

The effectiveness of Tai Chi Chuan on fear of movement, prevention of falls, physical activity, and cognitive status in older adults with mild cognitive impairment: A randomized controlled trial

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Abstract

Purpose: This study aimed to investigate the effectiveness of Tai Chi Chuan (TCC) on fear of movement, prevention of falls, physical activity, and cognitive status in older adults with mild cognitive impairment.

Design and Methods: This controlled trial was conducted with 20 participants in the intervention group, and they did exercises for 35-40 min/session, twice a week for 12 weeks.

Finding: The posttest scores of the scales indicated that the scores of cognitive adaptations, being observant, and changes in level subscales of the fall behavioral scale in the older adults who did Tai Chi exercise in the intervention group significantly increased ($p < .01$).

Practice Implications: The nursing home provider can safely manage TCC exercise interventions for older adults with MCI.

KEYWORDS

mild cognitive impairment, older adults, risk of falling, Tai chi chuan

1 | INTRODUCTION

Mild cognitive impairment (MCI) is being a common disorder experienced by elderly individuals and also a significant public health problem.¹ MCI is regarded as a transient stage between healthy ageing and dementia and is characterized by memory problems and the decline of cognitive functions.² The impaired cognitive functions cause a significant decrease in the quality of life, activities of daily living, and independence of individuals with MCI.³ Also, elderly individuals with MCI have a higher risk of dementia and falls, as well as low balance.^{4,5}

There has been no effective treatment yet to alleviate the clinical outcomes of MCI.¹ Therefore, there is a considerable need to develop preventive interventions and therapeutic approaches to prevent the progression of dementia.¹ Recent studies on nonpharmacological interventions have suggested that lifestyle factors, such as physical activity may contribute to modifying disease progression.^{6,7} Also,

decreased levels of physical activity may be a risk factor for dementia in older adults. The previous study has highlighted the importance of physical activity programs that are effective in fear of movement, prevention of falls, and improving cognitive functions.⁸ However, no consensus has yet been reached regarding exercises to be given to patients with MCI.⁹ It has been stated that the most appropriate exercise training program that can be given to MCI individuals should include parameters, such as balance, flexibility, lower and upper extremity muscle strengthening exercises, and goal-oriented activities.¹⁰

Tai Chi Chuan (TCC), one of the aerobic exercises maintaining muscle strength and balance, is the most recommended traditional Chinese exercise for older adults.¹¹ TCC diminishes the risk of falls, ameliorates balance, and enhances endurance and flexibility of muscle.^{12,13} The current evidence has revealed that Tai Chi can be considered as an ideal exercise for older adults to improve cognitive functions and quality of life.¹⁴

As long as the value of improving cognitive health and preventing falls in the elderly has increased worldwide, MCI has attracted significant attention from researchers. However, there has been no study examining the effectiveness of exercise programs, such as TCC on fear of movement, prevention of falls and cognition in people with MCI in the Turkish population. Furthermore, A research study has highlighted that there are physical inactivity and low levels of regular exercise in older adults in the Turkish population¹³ Therefore, it is incredibly crucial to understand better the role of Tai Chi exercise in cognitive and physical health in the Turkish population. This study aimed to investigate the effectiveness of TCC on fear of movement, prevention of falls, physical activity, and cognitive status in older adults with MCI.

Hypotheses of the study

- (1) Is TCC exercise effects on the prevention of falls in older adults with MCI in the Turkish population?
- (2) Is TCC exercise effective on physical activity and fear of movement in older adults with MCI?
- (3) Is TCC exercise effective on cognitive adaptations in older adults with MCI?

2 | METHODS

2.1 | Study design

The present study was a randomized control trial conducted with pretest, posttest, and control-group design.

2.2 | Sample and setting

This study was conducted in a nursing home located in Turkey. Seventy-nine older adults live in this nursing home. The mini-mental state examination (MMSE),¹⁵ Montreal cognitive assessment (MoCA)¹⁶ tests, and clinical dementia rating scale (Stage 0.5–1)¹⁷ were used to determine whether or not the older adults had MCI. The inclusion criteria of the study were determined as follows; (1) having a score of MMSE and MoCA of <25 points, (2) being Turkish and aged 65 years and over, (3) being able to communicate, read, and write independently in their local language, (4) being able to perform Tai Chi physical activity, (5) having no diagnosis of dementia and other psychiatric disorders. The exclusion criteria of the study were determined as follows; (1) having a body-mass index of ≥ 30 , (2) having infectious diseases or immunological disorders, (3) being users of medications that would affect cognitive functions, (4) not signing the informed consent form.

