SIN-CHN
SCIENTIFIC PRESS PTE.LTD.

Molecular & Cellular Biomechanics 2024, 21(4), 505.
https://doi.org/10.62617/mcb505

Article

The influence of Taijiquan on athletes' body control ability was analyzed based on sports biomechanics

Yu Yang

School of Physical Education, Zhengzhou Shengda University, Zhengzhou 451191, Henan, China; 15036109406@163.com

CITATION

Yang Y. The influence of Taijiquan on athletes' body control ability was analyzed based on sports biomechanics. Molecular & Cellular Biomechanics. 2024; 21(4): 505. https://doi.org/10.62617/mcb505

ARTICLE INFO

Received: 28 September 2024
Accepted: 6 November 2024
Available online: 27 December 2024

Abstract: Background: The growing number of Taijiquan practitioners has sparked considerable curiosity from studies on the responsibility of Taijiquan exercise. Numerous researches have been undertaken using various methods to examine the impact of Taijiquan on physical and mental wellbeing. **Objective:** The purpose of this paper is to look at the biomechanical effects of Taijiquan practice on athletes' ability to control their body equilibrium. **Methods:** 160 athletes (90 experimental groups and 70 control group) were assigned by chance to two groups. There were no significant variations in age, height, weight, or training time. The experimental group undergoes Taijiquan exercises for 8 months. The control group didn't perform any exercises. After 8 months, athletes in the two groups were tested for the Functional Reach Test (FRT), Stork Stand Test (SST), and plantar pressure measurement (PPM) and paired *t*-test. **Results:** The experimental group demonstrated improved FRT, SST, and PPM, indicating that Taijiquan practice improved equilibrium and stability during accomplishment activities. The experimental group demonstrated longer bearing maintenance, stability control, and a smaller average pressure area, indicating more capable pressure. Additionally, creative stability measurements were lower, indicating improved foot stability and control. **Conclusion:** Overall, the data indicates that the Taijiquan training considerably improves athletes' body balance organizing ability, with positive impacts on both dynamic and static balance actions.

Keywords: body control ability; biomechanics; stork stand test (SST); functional reach test (FRT); Taijiquan; athletes; plantar pressure (PP)

1. Introduction

Taijiquan is a martial art form, a gymnastics exercise that promotes health, as well as the approach to expressing one's cultural identity. It improves the intestinal function of organs, conserves joint mobility, and stimulates the essential nervous system. Taijiquan is an elastic approach to exercise that requires a lot of effort or space to practice [1]. It provides clarity to understand and accessible to all individuals, regardless of environment or age, despite its strange notions. The technique is simple, yet effective in enhancing health, which has led to its acceptance and popularity across the world [2]. In martial arts contests, taijiquan competitive rules are essential, depending on both indoor and outdoor situations. These regulations preserve reliability, independence, and intelligibility, concern for athletes, coaches, and referees. They assure effortless improvement and precisely illustrate the athletes' mechanical ability in Taijiquan [3]. Athletes can contribute without discrimination under the same regulations attributable to these uniform standards and criteria for sports competitions. Additionally, they maintain the current advancement of Taijiquan technology, which reflects the athletes' high mechanical principles [4]. The eight techniques as shown in **Figure 1**,

form the foundation for all Taijiquan abilities and strategies. They represent the eight fundamental principles for developing the body's capabilities.

