



## Muscle and Functional Parameters of Mid-Age Women with Fibromyalgia and Healthy Elderly

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### ABSTRACT

**Goes SM, Bento PCB, Stefanello JMF, El Tassa KOM, Homann D, Leite N, Rodacki ALF.** Muscle and Functional Parameters of Mid-Age Women with Fibromyalgia and Healthy Elderly. **JEPonline** 2013;16(3):20-29. Mid-age subjects with fibromyalgia show reduced ability to perform daily-life activities, which is also seen in the elderly. The impairment force generation may be a factor that influences the functional performance. Fifty women (16 mid-age with fibromyalgia syndrome – FS, 16 healthy mid-age – CG, and 18 healthy elderly – HE) were assessed. The 8 ft up and go, sit and reach, and the 30 sec chair stand tests were used to assess functional performance. The peak torque was determined by maximal voluntary isometric contraction- MIVC (hip, knee, and ankle joints) using a load cell. FS and HE groups showed lower performance ( $P < 0.05$ ) than the HC group in the 30 sec chair stand test. The HE group presented lower maximal torque in each MIVC test when compared to HC group ( $P < 0.05$ ). There were no differences between the FS and HE groups in ankle plantar flexors, hip flexors, and extensor muscles ( $P > 0.05$ ), although FS group did not show differences in comparison to the HC group ( $P > 0.05$ ). Both FS and HE groups showed lower knee extensor torque when compared to HC group ( $P < 0.05$ ). Women with fibromyalgia showed similar physical ability performance to the elderly women, especially in static and dynamic lower limb muscle strength. When added to the aging process, FS impairs functional performance.

**Key Words:** Chronic Pain, Ageing, Muscle Strength, Functionality

## INTRODUCTION

Fibromyalgia (FM) – also called 'fibromyalgia syndrome' (FS) – is a multifactorial chronic painful condition of unknown etiology. Its diagnostic label is based on several symptoms that include pain, fatigue, sleep disturb, and cognitive problems (33). In addition, patients with FS show reduced ability to perform daily-life activities when compared to their healthy counterparts (1,9,16).

A number of FM symptoms and a reduced level of physical activities may lead to a pronounced decline in the ability to perform functional tasks (3,21,22). Patients with FS show difficulties to perform everyday ordinary tasks. They also present similar physical ability to the elderly (24). In fact, the FM patients' changes in physical ability are prone to additional difficulties, given the frequent coexisting condition of ageing that aggravates and perpetuates symptoms.

The physical abilities and the capacity to generate torque (i.e., muscle strength) are essential to performing a number of daily tasks that influence functionality. Women with FS experience a reduction in their fitness level compared (9,16,22). It has also been shown that patients with FM are characterized by a remarkable change in their ability to produce force when compared to a paired group of healthy subjects (9,15), specifically when maximal strength of the lower limbs is measured. This premature deficit in physical capacity may lead to an early loss in the ability to generate muscle force that may compromise an independent lifestyle. However, the number of studies designed to determine and compare physical ability between patients with FM and a group of elderly subjects is small. It is therefore of interest to determine the function of muscles around the ankle, knee, and hip joints, especially since these joints are at the risk of falls. Since FM patients are prone to falls (9) it would be useful to understand how FM influences performance of these muscles.

Panton and colleagues (24) compared the performance of daily task activities and knee muscle strength in women with the diagnostic label 'fibromyalgia' to a control age-matched and an elderly group. Women without FM have significantly higher functionality scores compared with women with FM and older women. In fact, often there are no differences in functionality between women with FM and older women. Assessment of a single muscle group is relatively limited as other muscles groups play an essential role in the daily activities (4,18,19). The understanding of how FM influences these muscles is relevant to the development of physical activity programs to help reduce the risk of falls (2,4,25).

The decrease in physical ability and capacity to produce force can lead to negative implications on functionality, which can then lead to disability and a reduction in the quality of life of younger women (<65 yrs old). Obtaining information regarding the decrease in muscle strength and physical performance in the FS population is important to understanding how FM clinically impacts ageing and health. Thus, the purpose of this study was to compare physical abilities and the capacity to generate force in lower limbs between mid-aged women with and without FS and a group of healthy female elderly subjects.

