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Article

The impact of Tai Chi practice based on body perception and motion control on the physical function of elderly people

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Abstract: Tai Chi (TC) is an ancient Chinese practice characterized by slow, controlled actions and deep breathing, which has been recognized for its positive effects on physical health, particularly in enhancing balance, flexibility, and strength in older adults. This practice is believed to improve body perception and motion control, thereby supporting better physical function. This research aims to discover the effect of TC practice, based on the principles of body perception and motion control, on the physical function of elderly individuals. Two groups of 365 elderly citizens (60 years of age and older) are randomly allocated; one group participated in a 10-week TC program, while the control group continued with their regular activities. Physical function was assessed using various measures, including the Berg Balance Scale to evaluate balance, the Tinetti Gait Scale to assess gait, and the Timed Up-and-Go test to measure overall mobility. Statistical analysis, including repeated measures ANOVA, was conducted to compare pre-intervention and post-intervention scores for both groups. Additionally, to assess within-group variations in pre and post-intervention scores, paired *t*-tests were used. The association between TC practice and gains in physical function was examined using regression analysis. Additionally, Pearson correlation tests were used to assess the degree and direction of the relationship between changes in physical function ratings and the duration of TC practice. According to the findings, the TC group significantly performed superior than the control group in terms of balance, gait, and overall mobility. Furthermore, enhancements in body perception and motion control were linked to better physical function and a reduction in the risk of falls. In conclusion, TC practice based on body perception and motion control significantly improves the physical function of elderly individuals, supporting better balance and mobility. This intervention presents a valuable approach to fall prevention and promoting physical independence in older adults.

Keywords: Tai Chi; body perception; motion control; physical function; physical independence; elderly

1. Introduction

The Chinese martial arts and training method called TC was recently accredited as useful in decreasing the propensity of elders to fall. In TC practitioners shift the body weight from one leg to another stress on the smooth trunk rotation movement of all limbs and slightly slow, rhythmic, and alternating leg motion with bent knees [1]. The movements considered necessary for TC include foot placement that allows perceiving body position during movement, updated head-trunk integration and voluntary movements towards certain postures in TC [2]. Positive neurological reactions that involve controlling the ankle joint throughout disturbances and the dynamics and patterns of the swing leg during walking can also be attributed to TC as well as proprioception, strength, and flexibility of the movement in the distal lower extremity [3].

TC is worth exploring among the several forms of exercise advised for the elderly: TC is an ancient form of Chinese martial arts practiced by the Chinese civilization both for their health and protection [4]. TC is employed in right proportion a low impact exercise technique in which it entails slow, steady, and smooth movement utilized in a flowing movement without interruptions where every move of the feet of an individual corresponds with the centre of gravity (COG). It has been demonstrated that TC offers several health advantages, including reducing blood pressure, enhancing muscle strength and flexibility, promoting psychological wellness, reducing psychobiological stress reactivity, and postponing the onset of several chronic illnesses [5]. Dynamic posture control, lower limb strengthening, and lower limb control are all part of TC practice. TC practitioners test their balance control system by maintaining a variety of postures and keeping the COG inside a shifting support base.

The slow, purposeful motions of TC, an ancient Chinese martial art, are well known for encouraging flexibility, coordination, and relaxation. It helps to improve general physical health, lower stress levels, and increase cognitive function, which is especially advantageous for the elderly [6]. It focuses on harmony, mobility, stability, and concentration by combining correct breathing and meditative work with smooth and rhythmic motions. It has been noted to have positive impacts on the physical integral function of older individuals especially in the recent past and especially when focused on improving the person's abilities to govern their body movements [7]. These aspects of TC practice probably enhance older persons' physical functions and prevent age-related decline in physical functioning. One of the major advantages of TC is the effect on body perception, which may be described as a sense of position and movement of one's own body in space [8]. This consciousness of one's body often decreases with age, causing issues such as poor posture, balance issues, and the possibility of falls. TC has been proven to increase proprioception, or the ability to sense position and movement by practicing slow, controlled movements and being mindful during the practice [9].

TC benefits bodily movement coordination, which in turn is vital for sustaining balance and coordination in daily activities. Skeletal muscles usually weaken with age, especially when it comes to tasks that involve delicate movements such as walking, reaching, or bending. The slow and controlled motions that TC performs help elderly persons maintain and even regain control over their muscles and movements by integrating neuromuscular patterns [10]. Informing mobility control of motion can lead to enhanced posture, gait, and general functional mobility. In elderly subjects, TC has been described to be effective in improving such parameters as flexibility, strength, and balance [11]. These gains are associated with the considerable interaction effects of motion control and body perception. Additionally, this type of art helps improve the state of mental health because it relieves the hopelessness and anxiety that the elderly often experience. It may also enhance the value of lifetime in elder persons as TC not only focuses on the physical form but also is supportive of the overall well-being of a person [12]. This research aims to examine how TC practice, which is created on the concepts of body sensing and motion control, affects older people's physical purpose.

