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Recommended Citation

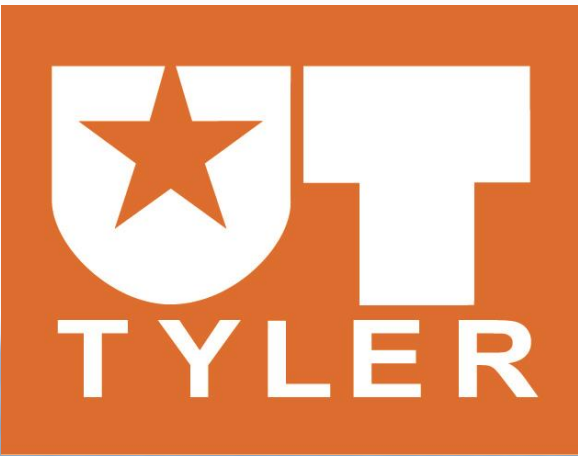
Ballard, Joyce E.; Arce-Esquivel, Arturo A.; Haas, Barbara K.; Hermanns, Melinda; Rizer, Carol; Kimmel, Gary T.; and Wang, Yong T., "Tai Chi Exercise on Muscle Strength and Physical Function in Peripheral Neuropathy Patients" (2016). *Faculty Posters*. Book 17.

<http://hdl.handle.net/10950/414>

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Tai Chi Exercise on Muscle Strength and Physical Function in Peripheral Neuropathy Patients

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ABSTRACT

An estimated 20 million people in the U.S. suffer from peripheral neuropathy (PN). Patients with PN develop gait abnormalities. Foot pain is one of the factors affecting walking ability. As a result, a large number of individuals with PN suffer from a reduction in daily physical activity and reduced quality of life. Tai Chi appears to be safe and effective in promoting strength and functional capacity in older patients with other chronic disabilities. **Purpose:** This study aimed to assess the effects of Tai Chi on muscle strength and physical function in patients with PN. **Methods:** Thirty seven participants (men=21, women=16) were randomly assigned to either Tai Chi exercise (Ex, n=20, age: 71 ± 9.50 years) or control group (Con, n=17, age: 75 ± 9.02 years). Exercise training consisted of 12-week progressive Tai Chi (i.e., Yang Style), offered 3 times per week, 60 minutes each time. Before and after training, muscle strength [One repetition maximum (1RM) for leg extension and leg curl] and physical function [time of 8-foot up-and-go; TUG] were evaluated. **Results:** Muscle strength increased significantly in the Ex group [leg extension: pre = 26.76 ± 16.05; post = 46.12 ± 25.55 kg; leg curl: pre = 28.69 ± 13.51; post = 44.22 ± 13.97 kg; ($p < 0.05$)]. In addition, the TUG decreased significantly in the Ex group [pre = 12.34 ± 5.73; post = 7.43 ± 2.87 sec, ($p < 0.05$)]. No significant changes were observed in the Con group. **Conclusions:** Clearly, these findings demonstrated that Tai Chi was capable of increasing lower extremity muscle strength and physical function among PN patients. Interestingly, the exercise training program was able to reduce the risk for loss of functional mobility (i.e., decreased 8-foot up-and-go time) among the participants.

INTRODUCTION

An estimated 20 million people in the U.S. suffer from peripheral neuropathy (PN), a pathology associated with damage to peripheral nerves that results in loss of function, amputation, and decreased quality of life (QOL). Patients with PN develop gait abnormalities, balance and mobility problems. Foot pain is one of the factors affecting walking ability. As a result, a large number of individuals with PN suffer from a reduction in daily physical activity and reduced QOL. Indeed, patients with PN exhibited lower scores on the functional reach test (Duncan *et al.* 1990), the 6-min walk test (6MW), and the Timed Up-and-Go (TUG) (Manor and Li, 2009) compared with age-matched controls. Furthermore, people with PN, typically, do not perform a lot of physical activity due to their limitations.