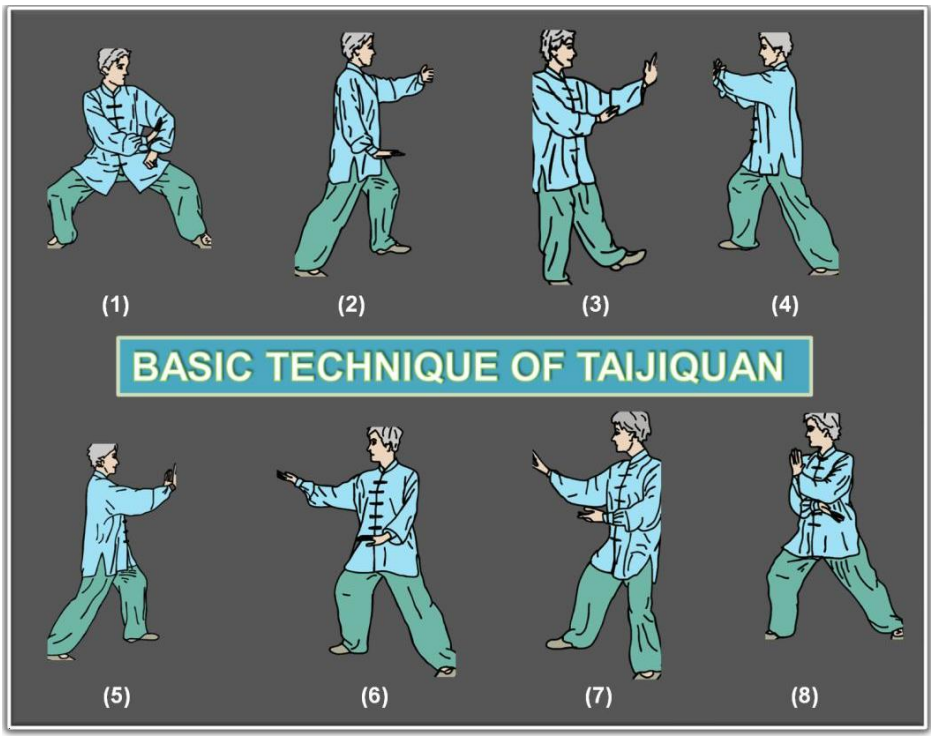

Figure 1. Fundamental techniques of Taijiquan.

Taijiquan is well-known for its sensitive motions and affinity for body culture. Taijiquan has been included in foreign cultural events as an effect of standardization, interaction with immigrants, and Kungfu making videos [5]. A generous of Taijiquan has been demonstrated a treat chronic disease by promoting calm activity, restoring cerebral operation, and healing neurologic anomalies. It also improves respiration, reduces neck, shoulders, and back pain, and assists in the treatment of cardiovascular disorders [6]. Taijiquan is a slow, circular, soft, and cohesive reflected exercise that assists the body to become more flexible and relaxed. It allows feasible for joints and muscles to extend, which facilitates soft tissue, joint, and muscle activity [7]. Regular exercise assists in preventing and managing spinal skeletal abnormalities, arthritis, and muscular atrophy in addition to maintaining joint flexibility. Movements involving taijiquan enhance knee function, blood flow, digestion, endurance, stability, and adaptability. It also guards against skeletal deformities, fractures, and other diseases by increasing the protein matrix in bones [8]. Taijiquan training can increase lower limb strength given that it constantly modifies the mechanism of muscle contraction with movement. This continual variation in muscle participation in contraction demands diverse muscle strengths to maintain a stable posture, as the way, muscles contract changes with different activities. As a consequence, practicing taijiquan has advantages for overall wellness [9]. The objective of this study is to analyze the biomechanical effects of Taijiquan practice on athletes' body control ability, specifically focusing on improvements in balance and stability.

The remaining part of the paper is presented as follows: Section 2 discusses

the research's related work, whereas Section 3 shows the materials and methods. Section 4 describes the results and discussion. Section 5 illustrates the research's conclusion.

2. Related works

Su et al. examined the effect of a systematic imagery training program on a 31-year-old women component [10]. The program, lasting 11 weeks, focused on five apparatuses: imagery content, perception, rapidity, environment, and distraction position. Results showed that the training improved description capability and assurance, improved timing accuracy, and stabilized association execution during actual performances. TCC, which is represented as Tai Chi Chuan, an ancient Chinese martial art, has been divided into two primary schools: competitive TCC and traditional TCC, which was investigated by the author Mengjiao et al. [11]. Though competitive tai chi, which incorporates influence from modern sports, emphasizes conventional methods and aesthetic appeal, traditional taichi focus on internal force growth via difficult, flowing motion and breath control. By investigating the variation, practitioners are superiorly able to realize the chronological and enriching value of the art as well as establish the training method that superlatively fits their requirements. The influence of a MTCC which is referred to as a mindfulness-enhanced Tai Chi Chuan intervention on the mental and substantial health of novices to TCC was examined by Qu et al. [12]. 119 healthy college students were separated into two groups: TCC group and MTCC group. Ten weekly ninety-minute training sessions were provided to both groups, with the MTCC group emphasizing the mindfulness mechanism. The findings revealed no discernible transformation in depression between the MTCC and TCC groups, while the MTCC group significantly enhanced mindfulness, anxiety, stress, and substantial strength.

Wu et al. suggested that Taijiquan training can enhance older people's cognitive task-switching skills [13]. The baseline white matter dependability of three intention white substance region groups was found to be analytical of the development in task-switching following a 12-week training regimen in TCC, according to a randomized and controlled experiment. Only the TCC group showed statistically significant gains in task switching and substantial evaluation, of the research. Following the Taijiquan exercise, the only self-determining forecaster of task-switching error reductions in white matter reliability was the baseline general fractional anisotropy (GFA) of the pre-fronto-striato-thalamo-prefrontal sphere fiber. Zhang and Zhu determined that in traditional Chinese sports, people suffering from amphetamine (ATS) drug abuse might benefit from it [14]. There were 38 Taijiquan and control groups in a parallel control trial for the research. The outcomes demonstrated that practicing Taijiquan exercise enhanced balance control, enhanced general health, energy, and psychological well-being, and decreased drug cravings. According to the study's findings, Taijiquan training improves dependent patients' rehabilitation both physically and mentally, lowering their cravings for drugs and averting relapses.