Contribution

- It demonstrated that a 10-week TC program dramatically increases elderly people's balance, gait, and general mobility, representing that TC is a successful strategy for improving elderly people's physical function.
- TC exercise improves body awareness and motion control, which boosts physical function and is essential for lowering the risk of falls and increasing older people's general mobility.
- It highlights TC's significance in fostering physical independence and enhancing older individuals' balance and mobility while offering compelling evidence in favor of its use as a fall prevention technique.

The remaining portion of the research is split up into many sections to guarantee that the results are presented clearly and thoroughly. Section 2 evaluates previous studies to give relevant works. In Section 3, several strategies are examined; the tactics and processes used are described. Part 4 examines the consequent results, including the experimental findings. In Section 5, there is a discussion. In Section 6, it is effectively concluded by summarizing the key findings, elucidating their significance, and proposing potential directions for further research.

2. Related works

It examined how a communal TC program affected older individuals' sensorimotor function and balance [13]. After a 12-week TC intervention, participants' balance improved, and those in a smaller sample also showed improvements in lower body proprioception and electrophysiological delay. Additional sensorimotor alterations brought about by TC included enhanced hip proprioception and a quicker contraction of the hip abductor muscles.

Long-term Tai Chi Chuan (TCC) practice was evaluated for its effect on an elderly person's ability to maintain balance when navigating difficulties. According to the investigation [14], TCC practitioners had lower trailing stride lengths but more toe-obstacle clearing before and after. The benefits were linked to TCC activities that prioritized balance through the use of single-leg support and maintaining the leading limb's body weight while gradually moving the burden on double-limb support.

Physical activity was important for maintaining energy balance and functional health [15], and aging could be controlled. It was recently demonstrated that TC causes serious health problems. Research evaluating the effects of lifestyle on functional capacity and continuous long-term practice of TC revealed that especially when taking into consideration the martial arts long-term training, TC performed better on the Senior Fitness Test (SFT). The significance of integrating physical activity into one's lifestyle was emphasized by the issue.

The impacts of a 12-week Wheelchair Tai Chi Ball (WTCB) program on older people with impairments' mental and physical health as well as their ability to function were examined in [16]. By comparing the changes among the WTCB group and the controller group, there were better changes in the Pain Self-Efficacy Questionnaire (PSEQ), overall physical health, wrist, elbow, shoulder, and knee strength. Elderly people with impairments could benefit from the WTCB exercise

since it also increases upper extremity muscular strength and self-efficacy for pain management.

The physical control intervention, 8-form TC, and TC lower-extremity exercise (TC LEE) in [17], for the ability to improve functional mobility and balance in elderly individuals. The Timed Up and Go (TUG) evaluation, the centre of pressure assessment, and the Berg Balance Scales all showed the anticipated improvements. In the TUG test, there was a substantial difference among the 8-form TC groups and TC LEE, with the TC LEE group achieving greater variation ratings, thus explaining the superiority of TC LEE in assisting older persons in their balance and functional mobility.

In a biomechanical assessment, Law evaluated the lower limb's electromyography (EMG) activity, joint angles, and joint moment while performing seven TC movements with the walking data [18]. When compared to walking, dynamic TC actions needed larger lower limb joint movement angles, the majority of dynamic TC actions produced higher extension and abduction joint moments at a lower limb joints, and TC increased minor limb muscle activity, especially in the hips abductors and adductors. For all populations, but especially for older adults, the hips adductors and adductors play a important role in postural stability.

The effect of TCC exercise on older people's lower-limb inter-joint organization shapes and variation throughout obstacle-crossing were anticipated [19]. 15 senior TCC practitioners and 15 healthy controls participated in the research. TCC training considerably improved foot-obstacle clearances and decreased lower limb joint movement variability during obstacle-crossing, according to the results. Slow movement patterns that emphasized body weight transfer between limbs could have long-lasting impacts, which could be an explanation for the long-term impacts of TCC practice.

It examined the differences in lower-extremity characteristics between middle-aged and older TCC practitioners and healthy people during a countermovement leap in investigation [20]. Exercise type and age did not interact, according to the results; however, aging could decrease jump height, knee power, and ankle power during the takeoff phase. During the take-off phase, long-term TC training dramatically improved jump height, ankle and knee ankle moments, hip power, knee power, and ankle power. It recommended frequent exercise for middle-aged and older people and implies that TC could reduce age-related functional loss.

Taijiquan hand movements were biomechanically examined in [21]. Kinematics and muscular strength issues were resolved by analyzing competitive Taijiquan arm manipulation using biomechanical data techniques and equipment. Pull and regulate arm motion while making adjustments. It evaluated players' skill levels, looked at how players at a sports college moved their hands, and used the synchronous measurement approach to execute two sets of synchronized movements.

The impact of TC (eight techniques and five phases) on participants' capability to control their body stability was examined in [22], mostly from a biomechanical approach. Twenty athletes participated in a nine-week experiment that revealed TC (eight techniques and five steps) could significantly improve the Y-balance testing (YBT) score and extend the amount of time spent standing on one leg with eyes closed. Tai Chi was also found to lower elliptical area (EA), anterior-posterior

direction (Delta Y), and left and right direction (Delta X) values, all of that differed significantly from the blank group's outcomes.