Considering the gait and balance challenges associated with PN, low velocity, low impact exercises might be the most effective for this clinical population. Tai Chi, is an ancient Chinese healing/martial art that consists of a series of graceful movements with deep and slow diaphragmatic breathing. Tai Chi training appears to be safe and effective in promoting balance, strength, and functional capacity in older patients with chronic disabilities (Song *et al.* 2003, Wang *et al.* 2004). Thus, the purpose of this study was to assess the effects of Tai Chi on muscle strength and physical function in patients with PN.

METHODS

Participants

Thirty seven participants (men=21, women=16) with a physician's diagnosis of PN were recruited from the Tyler metropolitan area. They were randomly assigned to either Tai Chi exercise (Ex, n=20) or control group (Con, n=17). All participants signed informed consents prior to testing.

Exercise Program

Exercise consisted of 12-week progressive Tai Chi (i.e., Yang Style), offered 3 times per week, 60 minutes each time. A typical Tai Chi practice session was 60 minutes long, included diaphragmatic breathing and gentle stretching exercises for warm-up (10 min), learning and practicing Tai Chi Yang Style 10 forms (45 min), and cool down (5 min). All classes were taught by a Tai Chi Master.

Assessments

One Repetition Maximum (1RM): One RM was conducted on weight machines (i.e., Life Fitness) designed for lower body (i.e., leg extension, and leg curl) muscle groups. Participants were asked to lift one time the heaviest weight they were able to lift within their comfort level.

Time of 8 Foot up and Go (TUG): This test was used to assess agility, coordination and dynamic balance. The test requires standing up from a chair, walking eight feet, turning and walking back to the chair as quickly as possible.

Six minute walk test (6MW): Participants were instructed to walk at their own pace trying to cover as much distance as possible in 6 minutes on an indoor track. To standardize the protocol, the participants were not coached during the test, but made aware of time remaining to completion. The distance covered was recorded to the nearest meter.

RESULTS

Participant Characteristics

Variable	Con (n=17)	Ex (n=20)
Age (yr)	75 ± 9.02	71 ± 9.50
Height (cm)	170 ± 12.04	173 ± 8.63
Weight (kg)	83 ± 20.15	87 ± 12.92
BMI (kg·m ⁻²)	28 ± 5.69	29 ± 3.82

Table 1. Values are means ± SD.

Changes in lower muscle strength (pre and post)