Yasol-Vicente et al. assessed that college students' flexibility, balance, and leg

strength were affected by Taijiquan exercises [15]. 76 students from three sections of physical education take components in 15-week Taijiquan program of instruction as a component of the investigation. The program lasted 80 min per session, which was held twice a week. The outcomes demonstrated a noteworthy enhancement in wall squat, sit-and-reach, and one-leg standing balance performance, demonstrating Taijiquan's efficaciousness in enhancing strength, flexibility, and equilibrium. Relaxation methods, including eastern martial arts training regimens similar to Taijiquan, can facilitate relief of stress. Based on Chinese understanding, Skrzęta et al. examined the well-known across the world for rehabilitation and health-related purposes [16]. Taijiquan's possible effects on people's psycho-emotional states are also being researched. The study examined the possible effects of Qigong and Taijiquan on emotional regulation using theoretical, instrumental, and survey research using internet databases. For a variety of health-related reasons, millions of individuals worldwide dedicate themselves to the practice. Ma and Dong's assessed Taichiquan Sanda and competitive Sanda revealed common characteristics in fighting styles that attack imaginary targets and ignore reality [17]. Both incorporate both aerobics and anaerobic workouts and adhere to biomechanical concepts. The research discussed the features of competitive Taichiquan Sanda, as well as the ideas and practices of in struction in colleges and universities. When Wushu martial arts and Taichiquan Sanda arecombined, it can captivate audiences with its beauty and advance Sanda's development, advancing Taichiquan's culture and well-being.

Langweiler investigated that in North American and European cities, beneficial and contemporary medical practices such as acupuncture, taijiquan, and traditional Chinese medicine are common, but lack current scientific research are frequently not recognized or regulated. Research frequently demonstrated these techniques' actual characteristics, which lessens their legitimacy [18]. The study examined the feasibility of obtaining recognition and acceptance for these technologies, considering their subjective character. Research determined to create a pluralistic healthcare system that maintains Western ideals and respects diversity. The martial art of taijiquan, which promoted health, it was utilized in the article as a model for incorporating these techniques. Ong described the Yin-Yang Balance; Taijiquan practice cultivates the cognitive sense of fascia tension. The consequence of the optimal body alignment, enhanced dexterity, and maximal force production for optimal based performance [18]. In Taijiquan, the primary way that Qi manifests is through the cognitive sense of fascial tension in bipedal balance. Qi nurturing creates a road to balance with observable results by reducing imbalance mistakes. Interior durability, which has its foundation in balance, it is the force that results from the movement of the body with Yin-Yang equilibrium. Qi is nurtured for health and core strength through Taijiquan practice. Ma and Jennings investigated the dissemination of information in a distinctive association that blends Taijiquan with techniques including Qigong, body-loosening training, and consideration [19]. It emphasized the principal organization that pupils have developed, emphasizing important body parts including the feet, scapula, spine, and Kua. According to the research, Neigong and Taijiquan are effective methods for adult physical re-education [20]. It helps practitioners develop muscular, and

potential body power for martial arts, while promoting overall well-being by relieving stress in both the mind and body via focused, contemplative exercise.

3. Materials and methods

The study investigated the biomechanical effects of Taijiquan practice on established athletes (n = 160) and the study design focused on their balance and stability. Statistical analysis is performed using SPSS 24.0, The FRT predicts the probability of falls and overall movement by measuring a person's stability by determining how far they may advance forward while walking without maintaining their balance. The SST assesses core strength and equilibrium by having a person stand on their right foot to provide as extended as they can, which gives information about their balancing abilities. To help detect areas of excessive pressure that can signal danger of injury, PPM uses specific devices to study the placement of tension over the foot while standing or moving. Measuring the impact of treatments like Taijiquan practice on performance is made possible by the paired *t*-test, a statistical technique that compared the means of two associated groups, such as before and after treatment data, to see if it indicates a significant change with significant differences among the groups evaluated at <0.05 to determine the effects of Taijiquan on body balance.

3.1. Data collection

This research involves the random assignment of 160 athletes, with these parameters ensuring the two groups, the experimental group (n = 90 athletes, comprising 60 males and 30 females) and the control group (n = 70 athletes, comprising 45 males and 25 females), are equivalent when analyzing the biomechanical effects of Taijiquan practice on athletes' body balance. **Table 1** represents the demographic variables such as age, height, body weight, and training time were measured for comparison. These metrics ensure that the two groups are comparable in analyzing the biomechanical effects of Taijiquan practice on athletes' body balance.

Table 1. Characteristics of demographic variables.

Demographic experimental group variables (n = 90)	**Control group (n = 70)**	**Total (n = 160)**
Gender		
Male	60	45	105
Female	30	25	55
Age (years)		
Mean (SD)	23.5 (3.2)	24.1 (2.8)	23.8 (3.0)
Height (m)		
Mean (SD)	1.75 (0.07)	1.73 (0.08)	1.74 (0.08)
Body weight (kg)		
Mean (SD)	70.5 (8.6)	69.8 (7.9)	70.2 (8.3)
Training time (years)		
Mean (SD)	4.2 (1.5)	4.8 (1.4)	4.5 (1.5)

3.2. Purpose of data splitting

The collected data is split into 2 different groups, such as the experimental group (n = 90) consisting of athletes and the control group (n = 70) consisting of athletes.