Through vigorous walking and Taijiquan exercises [23], it intended to develop the quality of life for older Chinese women. Three weekly exercise sessions improved the intervention group's arms curl, one-legged standing, chair stand, handgrip strength, as well as sit and reach assessments. However, there was no increase in life satisfaction, body composition, or cardiovascular health. The activity could be marketed as a way to boost elderly people's health.

3. Methodology

This investigation examined how a 10-week TC practice affected the physical function of elderly citizens, with a particular emphasis on motion control and body awareness. Participants aged 60 years old and above: 365 of the participants were separated into a TC groups and a control groups. Mobility, gait, body perception, the risk of falling, and balance were used to assess the physical function of the patients. Finally, in relating the TC groups to the control groups, a quantitative data from multiple regression analysis, paired *t*-test, Pearson correlation, and repeated measures ANOVA showed a significant increase in the static and dynamic, and postural stability, aspects of their mobility, gait, and balance. In inference, the results suggest that TC enhances some aspects of physical functioning and might prevent the elderly from experiencing fall.

3.1. Participants

The data collection included 365 elderly participants (60–80 years old), randomly assigned to a 10-week Tai Chi (TC) program or a control group. Both groups had an average age of 68. Gender distribution was similar, with males in TC and Control. Most participants had fundamental school education or less, and moderate physical activity levels. The data for this investigation were collected through a structured recruitment process, where elderly individuals randomly allocated to either the TC intervention groups or the control groups. The sampling approach ensured that both groups were comparable in terms of demographic variables along with age, gender, marital status, educational background, and physical activity levels, minimizing bias in the sample. The participants were separated into two collections: The intervention groups ($TC, n = 183$) and the control groups (n = 182). In the TC group, there were 42.6% more men than women (57.4%), while in the Control group, there were 45.1%more men and 54.9% more women. Regarding education, 43.7% of the TC groups and 42.9% of the Control groups had primary school education or less. Most participants in both groups were married, followed by widowed, and fewer were single. In terms of physical activity, 50.3% in the TC groups and 49.5% in the Control groups had moderate activity levels, with fewer participants being sedentary or highly active. **Table 1** shows the demographic data. The demographic data of education level, marital status, and physical activity level are graphically illustrated in **Figure 1**.

Table 1. Demographic data.

Variables	Categories	TC Group (*n* = 183)	Control Group (*n* = 182)
Age	(60–80)	68.2 ± 5.7	68.5 ± 5.9
Gender	Male	78 (42.6%)	82 (45.1%)
	Female	105 (57.4%)	100 (54.9%)
Education Level	Primary School or Less	80 (43.7%)	78 (42.9%)
	Secondary School	65 (35.5%)	70 (38.5%)
	Higher Education	38 (20.8%)	34 (18.6%)
Marital Status	Married	120 (65.6%)	118 (64.8%)
	Widowed	45 (24.6%)	44 (24.2%)
	Single	18 (9.8%)	20 (11.0%)
Physical Activity Level	Sedentary	55 (30.1%)	58 (31.9%)
	Moderately Active	92 (50.3%)	90 (49.5%)
	Active	36 (19.6%)	34 (18.7%)