## METHODS

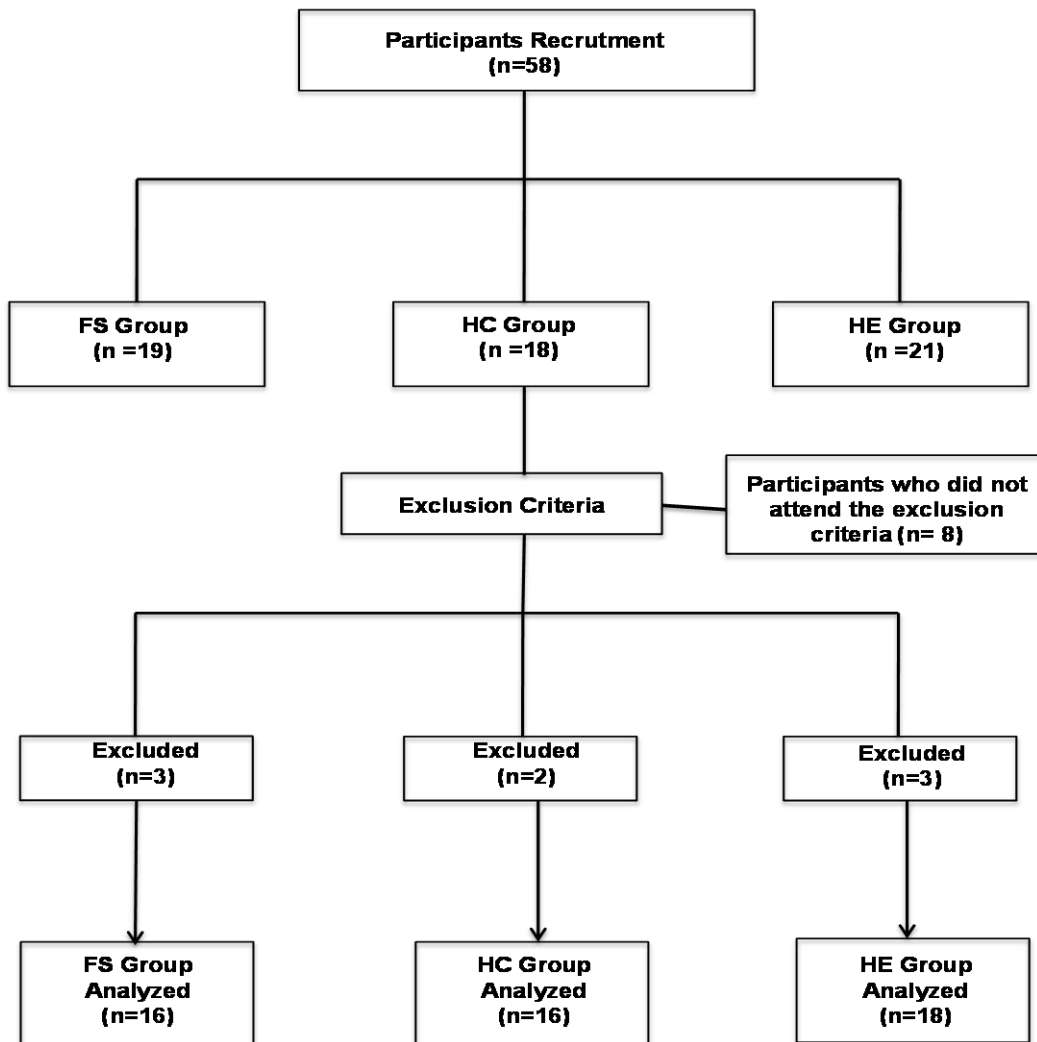
### Subjects

Fifty women aged between 30 and 79 yrs old agreed to participate. They were assigned to one of three groups. The first group was formed by patients recruited from the Rheumatology Ambulatory of the University's Hospital with FS (FS; n = 16; 41.5 ± 5.9 yrs old; 159.8 ± 5.3 m; 71.9 ± 9.9 kg, and 28.2 ± 3.9 kg·m<sup>-2</sup>). The patients were diagnosed by physicians who applied the American College of Rheumatology criteria (33). The second group included healthy control women (HC; n = 16; 40.4 ±

6.4 yrs old;  $159.4 \pm 5.8$  m;  $68.7 \pm 13.8$  kg, and  $26.7 \pm 5.6$  kg·m<sup>-2</sup>) who were recruited from University staff. The third group consisted of healthy elderly women (HE; n = 18;  $65.7 \pm 4.9$  yrs old;  $153.8 \pm 4.4$  m;  $70.5 \pm 10.4$  kg, and  $29.7 \pm 3.4$  kg·m<sup>-2</sup>). The HE subjects were recruited from the local community and from different groups with an interest in physical activity (via flyers and personal contacts). Subjects with untreated and/or uncontrolled cardiac, respiratory, and/or orthopaedic conditions that impeded the performance of the functional tests or daily tasks were not included in the study.