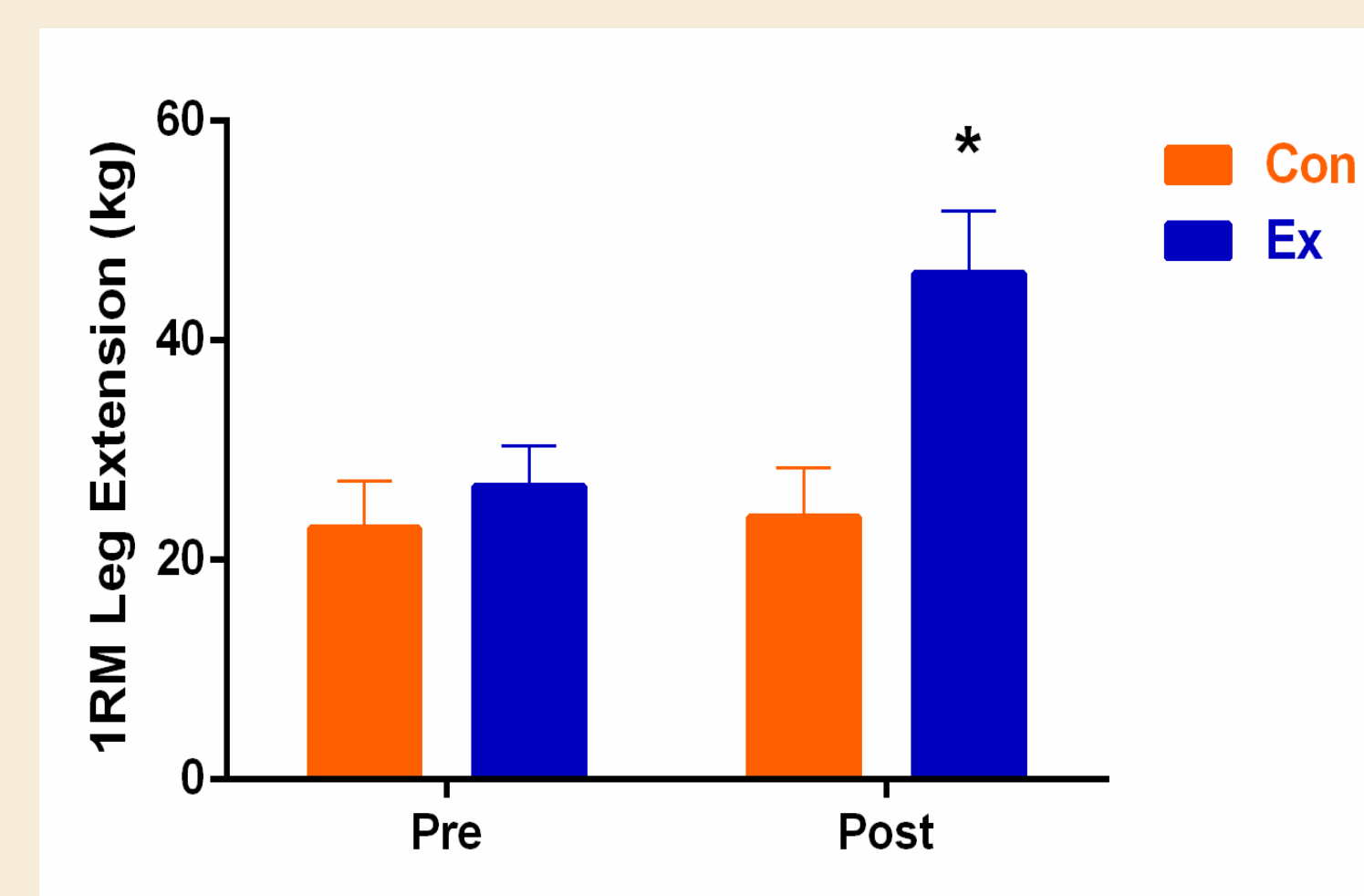


Figure 1. One repetition maximum (1RM) leg extension. Values are means ± S.E. * $p < 0.05$ vs. Pre