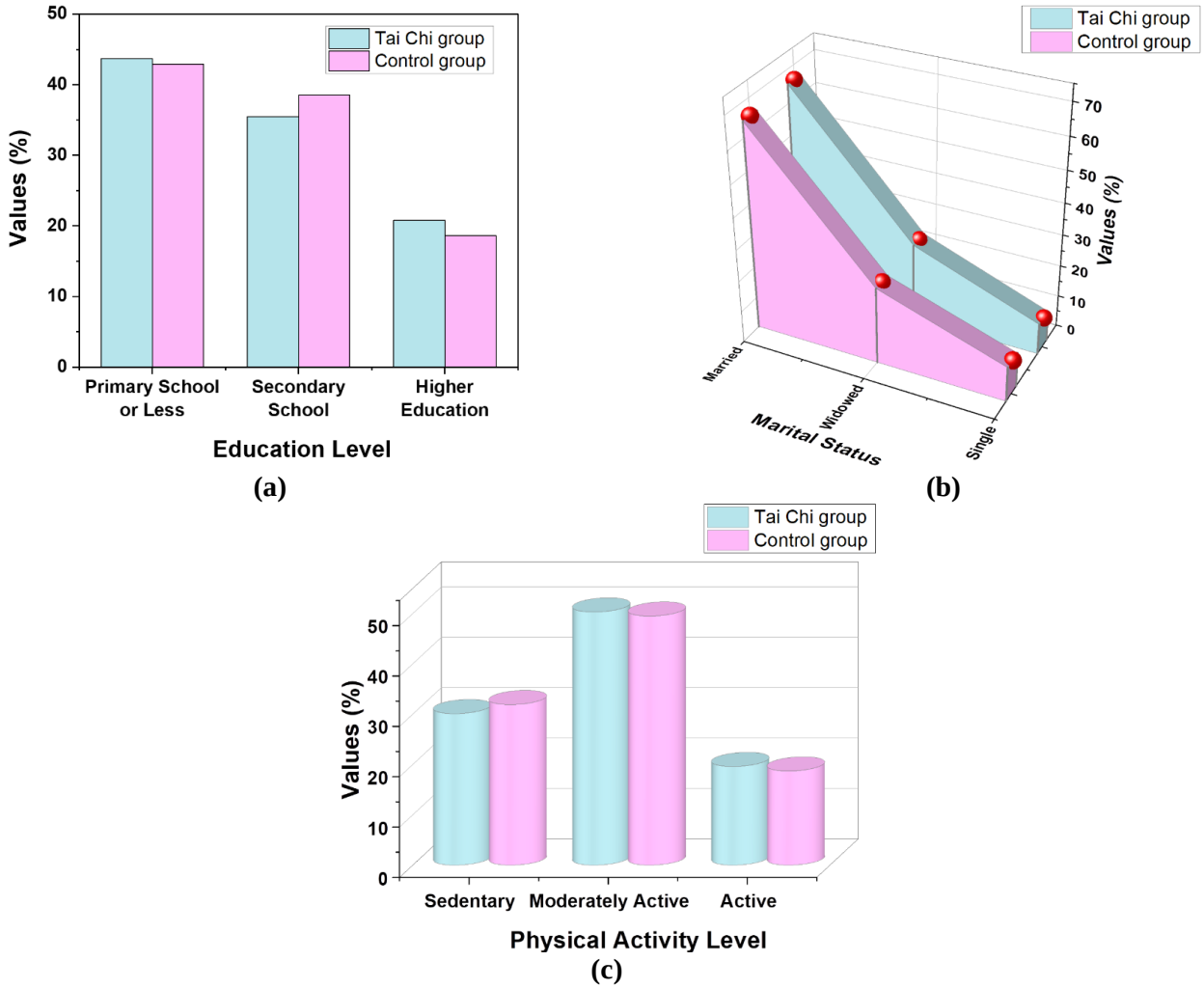

Figure 1. (a) Demographic data of education level; **(b)** demographic data of marital status; **(c)** demographic data of physical activity level.

3.2. Research instrument

Three essential research instruments were used in the research to assess the physical function of elderly people. Through exercises including standing, reaching, and turning, the Berg Balance Scale evaluated balance and determined a person's stability and posture-maintenance skills. By measuring walking patterns, speed, and stability during ambulation, the Tinetti Gait Scale assessed gait and revealed information about a person's capacity for safe walking. To assess participants' general mobility and agility, the Timed Up-and-Go Test timed them while they got out of a chair, walked a short distance, and then came back. These assessments were given at beginning and at the conclusion of the 10-week TC intervention for the purpose to compare the modifications in physical performance in the two groups. These tests, taken together, afford objective and unbiased assessments of mobility, gait, and balance, giving a sound basis for evaluating the extent of functional gain after TC in elderly individuals.

3.3. Method for analysis

The impact of TC practice on elderly persons was discoursed in this research by focusing on how body perception and motion control were affected. Descriptive data analysis was examined with SPSS version 29.0 data software. To determine the changes in the attitudes of the group members before and afterwards the intervention, the data collected was analyzed using the paired *t*-test statistics. The results of the interaction between the time and group effects on the physical function were further analysed using a mutual ANOVA to establish its significance. Significance in body image, motion, and physical functioning were compared by Pearson correlation. Cohort baseline data were used to control variables in upgraded physical function multiple regression analysis predicting increase in physical function.

4. Result

The TCs were compared to the control groupings with the Repeated Measures ANOVA, pre and post-intervention scores to determine the presence of clinically meaningful changes in physical function. To determine the relationship between TC practice and improvement in mobility, gait, fall risk, body perception, and balance, any confounding variable was excluded in the multiple regression analysis. The within-group differences in the physical function evaluations post and pre-intervention were compared using a Paired *t*-test. Pearson Correlation applied in analyzing the intensity and direction of the link between gains in body perception, motion control, and physical function outcomes was positive.

- ANOVA

In the comparison among the TC group and the control group, five parameters Balance Performance, Gait Quality, Mobility, Body Perception, and Fall Risk are analyzed, as shown in **Table 2** and **Figure 2**. The control group demonstrates consistently low mean squares (MS) and shows no significant changes across the parameters. In contrast, the TC group exhibits higher sums of squares (SS) and significant findings for each parameter. For Balance Performance, the TC group

shows a significant effect with an SS of 45.6, MS of 45.6, an *F*-statistic of 6.2, and a *p*-value of 0.014, suggesting a notable improvement over the control group, which has a much lower MS of 0.61 and no statistical significance. Similarly, in Gait Quality, the TC group's SS of 38.4, MS of 38.4, *F*-statistic (5.4), and *p*-value (0.022) highlight a significant variation contrasted to the control group's MS of 0.58, which shows no discernible change. In terms of Mobility, the TC group achieves an SS of 52.0, MS of 52.0, *F*-statistic (7.5), and *p*-value of 0.008, indicating a substantial improvement, whereas the control group's MS is only 0.65. For Body Perception, the TC group also demonstrates significance with an *F*-statistic of 4.2 and a *p*-value of 0.041. Lastly, in Fall Risk, the TC group's performance (SS of 25.1, MS of 25.1, *F*-statistic of 3.8, *p*-value (0.043) again shows a notable variation. In all comparisons, the TC group consistently outperforms the control category.