- Experimental group: The research involves athletes (n = 90) who participated in 8 months of Taijiquan exercises, focuses on balance, flexibility, and coordination. Standard training sessions have been conducted to enhance the body responsiveness and control, to promote these fundamental components of Taijiquan practice.
- Control group: The study involves (n = 70) athletes who did participate bench press and leg press exercise program for 8 months that serves as a baseline to contrast the Taijiquan practice effects with the experimental group, who preserve the regular training routines without any balance- focused or any additional interventions.

After completing the 8 months regimen, the athletes' balance capabilities have been assessed through standardized tests, which include the Functional Reach Test (FRT), and the Stork Stand Test (SST), along with dimensions of plantar pressure (PPM), to estimate the Taijiquan effectiveness on their equilibrium as well as immovability. The control group requires targeted the balance training, which allows the researchers to determine the specific benefits of Taijiquan practice.

3.3. Study design

This examination evaluates the control and experimental groups to assess the outcome of involved Taijiquan on athletes' balance and stability utilizing a supervised experimental process by utilizing FRT, SST, and PPM.

- Functional Reach Test (FRT): The FRT is widely utilized measurement tool that measures an individual's ability to maintain balance while reaching promote. Participants stand upright and instructed to reach as far as possible without losing their stability. This test is significant as it imitates an individual's dynamic balance and stability during functional movements, which are essential for daily activities and athletic performance.
- Stork Stand Test (SST): This test evaluates static balance by requiring participants to stand on one leg while the other foot is placed against the knee of the standing leg. They must maintain this position for as long as potential. The duration for which they can maintain the position without support or losing their balance is recorded. This test specifically assesses the athlete's capacity to sustain stability and manage in a static attitude, an important characteristic of overall balance.
- Plantar Pressure Measurement (PPM): Plantar pressure assessments provide insights into the distribution of pressure across the feet while standing or during association. Dedicated pressure sensors or platforms are used to measure how force is distributed across the foot. This test facilitates recognizing balance systematize and postural stability by analyzing how effectively the participants engage their feet and lower limbs during a variety of tasks.

3.4. Statistical analysis

The statistical analysis was carried out using the SPSS 24.0 software platform for the athlete's replies to analyze the influence of Taijiquan in the research. The FRT predicts the probability of falls and overall movement by measuring a person's stability by determining how far they may advance forward while walking without maintaining their balance. The SST assesses core strength and equilibrium by having a person stand on their right foot to provide as extended as they can, which gives information about their balancing abilities. To help detect areas of excessive pressure that can signal danger of injury, PPM uses specific devices to study the placement of tension over the foot while standing or moving. Measuring the impact of treatments like Taijiquan practice on performance is made possible by the paired *t*-test, a statistical technique that compared the means of two associated groups, such as before and after treatment data, to see if it indicates a significant change. The independent samples $-e$ has been utilized to assess differences among groups. A significance threshold (0.05) has been established. A significant difference is shown through a $-au$ of less than 0.05, and a significant distinction is indicated by a $-aue$ of less than 0.01.

4. Results

The present research determines that the Taijiquan practice significantly improves the athletes' body balance control ability, with a positive impact on both dynamic as well as static equilibrium procedures. This research establishes the significant improvements in athletes' body control abilities through Taijiquan, as evidenced by the FRT, SST, and PPM consequences. The data distribution was examined for homogeneity of variance and normality tests to verify that statistical procedures were adequate. The findings supported the use of paired *t*-tests to compare pre- and post-test results by showing that the data satisfied the assumptions of normality and equal variances. These tests confirm that the Experimental group reported gains in stability and balance are statistically significant.

4.1. Performance of FRT

The FRT constitutes an essential assessment tool for assessing the balance and stability during functional movements, crucial for daily activities as well as athletic performance. In the experimental group, the mean distance has been increased considerably from 21.0 cm before involved Taijiquan to 25.8 cm after practicing, with a *t*-value (5.12) along with a highly significant *p*-value (0.0001), which suggests a consequential improvement in dynamic strength and stability. The FRT before and after enthusiastic Taijiquan results for both experimental and control groups are represented in **Table 2**.

The FRT was used to measure the influence of Taijiquan practice on equilibrium and coordination in the control as well as the experimental groups, and the results are shown in the table. With a *t*-value of 5.12 and a p-value of 0.0001, the group receiving the experiment's mean reach range improved statistically substantially from 21.0 cm (SD = 3.1) prior to Taijiquan practice to 25.8 cm (SD = 3.2) during the 8-month program. With a t-value of 0.28 and a p-value of 0.783, the control group, which

didn't participate in Taijiquan practice, demonstrated a small decrease in mean reach geographical distance, going from 21.4 cm (SD = 3.0) to 21.2 cm (SD = 3.2). This suggests that there was no meaningful change. These findings imply that practicing Taijiquan helps athletes' equilibrium and muscle control, especially.