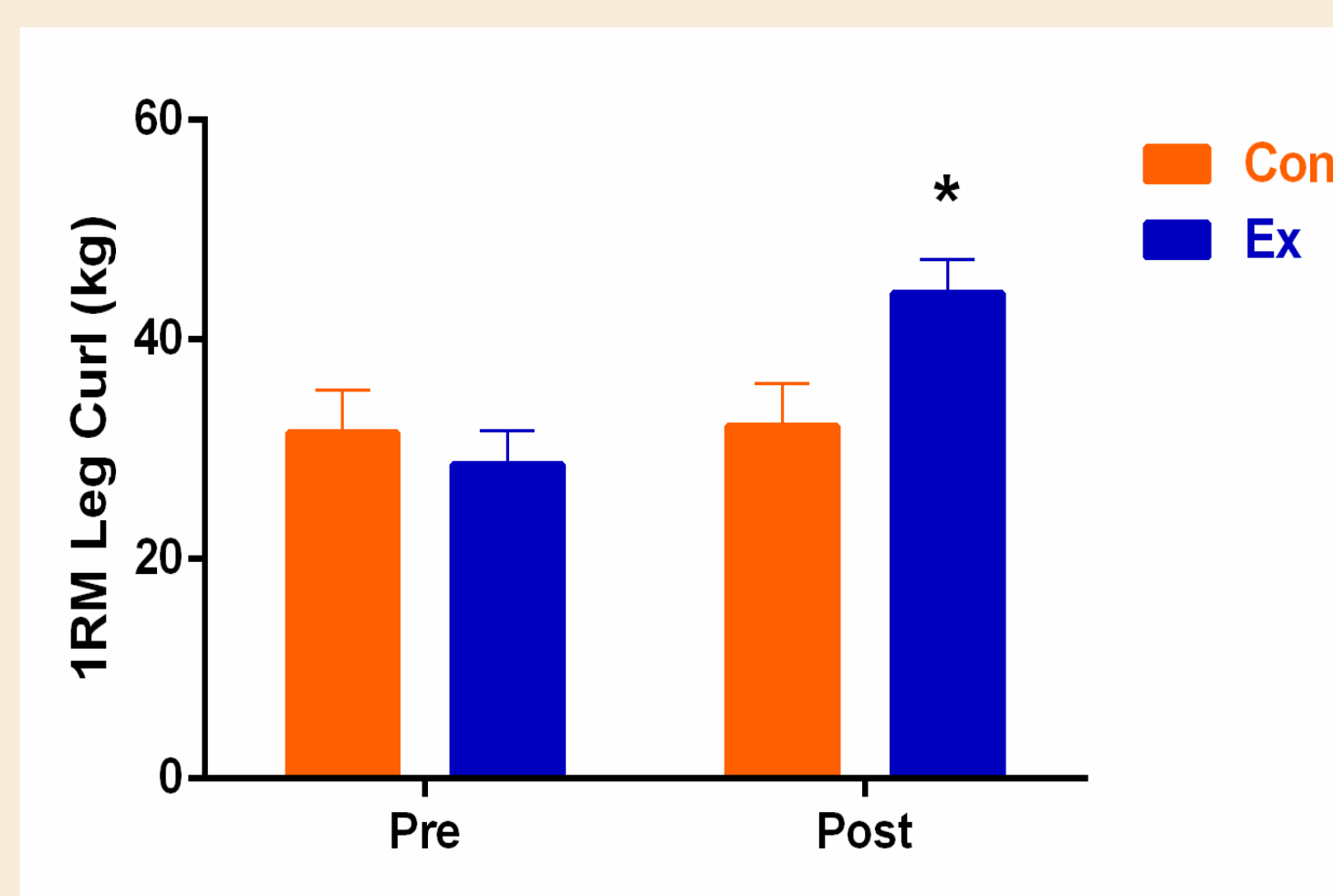


Figure 2. One repetition maximum (1RM) leg curl. Values are mean ± S.E. * $p < 0.05$ vs. Pre

Time of 8 Foot up and Go (pre and post)