The sample size of the present study was determined to be 34 (17 per group), with a power of 90% and Type I error of 5% using the power analysis (the program G*Power 3.1 was used). Considering the withdrawal possibility of 15% of participants, we enrolled 47 (control group = 24; intervention group = 23) older adults who met the

inclusion and exclusion criteria in this study. All participants were randomly assigned to the intervention (TCC) and control (untrained) groups. Three participants from the intervention group were excluded from the study since they could not continue the 12-week exercise program regularly. Also, two participants from the control group were excluded from the study since one of them refused to participate in the posttest, and the other was on leave for a long time. The data obtained from 42 participants who completed the study were analyzed. The individuals were stratified based on the age (between 65 and 74 years or being aged ≥ 75 years), gender (female or male) and the history of falling (yes or no) by using the blocked randomization method¹⁸ and assigned to the intervention (TCC exercise) group ($n = 23$) and the control (untrained) group ($n = 24$) by drawing the lot. There was no significant difference between these groups ($p > .05$). The flow diagram of the Tai Chi Chuan exercise trial was shown in Figure 1.

2.3 | Intervention

The data were collected between October 2018 and December 2019. The personal information form, the Tinetti assessment tool (TAT), the Tampa scale of kinesiphobia (TSK), the physical activity scale for the elderly (PASE), and the falls behavioral (FaB) scale were applied as pretest by conducting the face-to-face interview with all the participants. After these forms were completed, patients in the intervention group started to do TCC exercises with the help of the researcher. As previously stated,¹³ they performed the TCC exercise program every Wednesday and Thursday per week, like two sessions and 35 and 40-min- sessions (Figure 2).

The PASE, TAT, FaB, and TSK had applied again as post-tests to the intervention group ($n = 20$) at the end of 12 weeks. The individuals in the control group ($n = 22$) were not subjected to any physical practice, and only the data collection forms (pretest and posttests) were applied and evaluated together with the intervention group.

2.4 | Outcome measures

The outcomes were evaluated before the TCC training and at the end of 12 weeks. The researcher was blind to all outcome evaluations to reduce bias. The data were collected using a personal information form, TAT, PASE, TSK, and FaB. Personal Information Form was prepared by the researcher upon the literature review.^{12,13} This form includes the life habits and health conditions of the participants.

TAT, which was developed by Mary Tinetti to evaluate the risk of falling in people with MCI, was used in the present study.¹⁹ The scale consists of a total of 28 items, including 12 items for gait and 16 items for balance. TAT was adapted to the Turkish population by Agırcan,²⁰ and it was found that the value of Cronbach's alpha coefficient was 0.97.²⁰ In the present study, Cronbach's alpha coefficient was found to be 0.96.