### Procedures

All subjects signed an informed consent form that was approved by the University Ethics Committee (CEP/HC: 1469.137/2007-06). The experimental design of the study is shown in Figure 1.



**Figure 1. Study design. FS: Fibromyalgia Syndrome Group; HC: Health Control Group; HE: Health Elderly Group.**

### **Physical Ability Tests**

Three physical ability tests were applied: (a) the 8 ft up and go test to determine balance and agility (27); (b) the sit and reach test to evaluate flexibility (32); and (c) the 30-sec chair stand test was used to assess lower muscle strength (27). Each test was performed twice with a minimal interval between trials of 10 min and the best performance was chosen for analysis purposes.

### **Lower Limb Muscle Strength Assessment**

The maximal voluntary isometric contraction (MVIC) for hip, knee, and ankle flexion and extension, and hip abduction and adduction were assessed by a load cell (Kratos, Modelo CZC500) that was firmly attached to an adjustable pole that permitted alignment perpendicular to the tested (dominant limb) segment. An adjustable cuff was used to attach the cable to the participant.

The MIVC for lower limb flexion and extension tests were performed in a recumbent posture with joints positioned at approximately 90°. The hip abduction and adduction tests were performed with the subjects in a standing posture. To ensure that additional movements did not improve the subjects' performance, the proximal segments were firmly secured and stabilized by velcro straps. The perpendicular distance between the load cell and the joint center was determined and used to calculate net joint torques (N·m) (4).

The subjects were instructed to produce torque as fast and hard as possible. Each subject sustained the contraction for approximately 2 to 3 sec. To minimize fatigue effects, short periods of contraction were applied with 1 min rest between trials. All subjects were allowed 3 to 5 trials to familiarize themselves with the test demands.

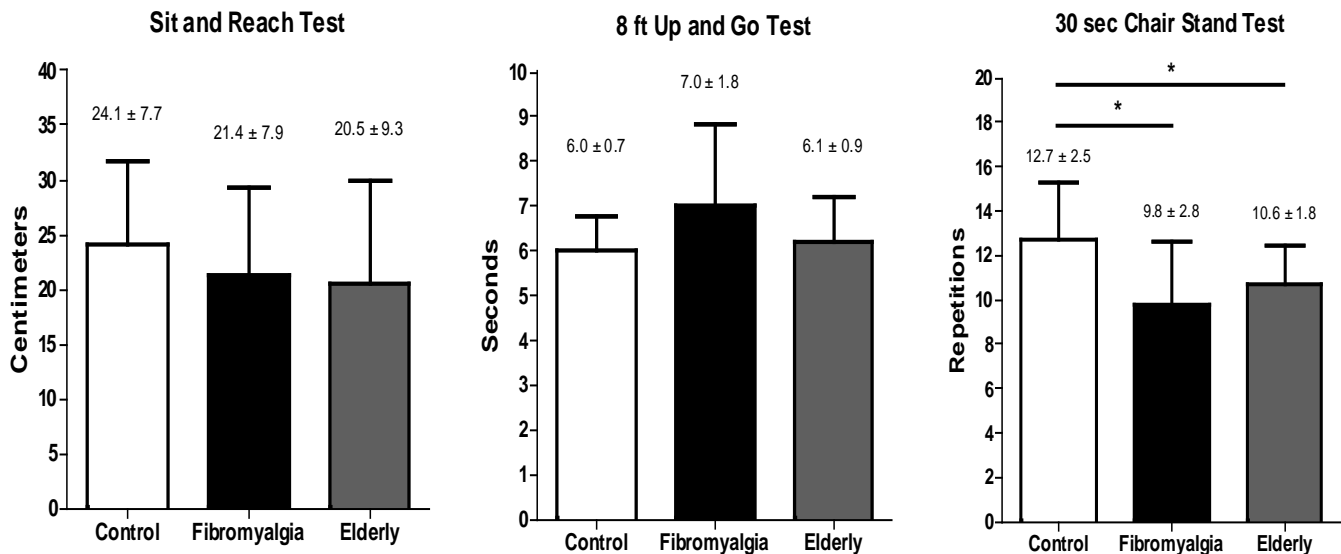
The force-time signals were sampled with a frequency of 1 KHz, amplified (Kratos, model IK-1C, São Paulo, SP, Brazil) and converted to digital signals with the aid of a 16 bit A/D card (National Instruments, model NI USB 6218, Austin, TX, USA) and, then, stored on a personal computer. Raw torque data were low pass filtered with a Butterworth second order recursive filter set at 20 Hz. Peak torque was determined as the highest torque value obtained after the onset of the voluntary contraction.