Table 2. Evaluation of functional reach test (before and after Taijiquan practice).

	Time	**Mean (M)**	**Standard Deviation (SD)**	***t*-value**	***p*-value**	**Significance**
Experimental Group	Before Taijiquan	21.0 cm	3.1	5.12	0.0001	Significant
	After Taijiquan	25.8 cm	3.2			
Control group	Before Taijiquan	21.4 cm	3.0	0.28	0.783	Not Significant
	After Taijiquan	21.2 cm	3.2			

The control group showed no significant changes, with a slight decrease in mean reaches distance between 21.4 cm and 21.2 cm, as well as a non-significant *t*-value (0.28) and *p*-value (0.783). The evaluation outcome of the control and experimental group evaluation, in FRT is represented in **Figure 2**.

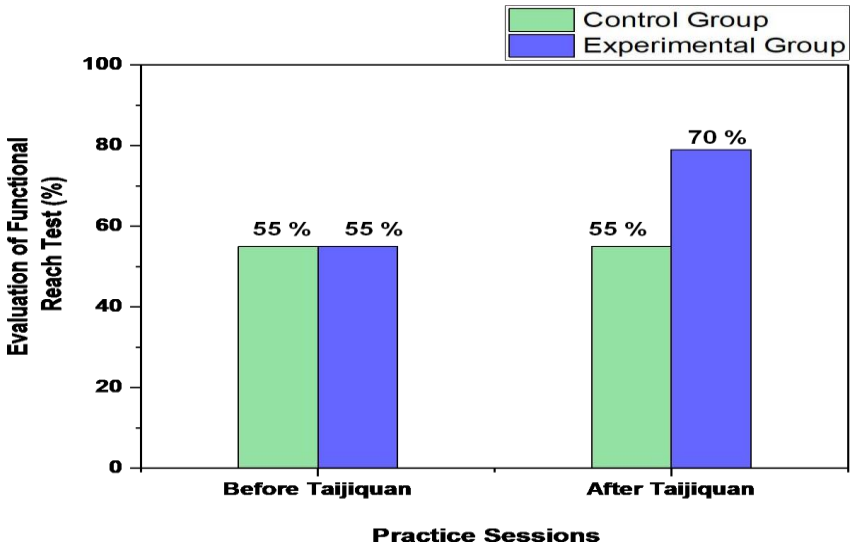

Figure 2. Graphical outcome of functional reach test.

This demonstrates that Taijiquan practice had a significant positive effect on balance in the experimental group, while such effect was experimental in the control group.

4.2. Performance of SST

Table 3 determines the outcome of the SST for both the experimental and control groups, before and after practicing Taijiquan. The experimental group establishes a

considerable improvement in their equilibrium, with an increased mean time from 34.5 s before Taijiquan to 40.6 s after session, reflected a strong *t*-value (4.65) and a highly considerable *p*-value (0.0003).

Table 3. Numerical findings of SST (before and after Taijiquan practice).

Group	Time	Mean standard (M)	Deviation (SD)	*t*-value	*p*-value	Significance
Experimental Group	Before Taijiquan	34.5 s	4.7	4.65	0.0003	Significant
	After Taijiquan	40.6 s 4.5				
Control group	Before Taijiquan	35.2 s	5.0	0.63	0.529	Not Significant
	After Taijiquan	35.3 s 5.1				

The effect of Taijiquan practice on balancing endurance, expressed in seconds, for both the experimental and control groups is shown in the table. With a t-value of 4.65 and a p-value of 0.0003, the experimental group's indicate regulate time increased substantially from 34.5 s (SD = 4.7) prior to Taijiquan perform to 40.6 s (SD = 4.5) following the eight months prevention. With a t-value of 0.63 and a p-value of 0.529, showing no significant distinction, the control group, which did not participate in Taijiquan, demonstrated a modest change in average equilibrium time from 35.2 s (SD = 5.0) to 35.3 s (SD = 5.1). These results imply that practicing Taijiquan improves balancing endurance, as shown by the Significant progress was noted in the experimental group **Figure 3** represents the comparison outcome of the control and experimental group evaluation, in the stork stand test.