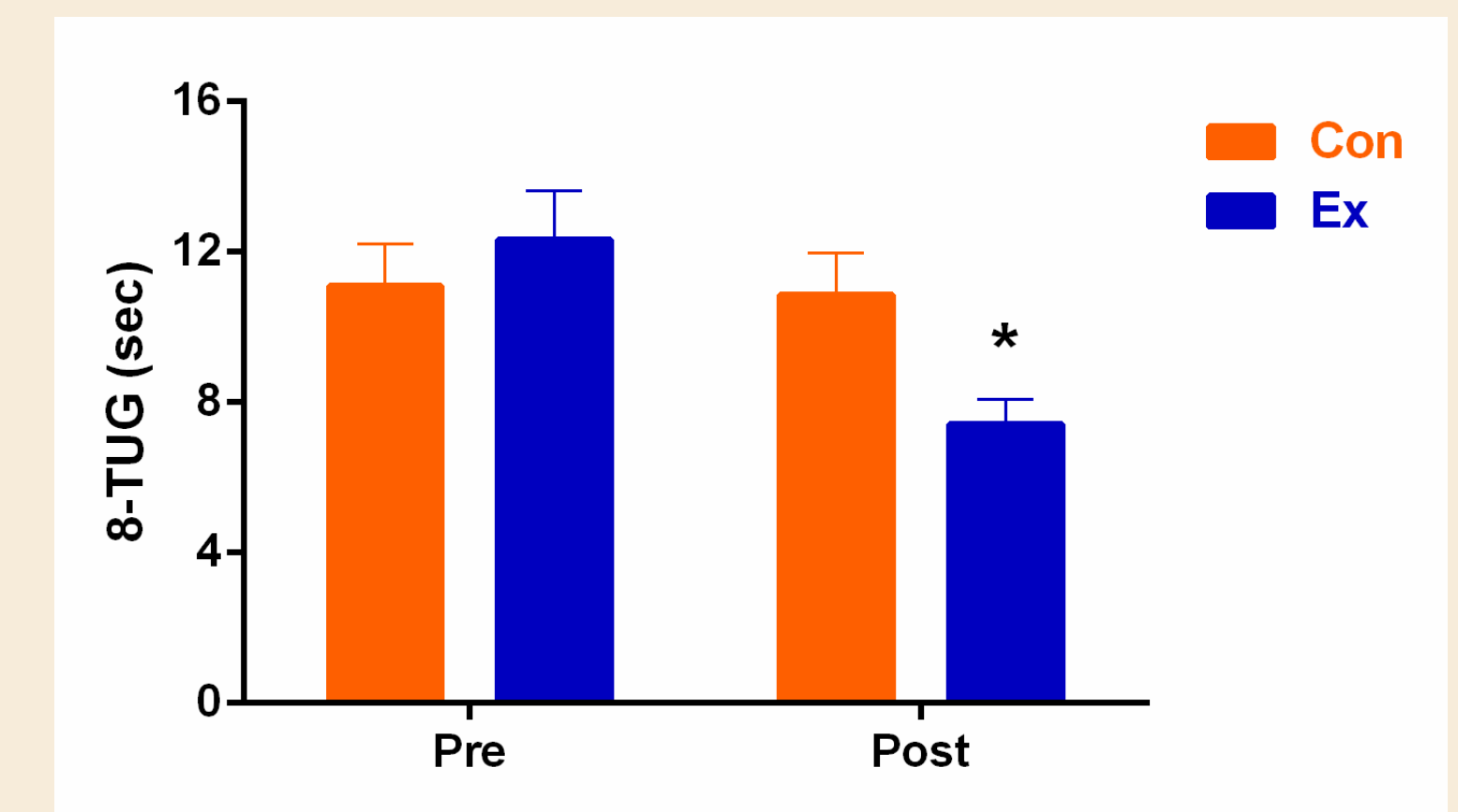


Figure 3. Time of 8 Foot up and Go (TUG). Values are means ± S.E. * $p < 0.05$ vs. Pre

Six minute walk test (pre and post)