### **Statistical Analyses**

Descriptive statistics were performed to characterize the subjects' responses. The Shapiro-Wilk test was used to ensure data normality. In order to compare groups ANOVA one-way and Bonferroni post hoc test were performed for parametric data, and Kruskal-Wallis and Dunns post hoc tests were used for nonparametric data. Statistical procedures were conducted using a standard statistical package (STATISTICA®, Version 7.0, STATSOFT Inc., USA). Statistical significance was set at  $P < 0.05$ .

## **RESULTS**

There were no differences between groups in physical features and age ( $P > 0.05$ ), except the HE group, which was older compared to the other groups ( $P < 0.05$ ). There were no differences between groups in the physical abilities tests, except in the 30-sec chair stand test, in which FS and HE groups showed lower performance ( $P < 0.05$ ) than the HC group (see Figure 2).



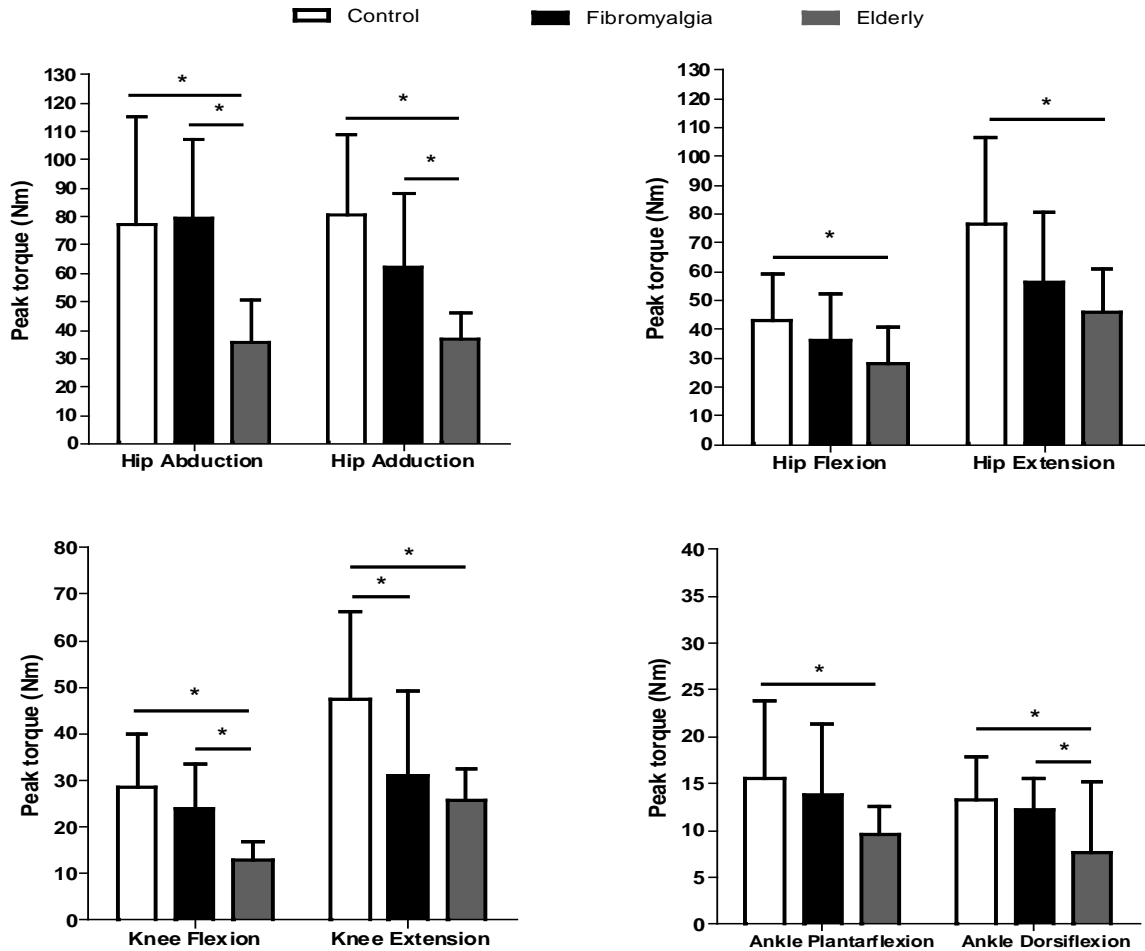
**Figure 2. Physical Abilities Tests Performance in Each Group.** ANOVA and Kruskal-Wallis Test. \* $P < 0.05$ .