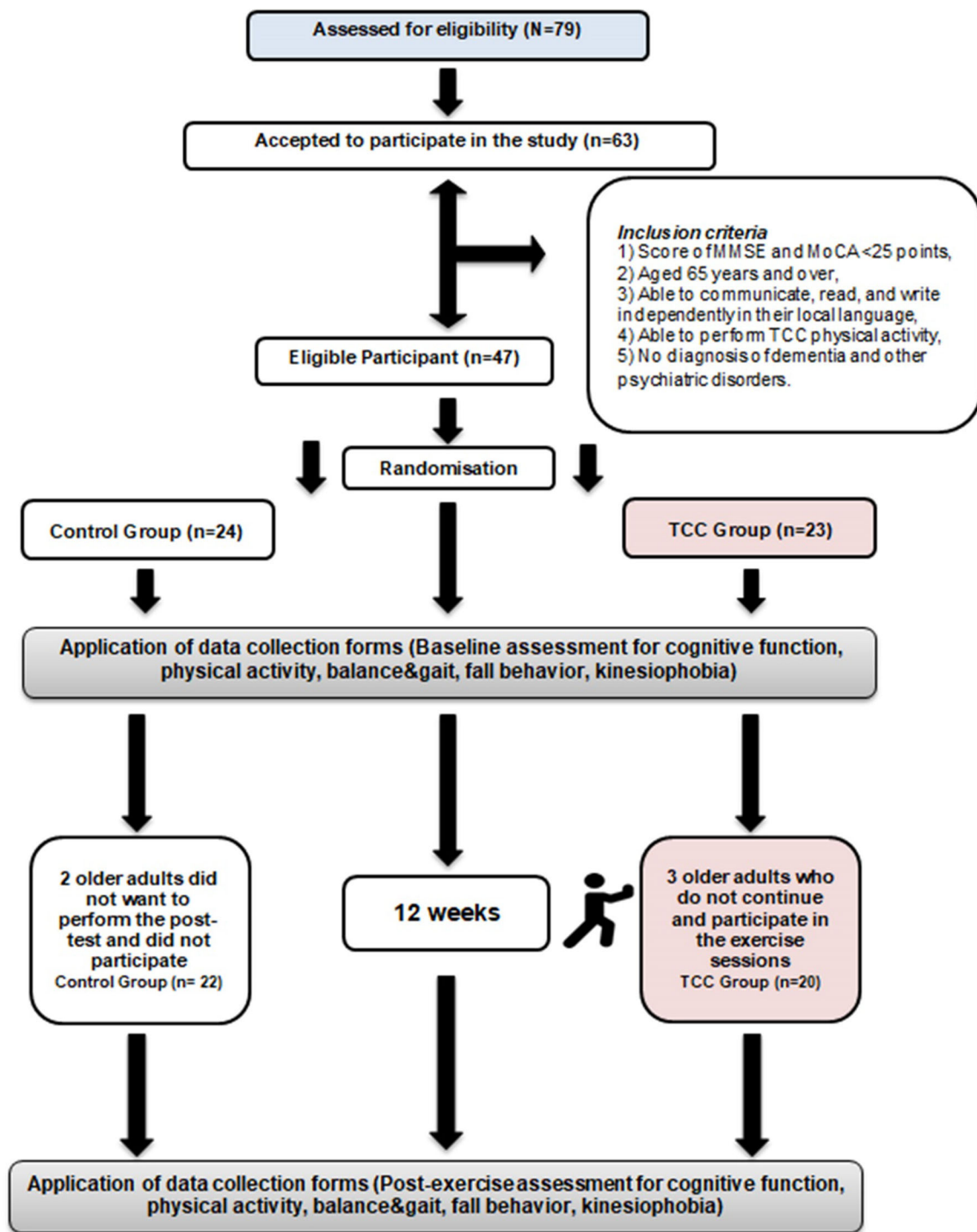


FIGURE 1 Flow diagram of the Tai Chi exercise trial. TCC, Tai Chi Chuan [Color figure can be viewed at wileyonlinelibrary.com]

PASE, which was developed in 1993 to assess the status of physical activity in people with MCI, was used in the present study. The PASE total score varies between 0 and 400, and higher scores signify high levels of physical activity.²¹ Ayva et al.²² adapted this scale to the Turkish population and determined that Cronbach's alpha coefficient of the scale was 0.71. In the present study, Cronbach's alpha coefficient was found to be 0.70.

TSK with 17 items was used to evaluate the fear of movement in the present study. The total score of TSK ranges from 17 to 68.²³ Yılmaz et al. adapted TSK to the Turkish population and found that the test-retest reliability was 0.806.²⁴ In the present study, Cronbach's alpha coefficient was found to be 0.78.

The FaB scale, which was developed by Clemson et al., was used in the study to assess behaviors related to falls in people with MCI. The FaB scale includes 30 items and ten subscales. While higher



FIGURE 2 Example of Yang style of TCC. TCC, Tai Chi Chuan [Color figure can be viewed at wileyonlinelibrary.com]

scores indicate the safe or protective behaviors of the individuals related to falling, lower scores signify the risky behaviors.²⁵ Uymaz and Nahcivan adapted the FaB to the Turkish population and found that the Cronbach's alpha coefficient was 0.90.²⁶ In the present study, Cronbach's alpha coefficient was determined to be 0.89.

2.5 | Statistical analysis

The data of the study were analyzed through The statistical package for social sciences 22.0 version, and Graphs in the study were prepared via GraphPad Prism software. All data were represented as the mean \pm SD. The Kolmogorov–Smirnov test and the Shapiro–Wilk test were used as the normality distribution test. The data regarding demographic and clinical characteristics in the intervention and control groups were analyzed by using χ^2 and t test. Differences in falls, balance, physical activity, and kinesophobia were compared between intervention and control groups at both beginning and end of the study by using The Wilcoxon signed-rank test or paired t test where appropriate. The value of $p < .05$ was considered statistically significant.