Table 2. Values for the ANOVA test.

Variable	Source of Variation	SS	MS	df	*F*-Statistic	*p*-value
Balance Performance	TC Group	45.6	45.6	1	6.2	0.014
	Control group	220.8	0.61	363		
Gait Quality	TC Group	38.4	38.4	1	5.4	0.022
	Control group	210.0	0.58	363		
Mobility	TC Group	52.0	52.0	1	7.5	0.008
	Control group	235.0	0.65	363		
Body Perception	TC Group	30.2	30.2	1	4.2	0.041
	Control group	180.3	0.50	363		
Fall Risk	TC Group	25.1	25.1	1	3.8	0.043
	Control group	197.6	0.54	363		

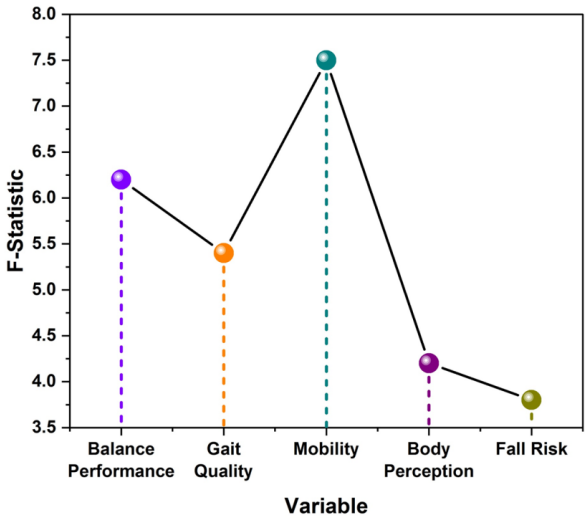

Figure 2. ANOVA performance.

- Multiple Regression Analysis

The regression analysis results for factors such as fall risk, mobility, body perception, gait quality, and balance performance are presented in **Figure 3** and

Table 3. These variables are assessed using key statistical measures: *t*-statistic, *p*-value, standardized coefficient (β), standard error (SE), and unstandardized coefficient (*B*). The analysis reveals that all variables have statistically relevant associations, with *p*-values < 0.05, representing a robust probability, these interactions are not due to random chance. Among the variables, balance performance (β = 0.396) shows the greatest influence on the dependent variable, suggesting it plays a dominant role. Fall risk (β = 0.350) follows closely behind, indicating its substantial impact. Both mobility (β = 0.298) and gait quality (β = 0.315) also contribute significantly but to a lesser degree. Body perception (β = 0.219) has the smallest effect, though it remains statistically significant. The robustness of the findings is confirmed by the *t*-statistics, which exceed the critical value, further supporting the reliability and strength of the associations between these variables and the dependent factor. This comprehensive analysis underscores the importance of balance performance and fall risk in the context of mobility and physical health assessments.

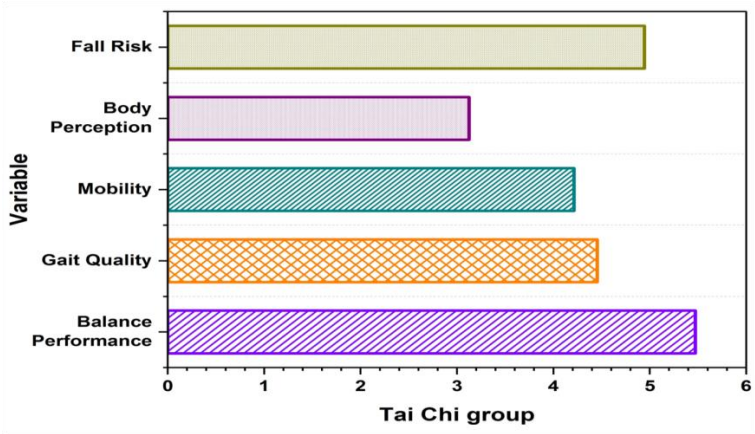

Figure 3. TC group performance for multiple regression tests.

Table 3. Multiple regression analysis test for TC group.

Variable	*B*	*β*	SE	*t*-value	*p*-value
Balance Performance	0.520	0.396	0.095	5.474	<0.001
Gait Quality	0.410	0.315	0.092	4.456	<0.001
Mobility	0.375	0.298	0.089	4.215	<0.001
Body Perception	0.275	0.219	0.088	3.126	0.002
Fall Risk	0.450	0.350	0.091	4.945	<0.001

The regression analysis in **Table 4** and **Figure 4** examines the relationship between five variables: Fall risk, mobility, body perception, gait quality, and balance performance. Key metrics such as the coefficient (*B*), standard error, β (beta), *t*-statistic, and *p*-value were used to assess the impact of each variable on the outcome. Balance performance showed a strong positive correlation, with a coefficient of 0.310, β of 0.239, *t*-statistic of 3.100, and a relevant *p*-value of 0.002, representing a statistically significant relationship. Similarly, gait quality, mobility, body perception, and fall risk all showed positive correlations. Gait quality had a coefficient (0.230), β (0.188), *t*-statistic (2.474), and *p*-value (0.014); mobility had *B*

= 0.210, β = 0.165, t = 2.365, and p = 0.019; body perception had B = 0.180, β = 0.141, t = 2.118, and p = 0.035; and fall risk had B = 0.280, β = 0.220, t = 2.857, and p = 0.005. All p-values are <0.05, confirming that these variables significantly facilitate to the outcome, suggesting that higher scores in balance performance, gait quality, mobility, body perception, and fall risk are positively related.

