full-body pain,[1] decreased muscular strength and endurance,[2-4] orthostatic intolerance,[5,6] decreased cold tolerance,[7,8] and fatigue.[3,9] Although the cause of FM is unknown, data suggest that autonomic dysfunction may explain some of the symptoms.[10-14] Studies that have evaluated autonomic modulation in women with FM by using HRV have reported decreased parasympathetic (vagal) tone at rest[13] and an inability to increase sympathetic activity during a physiologic stressor, such as standing[6,13] or cold.[7,8]

Reports investigating autonomic recovery from endurance exercise[15-18] are more widespread than those using an acute bout of resistance exercise.[19-21] Heffernan et al[19] and Rezk et al[20] both reported decreases in vagal activity after resistance exercise in young healthy men and women. Conversely, we[21] have reported that acute resistance exercise increased postexercise vagal modulation in women with FM compared with HCs. However, 1 limitation of that study was that women with FM were closer to stage 1 obesity, whereas HCs were slightly overweight. To better evaluate the effect of exercise in women with FM, group differences in BMI should be minimized.

Studies using RET in women with FM have shown increases in maximal strength[2,4,22-29] and decreases in FM severity, such as number of active tender points,[26,29] myalgic score,[26,28] and FM impact.[4,26] Furthermore, although some studies reported no change in HRV after RET in young healthy men and women,[30,31] Figueroa et al[12] showed an increase in overall HRV and parasympathetic tone after 16 weeks of RET in women with FM who had autonomic dysfunction before the intervention.[12] Therefore, the purpose of the present study was to evaluate the effects of an acute bout of resistance exercise on autonomic modulation at rest and postexercise and disease

List of Abbreviations

1RM	1-repetition maximum
10-RM	10-repetition maximum
ANOVA	analysis of variance
BMI	body mass ind
CI	confidence interval
ECG	electrocardiogram
FIQ	Fibromyalgia Impact Questionnaire
FM	fibromyalgia
HCs	healthy controls
HF	high frequency
HRV	heart rate variability
Ln	natural log
LF	low frequency
RET	resistance exercise training

From the Department of Physical Education, Indiana State University, Terre Haute, IN (Kingsley); McIntosh Clinic, Thomasville, GA (McMillan); and Department of Nutrition, Food and Exercise Sciences, Florida State University, Tallahassee, FL (Figueroa).

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Reprints requests to J. Derek Kingsley, PhD, Dept of Physical Education, C-34 Arena Bldg, 401 N 4th St, Indiana State University, Terre Haute, IN 47809, e-mail: *derek.kingsley@indstate.edu*.

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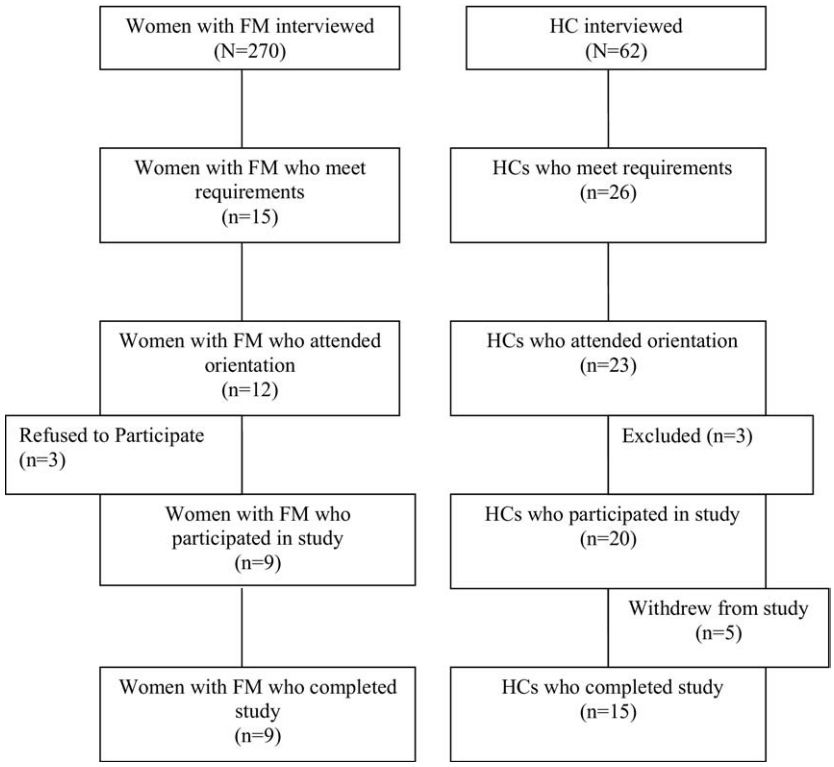

Fig 1. Flow diagram of progress of participants through the study.

severity before and after 12 weeks of RET in women with FM compared with HCs. We hypothesized that RET would both cause greater improvements in autonomic modulation in women with FM compared with HCs and decrease disease severity.

METHODS

Participants

Participants were recruited from the local community through newspaper advertisements. Of the initial 332 women interviewed, only 29 premenopausal women aged 35 to 50 years met the necessary criteria to participate in the study (fig 1). Participants were categorized as either having a clinical diagnosis of FM (n=9) or as an HC (n=20). Inclusion criteria included a diagnosis of FM by a board-certified rheumatologist,[1] premenopausal, and no history of chronic diseases. Women were excluded if they had exercised within the past year, had smoked within the past 6 months, had a history of chronic diseases, had BMI less than 25kg/m^2 or more than 35kg/m^2, were using any form of estrogen/progesterone, or were using any medications that altered cardiovascular function. Medications being used by the women with FM in the beginning and throughout the study were sleep aids (n=3) or painkillers (n=1). None of the HCs were using any medication. All participants gave written consent, as approved by the Institutional Review Board of Florida State University.

Study Design

Participants were tested at baseline (before) and after a 12-week RET period (after) for all variables. There were 6 visits in each period. Testing at each period occurred over 2 weeks. The initial visit consisted of orientation, which included signing the informed consent, and questionnaires. Number of active tender points, myalgic score, and FIQ score were collected on the second and sixth visits to the Rheumatology Clinic. Participants then underwent measurements of muscle strength and anthropometrics on both the third and fourth visits. The fifth visit consisted of measurements of autonomic modulation at rest and postexercise. All measurements at these times were conducted at the same time of day to reduce possible diurnal physiologic variations. All participants refrained from using any medication 24 hours before any of the testing procedures. Participants returned to the laboratory for testing 48 hours after the last exercise session. Participants were asked to maintain their present habits during the course of the study.

Tender Points

The diagnosis of FM was made in all women by a board-certified rheumatologist (V.M.) in a blinded manner according to the guidelines of the American College of Rheumatology[1] on 2 separate occasions before participating in the study and after RET. Diagnosis was defined as pain in 3 of 4 quadrants of the body, pain for 3 months, and pain upon pressure on 11 of 18 specific tender points.[1] In the present study, all of the women were examined for both the number of active tender points and total myalgic score. The total myalgic score was assessed by assigning each active tender point a sensitivity score of 0 (no pain) to 3 (withdrawal of the subject from the examiner) for each of the 18 tender points, which were totaled for a possible total myalgic score of 54 units.[32] The rheumatologist was blinded to the group assignment of participants but not to the intervention. For the 9 women with FM, test-retest correlations (r) for the number of active tender points and myalgic score before RET were .99 and .98, respectively.