The HE group presented lower maximal torque in each MIVC tests when compared to HC group ( $P < 0.05$ ). There were no differences between FS and HE groups in ankle plantiflexors, hip flexors and extensor muscles ( $P > 0.05$ ), although FS group did not show differences in comparison to the HC group in all tests ( $P > 0.05$ ). Furthermore, FS and HC group did not differ in hip abduction and adduction, knee flexion and ankle dorsiflexion ( $P > 0.05$ ). However, both FS and HE groups showed lower knee extensor torque when compared to HC group ( $P < 0.05$ ). The MIVC tests results are shown in Figure 3.

## DISCUSSION

Findings of this study showed that middle-age women with FM present a similar static and dynamic lower limb strength performance that is comparable to healthy elderly women. Both the FM subjects and the elderly women showed a reduced performance in a number of functional parameters, which included the ability to generate torque when compared to the healthy middle-age control group.

The ability to generate torque has been investigated in elderly subjects (17) and in women with FM (9,14,31). The elderly showed the lowest peak torque in all muscle groups when compared to the FM and healthy middle age groups, which is a common finding described in senescent subjects (18,19,29). On the other hand, the group of fibromyalgia was able to produce similar joint torques in comparison to the control group, except around the knee extensor muscles. The causes for the reduced torques around the knee extensor muscles are not clear and a number of mechanisms have been proposed (10,11,13,14,31), but the discussion of such mechanisms is beyond the scope of the present study.



**Figure 3. Peak Torque Values for Hip, Knee, and Ankle Flexion and Extension and Hip Abduction and Adduction.** ANOVA and Kruskal-Wallis Test. \*P<0.05.

Women with fibromyalgia have lower knee extensors peak torque in comparison to healthy women (9, 14,24,31), which is in agreement with the findings of the present study. However, it is intriguing to observe the fact that only the knee extensor muscles of the FS group showed a large discrepancy (~40% less) when compared to the CG. It may be argued that the pain in large and bulky muscles is more limiting than when smaller muscles groups are affected (i.e., as a protective mechanism) (20). Indeed, large muscles are more required in almost all daily tasks. Also, the preserved torque around the knee flexor muscles may have decreased the net extensor torque, especially in the FS patients who are described as predisposed to greater agonist-antagonist activation (13,31). The absence of differences in peak torque between the FS group and the elderly group may be also explained due to the fact that the amount of muscle strength reduction varies according to the muscle group assessed (30).

Valkeinen et al. (31) reported larger coactivation in FM patients than in healthy counterparts. Their finding may be rather important since the performance of daily tasks is highly dependent on the ability of the quadriceps to produce large amounts of torque (12), which is comparable to the group of elderly subjects and is in agreement with the findings of Panton et al. (24). This point may have serious implications for women with FM, who may be at risk for premature age-associated disability.

In the present study, women with FM were about 25 yrs younger than the elderly group, but the similar knee extensors peak torque may indicate that these patients are likely to experience premature functional limitations that may become more severe as they age. Therefore, it is anticipated elderly FM patients will present with greater deterioration, especially since they use around 80% of their maximum capacity to produce torque production to perform everyday tasks. These values are much higher than the 50% of maximum capacity to produce torque in younger subjects (17).

The dynamic strength of the lower limb in the FM group and the elderly group was lower than the healthy middle-age group. Although the sit-to-stand test does not only provide a functional measure of the lower limbs daily living tasks, it is related to a higher risk of falls in healthy elderly (28) and in women with FM (9). The reduced strength and ability to resist to fatigue in the elderly have been consistently reported in the literature (5,7,8,26), and has been attributed to changes in the central nervous and muscular systems. Muscle mass loss, muscle architectural changes, modification in the recruitment and synchronism of motor units, and increased co-activation of antagonist muscles are reported in both the FM patients and elderly subjects (6,23). In particular, the increased antagonist muscles co-activation by itself is sufficient to compromise the ability to produce force (31).

The sit and reach test (flexibility) and the 8 ft up and go test (balance and agility) measures showed no significant differences across the groups. The performance of the group with FM ( $7 \pm 1.8$  sec) in the 8 ft up and go test was comparable to that found in the group of elderly women (50th percentile) (28). These findings indicate that the physical ability of the middle-age women is comparable to the physical ability of the FM and elderly subjects.

## CONCLUSIONS

Women with FM showed static and dynamic muscle strength similar to their elderly counterparts who were 25 yrs older. Women with FM showed similar physical ability performance to the elderly subjects, especially in lower limb muscle strength. Elderly and fibromyalgia groups presented lower performance when compared to the subjects in the control (healthy) group. The reduced lower limb muscle strength emphasizes the negative impact that FM symptoms play in these patients. Strategies to preserve the integrity of the muscles to generate strength, power, and functionality are required to minimize the ageing effects in the FM subjects.

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