2.6 | Ethical considerations

We obtained ethical approval (no: 2018/120) and institutional permissions before starting the study and conducted this study in accordance with the Declaration of Helsinki. We informed the participants about the current study and stated that the personal

identities of the participants will not be published and the participants had the freedom to withdraw from the study at any time without any reason being given. We obtained written informed consent from the elderly people before being included in the study.

3 | RESULTS

The mean age of geriatric individuals participating in the research was 74.21 ± 6.93 years. The %57.4 of the individuals in both groups were male in the experimental and control group (13 [56.5%] and 14 [58.3%], respectively), and the majority of older adults in the experimental and control groups had an education level of elementary school (56.5% and 45.8%, respectively). In both groups, the majority had social insurance (87.0% and 87.5%, respectively). Moreover, most participants in the experimental and control groups had balance issues (69.6% and 66.7%, respectively). Twenty-two males (mean age of 74.14 ± 7.8) and Twenty female (mean age of 74.30 ± 5.7) participants in the control and intervention groups completed the study. Seven participants from the intervention group could not complete the 12-week TCC training and thus were not included in the final analysis.

Tables 1 and 2 show the results of the present study, which was carried out to determine the effects of TCC as a mind-body movement therapy on the fear of movement, gait, risk of falling and cognitive improvement in older adults with MCI. The PASE, TBT & TGT, FaB, and TKS were applied as a pretest to all participants. It was determined in the present study that there was no significant difference between intervention and the control groups ($p > .05$).

TABLE 1 The mean pretest and posttest scores of the scales in the experimental group

Scales	Pretest		Posttest		The value and the significance of the test	
	\bar{x}	SD	\bar{x}	SD	t	p
Tinetti balance assessment	9.73	1.95	12.8	1.81	-10.788	.000
Tinetti gait assessment	10.6	0.88	11.7	0.44	-5.234	.000
TSK	42.34	3.31	48.21	5.5	-7.175	.000
PASE score (0–400)	41.77	12.10	62.27	13.82	-6.413	.000
Sub-dimensions scores of the FaB scale						
Cognitive adaptations	2.90	0.47	3.17	0.57	-3.042	.006
Protective mobility	2.48	0.50	2.86	0.62	-4.394	.000
Avoidance	2.38	0.60	2.39	0.61	-0.123	.903
Awareness	2.70	0.69	2.81	0.76	-1.796	.086
Hastiness	2.68	1.01	2.84	0.80	-1.567	.131
Practical strategies	2.00	1.08	2.08	1.04	-1.447	.162
Displacing activities	2.08	0.99	2.21	0.90	-1.817	.083
Being observant	2.04	0.76	2.43	0.72	-3.761	.001
Changes in level	2.82	0.38	3.39	0.49	-4.041	.001
Getting to the phone	2.73	0.81	2.78	0.67	-0.371	.714
Total of FaB scale	2.48	0.28	2.68	0.19	-5.010	.000

Abbreviations: FaB, falls behavioral; PASE, physical activity scale for the elderly; TSK, Tampa scale of kinesiophobia.

In the present study, a significant difference was observed in the pretest and posttest scores of the TAT, PASE, TSK, and FaB scale in the intervention group ($p < .05$). Also, the posttest scores of cognitive adaptations, protective mobility,

being observant, changes in level subscales of the FaB scale significantly increased in the intervention group ($p < .05$). On the other hand, the results of this study revealed that there was no significant difference between the pretest and posttest scores of

TABLE 2 The mean pretest and posttest scores of the scales in the control group

Scales	Pretest		Posttest		The value and the significance of the test	
	\bar{x}	SD	\bar{x}	SD	t	p
Tinetti balance assessment	9.95	1.73	9.45	1.66	1.906	.069
Tinetti gait assessment	8.50	2.26	8.54	2.24	-0.272	.788
TSK	43.16	3.5	43.37	3.5	-0.666	.512
PASE score (0–400)	42.86	13.01	42.70	13.27	0.335	.742
Sub-dimensions scores of the FaB scale						
Cognitive adaptations	2.76	0.45	2.75	0.53	0.115	.910
Protective mobility	2.47	0.49	2.43	0.56	1.000	.328
Avoidance	2.40	0.59	2.38	0.66	0.485	.632
Awareness	2.67	0.69	2.66	0.69	1.000	.328
Hastiness	2.65	1.00	2.61	0.57	0.296	.770
Practical strategies	1.95	0.75	1.91	0.97	0.272	.788
Displacing activities	2.08	0.97	1.95	0.90	1.141	.266
Being observant	2.20	0.78	2.16	0.76	0.225	.824
Changes in level	2.87	0.34	2.83	0.48	0.569	.575
Getting to the phone	2.79	0.78	2.75	0.73	1.000	.328
Total of FaB scale	2.48	0.28	2.44	0.23	1.307	.204

Abbreviations: FaB, falls behavioral; PASE, physical activity scale for the elderly; TSK, Tampa scale of kinesiophobia.