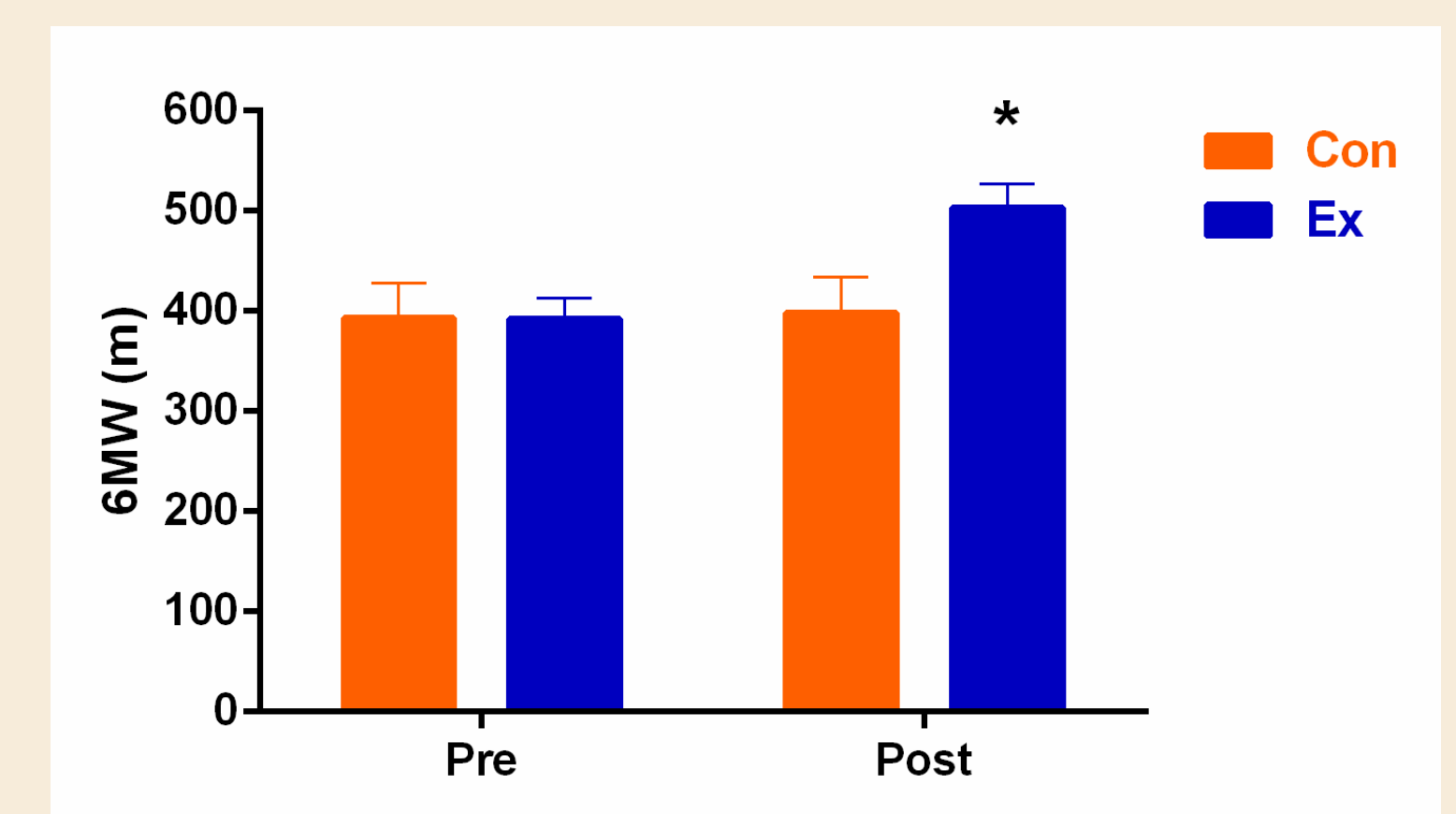


Figure 4. Six-Minute Walk Test (6MW). Values are means ± S.E. * $p < 0.05$ vs. Pre

Functional Assessments (pre and post)

Variable	Con (n=17) pre	Con (n=17) post	Ex (n=20) pre	Ex (n=20) post
Leg Extension (kg)	22.94 ± 17.46	23.91 ± 18.65	26.76 ± 16.05	46.12 ± 25.55*
Leg Curl (kg)	31.55 ± 15.72	32.15 ± 15.68	28.69 ± 13.51	44.22 ± 13.97*
TUG (sec)	11.10 ± 4.61	10.87 ± 4.51	12.34 ± 5.73	7.43 ± 2.87*
6MW (m)	393.3 ± 141.7	398.0 ± 148.7	392.2 ± 93.39	503.3 ± 105.3*

Table 2. Values are means ± SD. * $p < 0.05$ vs. Pre

CONCLUSIONS

These findings demonstrated that Tai Chi was capable of increasing lower extremity muscle strength and physical function among PN patients. Interestingly, Tai Chi training was able to increase the distance covered during the 6MW test, and to reduce the risk for loss of functional mobility (i.e., decreased 8-foot up-and-go time) among the participants.

ACKNOWLEDGEMENTS

We would like to thank Linda Friedemann, Sowmya Yarlagadda (graduate student research assistant), Crystal Bryce, Laura Hoyt, and Kleanthe Caruso for their technical assistance. This research was supported by The University of Texas at Tyler - College of Nursing & Health Sciences Intramural Grant Program (2015).