Table 4. Multiple regression analysis test for control group.

Variable	*B*	*β*	SE	*t*-value	*p*-value
Balance Performance	0.310	0.239	0.100	3.100	0.002
Gait Quality	0.230	0.188	0.093	2.474	0.014
Mobility	0.210	0.165	0.089	2.365	0.019
Body Perception	0.180	0.141	0.085	2.118	0.035
Fall Risk	0.280	0.220	0.098	2.857	0.005

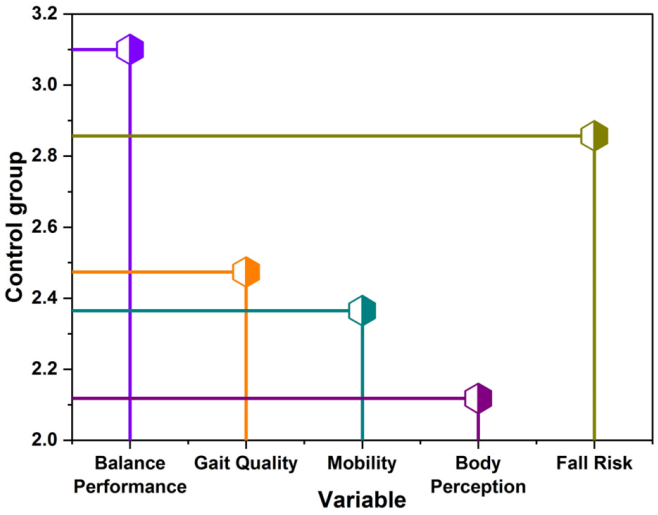

Figure 4. Control group performance for multiple regression tests.

- Paired *t*-test

The averages and standard deviations (SD) for the five variables—balance performance, gait quality, mobility, body perception, and fall risk—before and after the intervention are shown in **Table 5** and **Figure 5**. The mean difference (MD)(pre-post) for each variable demonstrates the improvement following the intervention. Statistical significance is determined by t-values and corresponding p-values. For example, balance performance improved significantly, with a average difference of 8.5, a t-value (6.52), and a p-value of <0.001, showing an increase from 35.0 (SD 6.5) to 43.5 (SD 5.8). Similar improvements were observed in gait quality, mobility, and body perception, each with t-values exceeding 6 and p-values less than 0.001, indicating significant changes. Fall risk, measured at 12.4 (SD 2.1) pre-intervention, decreased significantly to 8.5 (SD 1.6) post-intervention, with a MD of 3.9, a t-value of 9.28, and a p-value <0.001. These results collectively suggest that the interference led to substantial improvements across all five variables, particularly in balance, mobility, and fall risk reduction.

Table 5. Paired *t*-test for TC group.

Variable	Pre-Intervention Mean (SD)	Post-Intervention Mean (SD)	MD (Pre–Post)	*t*-value	*p*-value
Balance Performance	35.0 (6.5)	43.5 (5.8)	8.5	6.52	<0.001
Gait Quality	18.2 (3.4)	23.0 (3.1)	4.8	6.89	<0.001
Mobility	14.5 (2.8)	18.0 (2.3)	3.5	7.14	<0.001
Body Perception	24.0 (4.3)	30.2 (3.8)	6.2	9.31	<0.001
Fall Risk	12.4 (2.1)	8.5 (1.6)	3.9	9.28	<0.001

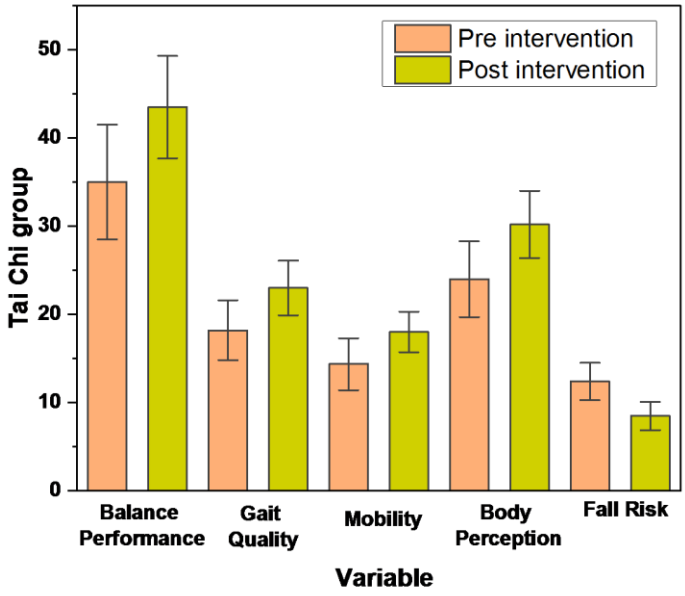

Figure 5. TC group performance for paired *t*-test.