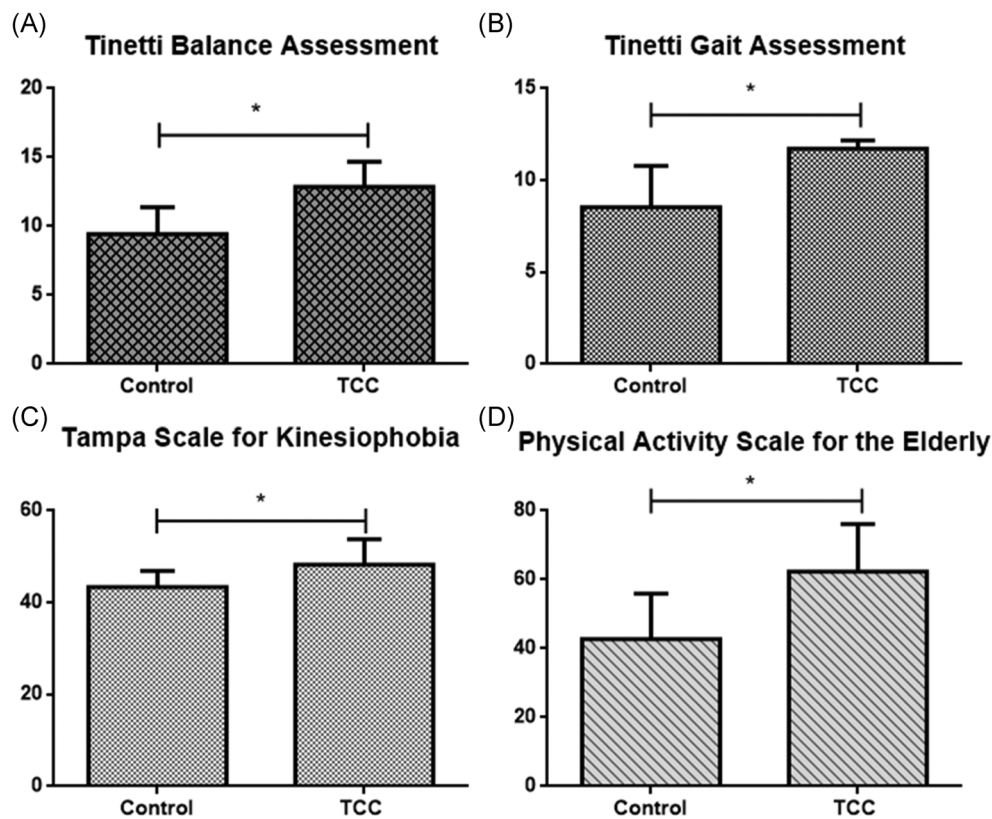


FIGURE 3 Comparison of posttest values of the scales in control and TCC groups. (A) Tinetti balance assessment, (B) Tinetti gait assessment, (C) Tampa scale for Kinesiophobia, (D) physical activity scale for elderly. * $p < .01$ compared with the control. All data were presented as mean \pm SD. TCC, Tai Chi Chuan

the TAT, TSK, PASE, and subscales of the FaB scale in the control group ($p > .05$).

When TAT, TSK, and PASE posttest scores of the intervention and control groups were examined, all scores of these scales were significantly higher in the intervention group compared to the control group ($p < .01$) (Figure 3). Moreover, the posttest scores of cognitive adaptations, protective mobility, and changes in level subscales of the FaB scale were significantly higher in the intervention group than the control group (Figure 4) ($p < .01$).

It was found that TAT, TSK, and PASE scores of the intervention group significantly increased after the TCC exercise ($p < .01$). Likewise, the posttest scores of the scales revealed that scores of cognitive adaptations, protective mobility, being observant, and changes in level subscales of the FaB scale significantly increased in the older adults in the intervention group whom did TCC exercise ($p < .01$).