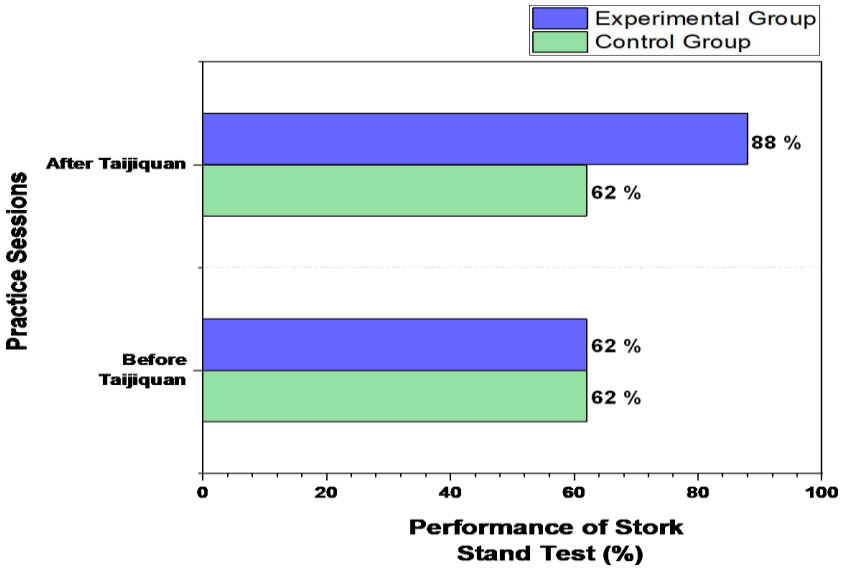

Figure 3. Graphical outcome of stork stand test.

In contrast, the control group showed minimal change, with the meantime slightly from 35.2 s to 35.3 s, but this difference was not statistically significant, as indicated through a low t-value (0.63) and a non-significant p-value (0.529). This indicates that Taijiquan practice had a positive effect on static balance in the experimental group.

Performance of plantar pressure measurement

The experimental group showed a significant improvement in plantar pressure, with the mean increased from 17.6 units (SD = 3.0) to 20.5 units (SD = 2.8) after Taijiquan practice. The t-value of 3.84 and p-value of 0.0009 indicate that the improvement is statistically significant. **Table 4** compares the PPM of the experimental and control groups before and after practicing Taijiquan. The comparison outcome of the plantar pressure measurement is depicted in **Figure 4**.

Table 4. Findings of plantar pressure measurement (before and after taijiquan practice).

Group	Time	Mean (M)	Standard deviation (SD)	*t*-value	*p*-value	Significance
Experimental Group	Before Taijiquan	17.6 units	3.0	3.84	0.0009	Significant
	After Taijiquan	20.5 units	2.8			
Control group	Before Taijiquan	17.9 units	3.1	0.42	0.675	Not Significant
	After Taijiquan	18.0 units	3.0			

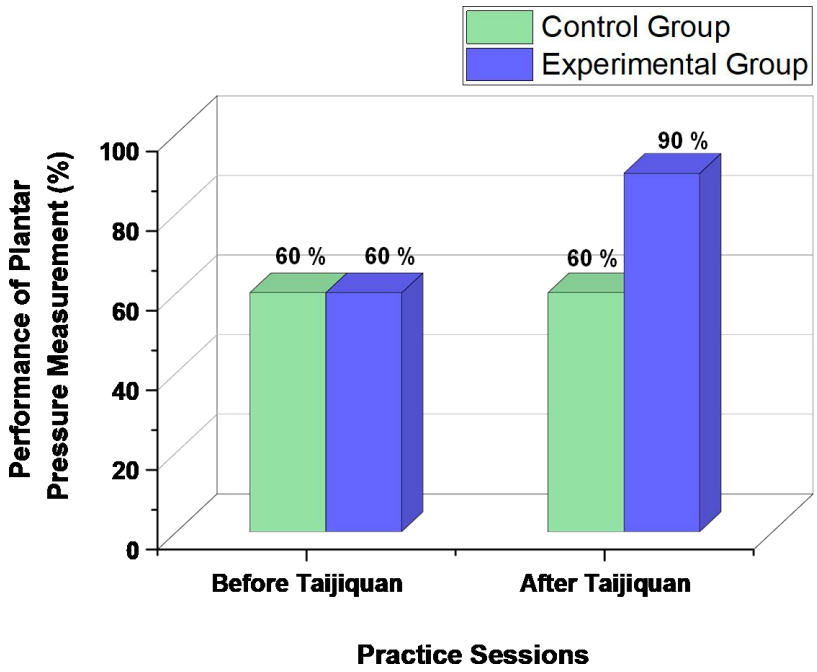

Figure 4. Graphical outcome of plantar pressure measurement.

The impact of Taijiquan practice on reference and equilibrium, expressed in units, are compiled here for both the experimental and control groups. With a t-value of 3.84 and a p-value of 0.0009, the experimental group's mean stability improved dramatically, rising from 17.6 units (SD = 3.0) prior to Taijiquan practice to 20.5 units (SD = 2.8) following the training session. With a t-value of 0.42 and a p-value of 0.675, indicating not to be significant, the uncontrolled group, which did not practice

Taijiquan, had a small reduction in consistency from 17.9 units (SD = 3.1) to 18.0 units (SD = 3.0). These findings suggest that practicing Taijiquan helps the experimental group become more stable and manage their bodies.