The results provided in **Table 6** and **Figure 6** show the statistical analysis of various variables before and after an intervention. For Balance Performance, there was no significant change among the pre-intervention mean (35.1) and post-intervention mean (35.3). The MD was only 0.2, with a *t*-value of 0.36 and a *p*-value of 0.72, indicating that the observed change was statistically insignificant. Similarly, for Gait Quality, the pre-intervention value was 18.5, and the post-intervention value was 18.7, showing a MD (0.2). The *t*-value of 0.68 and *p*-value of 0.50 suggest that this change was also not significant. Additionally, no meaningful improvements were noted in other variables such as Mobility, Body Perception, and Fall Risk. For Mobility, the MD was 0.2, with a *t*-value of 0.87 and a *p*-value (0.38). For Body Perception, the *t*-value was 0.89, with a *p*-value of 0.37, and for Fall Risk, the MD was 0.1, with a *t*-value of 0.68and a *p*-value (0.50). In all these cases, the results suggest no significant impact from the intervention, as the *p*-values exceed the commonly accepted threshold of 0.05 for statistical significance. In summary, the intervention did not lead to substantial improvements in any of the measured variables.

Table 6. Paired *t*-test for control group.

Variable	Pre-Intervention Mean (SD)	Post-Intervention Mean (SD)	MD (Pre–Post)	*t*-value	*p*-value
Balance Performance	35.1 (6.5)	35.3 (6.6)	0.2	0.36	0.72
Gait Quality	18.5 (3.5)	18.7 (3.6)	0.2	0.68	0.50
Mobility	14.7 (2.9)	14.9 (2.8)	0.2	0.87	0.38
Body Perception	23.8 (4.4)	24.0 (4.3)	0.2	0.89	0.37
Fall Risk	12.6 (2.0)	12.5 (2.1)	0.1	0.68	0.50

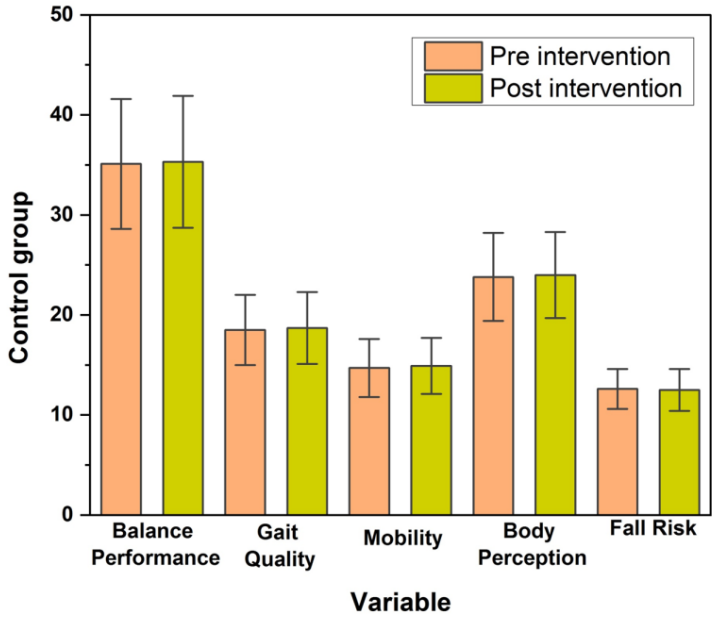

Figure 6. Control group performance for paired *t*-test.

- Pearson correlation

The correlation coefficients between Body Perception, Mobility, Gait Quality, Balance Performance, and Fall Risk, as shown in **Table 7**, reveal how closely related these variables are to each other. There is a significant positive relationship found among Balancing Performance and other variables such as Gait Quality (0.85), Mobility (0.88), and Body Perception (0.92). This shows that individuals with better gait, mobility, and body perception tend to exhibit better balance. These relationships propose that enhancing one of these factors is likely to result in improvements in the others, which is mainly relevant for physical therapy and rehabilitation programs. Similarly, Fall Risk shows weak correlations with all other variables, with the strongest correlation being just 0.15 with Gait Quality. This weak correlation implies that fall risk is not significantly influenced by balance, mobility, or body perception, suggesting that other factors may contribute more strongly to the risk of falls. While mobility and balance are somewhat linked, the lack of substantial correlation with fall risk indicates that fall prevention strategies may need to focus on additional aspects, such as environmental factors, underlying health conditions, or psychological elements, rather than solely improving balance or gait. Overall, the

data highlights the complex nature of fall risk and the need for multifaceted approaches to managing it.

Table 7. Pearson correlation values for TC group.