4 | DISCUSSION

The effects of 12-week TCC exercise on kinesiophobia, prevention of falls and cognitive functions in older adults with MCI were examined in this study. It was found that TCC exercise affected falls, physical activity levels, kinesiophobia, and falls-related safe or protective behaviors in older adults. Furthermore, it was

revealed that the TCC exercise positively affected these parameters, and the results of the study supported all three hypotheses. According to a previous study emphasized that aerobic exercise in individuals with MCI reduced cognitive impairment and prevention of falls in elderly individuals was also useful in terms of reducing the transition from MCI to dementia, and TCC was recommended as a new option in reducing the transition from MCI to dementia.²⁷ However, the effect of TCC on individuals with MCI is not precisely elucidated.

The most common problems experienced by elderly individuals include fear of movement and balance disorders associated with falls, and these factors affect their daily activities and social relationships.^{28,29} It was observed that TAT scores of elderly adults who did TCC exercise in the intervention group increased; whereas, their fear of movement decreased. Moreover, an increase was observed in physical activity levels (PASE); on the other hand, a decrease was determined in safety or protective behavior related to falls (Table 1). These results suggested that older adults had a reduced risk of falls, increased safety and protective behaviors related to falls, and increased physical movement levels as a result of TCC training. Physical activities might have a positive effect on cognitive status in individuals with MCI. The previous study demonstrated that decreased physical performance in older adults with MCI might increase the risk of

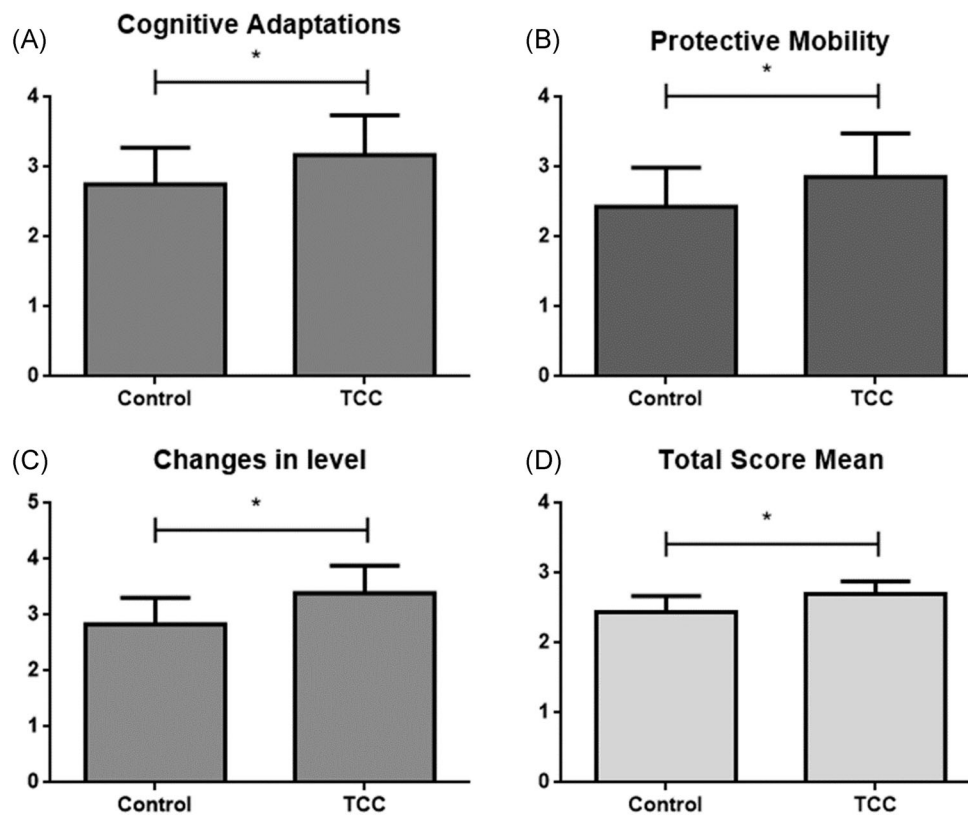


FIGURE 4 The sub-dimensions scores of the FaB scale, such as (A) cognitive adaptations, (B) mobility, and (C) changes in level in the posttest values of the scales in control and TCC groups. * $p < .01$ compared with the control. All data were presented as mean \pm SD. TCC, Tai Chi Chuan