The control group, which didn't perform Taijiquan, exhibited an insignificant change in the plantar pressure, with the mean shifting slightly from 17.9 units (SD = 3.1) to 18.0 units (SD = 3.0), and a non-significant *t*-value (0.42) and *p*-value (0.675). This determines the positive effect of Taijiquan on PPM along with equilibrium in the experimental group.

4.3. Performance of paired *t*-test

A statistical technique for comparing the means of two comparable groups for example, pre- and post-training measurements to ascertain whether an important distinction exists is the procedure known as the It evaluates the conditioning intervention's efficacy on balance and stabilization parameters in order to analyze how Taijiquan affects athletes' capacity for directing their bodies. The movement abilities measurement result could find in **Table 5**.

Table 5. Movement abilities measurement (before and after taijiquan practice).

Factor	Pre-training mean	Post-training mean	Mean difference	Standard deviation	*t*-value	*p*-value
Bearing maintenance (s)	12.5	16.2	3.7	1.5	6.2	<0.001
Stability control (score)	5.4	7.1	1.7	0.9	5.75	<0.001
Average pressure area (cm^2)	25	20.5	−4.5	2	−4.75	<0.001
Creative stability measurement	8	6.5	−1.5	0.7	−5	<0.001

The findings of the investigation evaluating the effect of Taijiquan instruction on several aspects of players' movement abilities are shown in the paired *t*-test table. For four important metrics bearing servicing, stability management, typical pressure area, and innovative stability measurements it contains the mean values before and after training. The mean changes show that after training, average pressure area fell by −4.5 cm^2, creative stability measures decreased by −1.5 points, and bearing maintenance improved by 3.7 s and stability control by 1.7 points. The estimated *t*-values and associated *p*-values show significant variation among all factors, with *p*-values less than 0.001 suggesting strong predictive value. The standard deviation of each factor represents the variability in the observations. All things considered, these findings imply that practicing Taijiquan helps athletes' equilibrium, stability, and stress dispersion.

Discussion

Athletes may be better equipped to preserve their primary focus of attraction and avoid falls throughout dynamic exercises, according to the FRT results, which show improved equilibrium and stability. The SST results, on the other hand, show enhanced core power and coordination, both of which are essential for athletic excellence. These conclusions are further supported by the PPM data, which show greater foot steadiness and a decrease in average pressure area, both of which are signs of a more efficient weight distribution and a lower risk concerning accident. The clinical importance of these improvements is supported by a paired-*t*-test analysis, which also verifies that

the advantages are real. All things considered, these findings advance our knowledge of how Taijiquan might be an effective training technique for improving athletes' morphological abilities linked to control and balance.

5. Conclusion

The findings of this study indicates that the Taijiquan practice significantly enhanced the athletes' body control ability, representing marked improvements in both focus and static balance as evidenced by the results from the FRT, SST, and PPM. Research revealed that Taijiquan practice significantly improved athletes' body balance control abilities, as evidence by distinguished development in both dynamic and static balance procedures. The FRT results revealed a mean reach distance increase from 21.0 cm to 25.8 cm (t-value = 5.12, p-value = 0.0001) for the experimental group, indicating a considerable enhancement in dynamic balance. Additionally, SST showed a indicate instance improvement from 34.5 s to 40.6 s (t-value = 4.65, p-value = 0.0003), reflecting significant advancements in static equilibrium control. Furthermore, PPM improved from 17.6 units (SD = 3.0) to 20.5 units (SD = 2.8) (t-value 260 = 3.84, p-value = 0.0009), suggesting more efficient force distribution and superior overall stability. The control group exhibited minimal changes across all tests, reinforcing the effectiveness of Taijiquan in promoting enhanced balance and stability among athletes.

Limitation and future scope

This research is intended to investigate the long-term effects of Taijiquan on athletes' equilibrium and body control, its applicability across dissimilar exercise coaching and age groups, and the physiological mechanisms underlying these enhancements. However, its short involvement stage focused on a specific athlete population may limit its generalizability. Future studies could benefit from larger sample sizes and diverse athletic backgrounds.

Ethical approval: Not applicable.