Variable	Balance Performance	Gait Quality	Mobility	Body Perception	Fall Risk
Balance Performance	1.00	0.85	0.88	0.92	0.10
Gait Quality	0.85	1.00	0.85	0.88	0.15
Mobility	0.88	0.85	1.00	0.86	0.12
Body Perception	0.92	0.88	0.86	1.00	0.08
Fall Risk	0.10	0.15	0.12	0.08	1.00

Balance Performance, Gait Quality, Mobility, Body Perception, and Fall Risk are the five variables whose correlation coefficients are shown in **Table 8**. Correlation coefficients range from −1 to 1. The data shows moderate positive correlations between balance performance and gait quality (0.60), balance performance and body perception (0.58), and gait quality and body perception (0.63), indicating that improvements in balance performance and gait quality are associated with better body perception. Mobility, which reflects the ability to move, shows moderate correlations with balance performance (0.55), gait quality (0.59), and body perception (0.56). This suggests that individuals with better balance, gait, and body awareness tend to experience improved mobility, though the relationships are not very strong. Fall risk, however, is less closely related to the other variables. It shows the weakest correlations overall, with the highest coefficient (0.25) observed with body perception. This suggests that fall risk might be somewhat linked to how individuals perceive their bodies, but the overall correlation with balance, gait, and mobility is minimal. In conclusion, while balance, gait, and mobility are strongly interconnected, fall risk appears to have a weaker association with these factors, particularly in body perception. This indicates that fall risk may be influenced by other factors not captured by these variables.

Table 8. Pearson correlation values for control group.

Variable	Balance Performance	Gait Quality	Mobility	Body Perception	Fall Risk
Balance Performance	1.00	0.60	0.55	0.58	0.20
Gait Quality	0.60	1.00	0.59	0.63	0.18
Mobility	0.55	0.59	1.00	0.56	0.22
Body Perception	0.58	0.63	0.56	1.00	0.25
Fall Risk	0.20	0.18	0.22	0.25	1.00

5. Discussion

The findings have significant improvements in Balance Performance, Gait Quality, Mobility, Body Perception, and Fall Risk, primarily in the TC group, as evidenced by the aid of multiple statistical analyses. ANOVA discovered that the TC organization achieved significant enhancements in Balance Performance (SS = 45.6, MS = 45.6, F = 6.2, p = 0.014), Gait Quality (SS = 38.4, MS = 38.4, F = 5.4, p =

0.022), Mobility (SS = 52.0, MS = 52.0, $F = 7.5$, $p = 0.008$), Body Perception (SS = 30.2, MS = 30.2, $F = 4.2$, $p = 0.041$), and Fall Risk (SS = 25.1, MS = 25.1, $F = 3.8$, $p = 0.043$). These findings align with paired *t*-test outcomes, which confirmed statistically full-size mean upgrades in Balance Performance (MD = 8.5, $t = 6.52$, $p < 0.001$) and a discount in Fall Risk (MD = 3.9, $t = 9.28$, $p < 0.001$). Pearson correlation in addition emphasised sturdy advantageous associations among key variables which include Balance Performance with Gait Quality ($r = 0.85$), Mobility ($r = 0.88$), and Body Perception ($r = 0.92$), indicating interconnected improvements across a couple of domains.

The investigation limitations include the absence of a long-term follow-up, which prevents an evaluation of the sustainability of the observed improvements in physical function through the years. Additionally, at the same time as ANOVA and t-exams had been used to examine pre-and put-up-intervention ratings, those techniques no longer account for person variability or baseline traits, that can affect the effects. Although regression evaluation diagnosed Balance Performance ($\beta = 0.396$, $p = 0.002$) and Fall Risk ($\beta = 0.350$, $p = 0.002$) as the most influential elements inside the intervention's outcomes, the analysis turned restricted by way of ability multicollinearity among predictors, that may difficult to understand the actual relationships among variables. Future studies should adopt longitudinal designs to take a look at the long-term effects and sustainability of Tai Chi exercise. Furthermore, extra advanced statistical techniques, such as blended-effects models or structural equation modeling, might be employed to address with man or woman variations and improve the accuracy of findings, ultimately enhancing the knowledge of the intervention's effectiveness and its interactions with diverse personal and environmental factors.

6. Conclusion

TC is a Chinese discipline that has been reported to have a beneficial impact on the health of people especially in enhancing the elderly people's strength, flexibility, and balance. The aim of this research is therefore to establish the impacts of TC that is based on body sensing and motion control on the physical function of the elderly group. A total of 365 elderly participants (aged 60 and above) were divided into two categories at random: One of the groups attended a 10-week TC program, and the other group carried out their routines. The means were compared for a TC groups and the control groups using ANOVA, paired *t*-tests, multiple regression, and Pearson correlation the outcomes was indicated important changes among the two groups. Analysis of variance yielded statistically relevant differences in mobility, body perception, fall risk, gait quality, and balance performance all at $p < 0.05$. Therefore, multiple regression analysis on all the variables in the TC group yielded significant improvements ($p< 0.05$) with the largest perceived benefit on balance performance (Beta = 0.396) followed by reduced fall risk having a beta of 0.350. When comparing the TC group both-intervention, paired *t*-tests revealed significant improvement in fall risk, mobility, body perception, gait quality, and balance performance with $p< 0.001$. On the other hand, the control group had average measurement variances among pre and post-intervention and their results were

moderate and varied between 0.1 and 0.2. These findings imply that TC has the potential to improve functional ability in the elderly through focusing on risk factors for falls, balance, gait, and mobility.

Ethical approval: Not applicable.

Conflict of interest: The author declares no conflict of interest.

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