Alzheimer's disease.³⁰ Therefore, increasing physical activity may prevent the development of cognitive impairment in older adults.^{31,32} Recent studies have also revealed that TCC is one of the best exercises to achieve this goal since balance can be developed with exercise that helps to improve joint movement and posture.^{12,13} It has been reported that older adults had improved balance and walking status after TCC exercise.^{12,33} Especially, Yang-style TCC is useful in terms of increasing musculoskeletal flexibility in healthy older women.³⁴ Balance exercises, such as TCC improve static and dynamic balance as well as performance in healthy older adults.³⁵ In another study, it was observed that while resistance exercise did not improve posture control, balance exercises improved posture in older adults.³⁶ In their study, Sangelaji et al. divided 40 individuals with multiple sclerosis into four groups and applied aerobic and resistive exercises in different combinations to those groups. The groups continued their programs four days a week for eight weeks, and at the end of the study, more effective results were obtained in balance, strength, agility, fatigue, speed, and walking distance values in the aerobic exercise group.³⁷ Fear of movement can lead to the avoidance of physical movements and activities in older adults since they think that movement can cause an injury once again.³⁸ In the present study, the fear of movement was found to be less in the intervention group compared to the control group, suggesting that

regular exercise habits reduce the fear of movement in elderly individuals.

The present study has some limitations. It was a randomized controlled trial with a relatively small population, and the MCI diagnosis of participants in the intervention and control groups was determined using a mini-mental test (the cognitive status assessment with (score of MMSE and MoCA <25 points) and clinical dementia rating scale (Stage 0.5–1).

5 | CONCLUSION

The results of the present randomized controlled trial suggested that TCC was effective in decreasing fear of movement and risk of falls and improving cognitive functions. TCC, which is not a challenging and high-speed exercise, is an appropriate exercise for elderly individuals. Furthermore, TCC exercise may be useful in reducing the transition to dementia and improving cognitive functions in patients with MCI. However, further comprehensive studies are required better to understand the effect of TCC in individuals with MCI. It is essential to increase the knowledge and awareness of healthcare professionals about the importance of TCC aerobic exercises in reducing the fear of falling in people with MCI. TCC aerobic exercises into the care practices of older adults.

Also, biochemical studies are needed to support the effectiveness of TCC in people with MCI.

5.1 | Implications for psychiatric nursing practice

The implications of this study suggest that it is exceptionally crucial to nurses' intentions to exercise with older adults in their professional practice in the Turkish population. Also, as far as we know, there is no study investigating the effect of TCC on falls, physical activity, and cognitive status and gait parameters in individuals with MCI in Turkey.

Health care providers should be knowledgeable about the TCC to provide sufficient information to individuals and should teach the elderly different types of physical activity they can perform. Also, care providers and caregivers can safely manage TCC exercise interventions for older adults with MCI. Ongoing support and exercise will promote older adults' commitment to their TCC exercise. Even though the majority of older adults should exercise in nursing homes, older adults in Turkey do not prefer to exercise. The addition of this TCC will interventions to patients with MCI enable nurses to adjust their nursing interventions to the needs of these patient populations. That is why it is crucial to increase the knowledge and awareness of healthcare professionals about the importance of TCC aerobic exercises in reducing the fear of falling, prevention of falls and improving cognitive functions in people with MCI. This article provides new information regarding the reduced risk of falls, sustain mental health, reducing the transition to dementia and improving cognitive functions in patients with MCI, increased safety and protective behaviors related to falls and increased physical movement levels as a result of TCC training. Also, the paper provides recommendations for nurses and other clinicians to assist in the implementation of TCC interventions to patients with MCI.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interest.

AUTHOR CONTRIBUTIONS

As the authors of this paper, they have declared that they all have made a substantial contribution to the information or material submitted for the publication and they have approved the final version of this manuscript. C.B.O. conceived and designed the study. C.B.O. and E.D. collected data. C.B.O. and E.D. wrote/drafted/edited the manuscript and interpreted the results. C.B.O. and E.D. conducted analyses, prepared graphs/figures and revised the manuscript. All authors approved the content of this manuscript.

ETHICS STATEMENT

Ethical approval from the Clinical Trials Ethics Committee of Medical Faculty of Hatay Mustafa Kemal University (2018/120) and official permission from The Ministry of Family and Social Policies of Hatay were obtained.

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