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

References

1. Yuan, W., Cherkashin, I., Cherkashina, E., Zhang, X.Q., Kruszewski, A. and Barashkov, I., 2020. Influence of taijiquan martial art on the indicators of external respiration function and psycho physiological state of basketball players. Arch. Budo, 16, pp.107-117. https://doi.org/10.30564/jim.v10i2.3365
2. Dell'Olio, A.J., 2022. Taijiquan as a way of life: The philosophy of Cheng Man-ch'ing. Sport, Ethics and Philosophy, 16(4), pp.461-475. https://doi.org/10.1080/17511321.2021.1981989
3. Liu, P., 2022. Research on the Evaluation of Taijiquan under the Background of Competitive Sports. Journal of Sociology and Ethnology, 4(5), pp.11-14. https://doi.org/10.23977/jsoce.2022.040504
4. Porchet, P., 2022. Translating Chinese Traditional Culture into institutional Sport: An ethnographic study of taijiquan in China. Martial Arts Studies, 12, pp.33-46. https://doi.org/10.18573/mas.155
5. Xiujie, M., Jennings, G. and Brown, D., 2022. Diffusion, transformation, and hybridization: Taijiquan body culture in the United Kingdom. Communication and Critical/Cultural Studies, 19(4), pp. 402-420. https://doi.org/10.1080/14791420.2022.2128196

6. Guo, M., 2021. Application of warm-up exercise based on intelligent body data analysis model in Taijiquan exercise. In International Conference on Information Technology, Education and Development (pp. 335-41). https://doi.org/10.25236/icited.2021.064
7. Zhang, Y., 2024. The spread and influence of Taijiquan in the background of globalization. International Journal of New Developments in Education, 6(3). 292 https://doi.org/10.25236/IJNDE.2024.060301
8. Ko, B.J., Hsu, T.Y. and Huang, C.F., 2020. The effects of tai chi chuan exercise training on countermovement jump performance in the elderly. Research in Sports 295 Medicine, 28(4), pp.563-571.
9. Ren, Y., Xue, H. and Li, A., 2020. Effect of Microscope Intervention on Taijiquan on Clinical Rehabilitation of Elderly Patients with Knee Arthritis. Investigación 298 Clínica, 61(1), pp.312-321. https://doi.org/10.2478/amns.2020.0051308
10. Su, N., Si, G. and Liang, W., 2024. Systematic imagery training for Taijiquan competitive routines: A case study. Asian Journal of Sport and Exercise Psychology. 301 https://doi.org/10.1016/j.ajsep.2024.08.002
11. Mengjiao, G., Hongke, J. and Jinyong, S., 2024. The Difference between Competitive Tai Chi Chuan and Traditional Tai Chi Chuan and Training Countermeasures. Journal of 304 Human Movement Science, 5(2), pp.68-73. https://doi.org/10.23977/jhms.2024.050210
12. Qu, P., Zhu, X., Zhou, H., Kang, Z., Li, R., Wen, J., Pan, F., Liu, Y., Zhu, T., Cao, Q. and Wang, X., 2024. The effects of mindfulness enhanced Tai Chi Chuan training on mental and physical health among beginners: a randomized controlled trial. Frontiers in 308 Psychology, 15, p.1381009. https://doi.org/10.3389/fpsyg.2024.1381009
13. Wu, M.T., Tang, P.F., Tseng, W.Y.I., Hsu, Y.C., Chen, Y.J., Goh, J.O., Chou, T.L., Chang, Y.K., Gau, S.S.F. and Lan, C., 2021. Integrity of the Prefronto-striato-thalamo- prefrontal loop predicts Tai Chi Chuan training effects on cognitive task-switching in middle-aged and older adults. Frontiers in Aging Neuroscience, 12, p.602191. 313 https://doi.org/10.3389/fnagi.2020.602191
14. Zhang, Z. and Zhu, D., 2020. Effect of Taijiquan Exercise on Rehabilitation of Male Amphetamine‐Type Addicts. Evidence‐Based Complementary and Alternative 316 Medicine, 2020(1), p.8886562. https://doi.org/10.1155/2020/8886562
15. Yasol-Vicente, J.L., 2021. Improving strength, flexibility, and balance using Taijiquan exercises.
16. Skrzęta, M., Włodyka, R., Pop, T., Włodyka, K., Piasecka, K., Rusek, W. and Cynarski, W.J., 2021. Attempts to assess the impact of Taiji Quan and Qigong exercises on emotional states. Ido Movement for Culture. Journal of Martial Arts Anthropology, 21(3), 322 pp.67-78. https://doi.org/10.14589/ido.21.3.9
17. Ma, Y. and Dong, Q., 2022. Discussion on Taichiquan Sanda and Competitive Sanda Technique and Teaching. International Journal of New Developments in Education, 4(1). 325 https://doi.org/10.25236/IJNDE.2022.040102
18. Langweiler, M.J., 2021. Evidence-Based Medicine and the Potential for Inclusion of Non-Biomedical Health Systems: The Case for Taijiquan. Frontiers in Sociology, 5, 328 p.618167. https://doi.org/10.3389/fsoc.2020.618167
19. Ong, C.P., 2021. Healthcare and sports from the perspective of qi, fascia, and taijiquan. Journal of Integrative Medicine, 10(2). https://doi.org/10.30564/jim.v10i2.3365
20. Ma, X. and Jennings, G., 2021. “Hang the Flesh off the Bones”: Cultivating an “Ideal Body” in Taijiquan and Neigong. International Journal of Environmental Research and 333 Public Health, 18(9), p.4417. https://doi.org/10.3390/ijerph18094417