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The Effect of Taijiquan Exercise Pattern on the Exercise Commitment and Behavior of Elderly Taijiquan Exerciser

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Abstract

This controlled experiment aimed to assess the effects of a Taijiquan exercise pattern on exercise commitment and behavior among elderly Taijiquan practitioners. Participants (N=40) from Jiaozuo city, China, were divided into an experimental group (N1=20) and a control group (N2=20). Demographic information was collected, and participants completed the experiment, including measures of the Taijiquan Exercise Commitment Scale (TECS). Descriptive statistics were used for data analysis. No significant differences in Taijiquan exercise behavior and commitment were observed between the experimental and control groups before the experiment. However, after the 12-week intervention, significant differences in exercise behavior and commitment were found between the two groups. The control group showed no significant changes, while the experimental group exhibited noteworthy improvements in both exercise behavior and commitment. These findings demonstrate the effectiveness of the Taijiquan exercise pattern in enhancing exercise commitment and behavior among elderly practitioners. The results support the use of the Taijiquan Exercise Pattern (TEP) to improve exercise engagement in this population. Incorporating TEP into tailored exercise programs for elderly Taijiquan practitioners may yield substantial benefits. Further research and long-term follow-ups are necessary to explore the sustained effects of TEP on exercise commitment and behavior in this demographic.

Key words: *Taijiquan; Exercise Commitment; Chinese Elderly Taijiquan Exerciser.*

Introduction

In response to the global aging population and the need to enhance the well-being of elderly individuals, the World Health Organization (WHO, 2018) has emphasized the importance of maintaining healthy behaviors, including regular physical activity and strength training to preserve muscle mass. However, despite these recommendations, global physical activity levels remain low and stagnant (Lightfoot et al., 2019). Taijiquan, a component of traditional Chinese medicine, has gained popularity worldwide as a means to promote health and prevent illness (Li, 2016). Numerous studies have explored the application of Taijiquan interventions among older adults, emphasizing the need to tailor such interventions to fit the specific exercise program and contextual factors of the community (Stevens et al., 2014). In the context of Taijiquan exercise for the elderly, many individuals struggle to adhere to the practice, with some discontinuing participation after an initial period. Therefore, investigating strategies to enhance adherence, reduce withdrawal rates, and increase the frequency of Taijiquan exercise among older adults is a valuable

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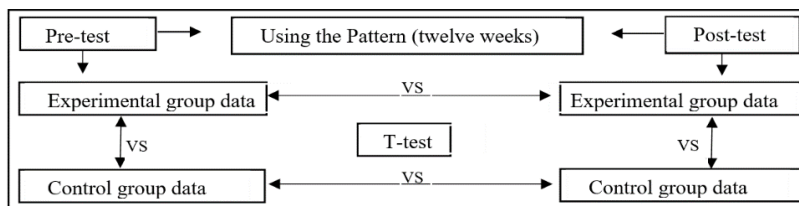
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research topic. One psychological construct that holds promise for understanding exercise behavior is commitment (Corbin et al., 1987). Commitment refers to a person's psychological pledge or obligation towards continued engagement in exercise (Martin et al., 1998). It provides insight into the motivational factors that predict commitment in sport settings (Choosakul et al., 2009). Research has shown that maintaining and improving exercise commitment is a key factor in promoting exercise participation (Wilson et al., 2004). Predicting and explaining exercise behavior through exercise commitment has been found to be more reliable (Chen & Li, 2005). In 2022, SUN Xianghao et al. developed a Taijiquan Exercise Pattern (TEP) based on the Exercise Commitment Model validated by Wilson in 2004. In this study, we aim to test the effectiveness of TEP through a 12-week controlled experiment, so that demonstrate the effect of TEP intervention on exercise commitment and behavior of elderly Taijiquan exercisers. The research objective was achieved by implementing the TEP intervention experiment from May 31, 2022, to August 19, 2022. A 12-week control experiment was conducted, and a comparative analysis was carried out using the framework outlined in the following sections.

Figure One the Experimental Idea to Implement TEP-CE



Participants

The study followed ethical guidelines, and all participants provided written informed consent after being informed about the experimental procedure and associated risks. The research was conducted in accordance with the regulations set by the Committee on Ethics for Research in Humans at Mahasarakham University, Division of Research (MSU-EC 054-347/2022).

A total of 40 elderly individuals and one qualified leader were recruited to examine the effect of the Taijiquan Exercise Pattern (TEP). The screening criteria for elderly participants were as follows: (1) They should have the ability to answer questions independently, participate in physical activities normally, and complete the experimental process. (2) Their age must be between 60 and 75 years old. (3) They should have 3-12 months of experience in practicing Taijiquan. (4) Their regular Taijiquan exercise place should be in the park at Jiefang District, Jiaozuo city, China.

The screening criteria for the leader were: (1) Possession of a social sport instructor qualification and a Taijiquan master certificate, along with at least 5 years of Taijiquan guidance experience. (2) Demonstration of high organizational and interpersonal communication skills to ensure the smooth implementation of the experiment. (3) Ability to participate in and complete the entire experimental process. (4) The Taijiquan exercise station where the leader is located should have at least 10 participants.

The sampling procedure adopted was snowball sampling. The researcher initiated the recruitment process, where 40 elderly Taijiquan exercisers aged 60 to 75, sharing similar demographic characteristics, were recruited from the elderly association in Jiaozuo Jiefang District, China. These participants were then evenly divided into the control and experimental groups. The researcher ensured that volunteers

fully understood the reasons for recruitment, the requirements for participation, and the precautions involved to ensure their informed and willing participation in the experiment.

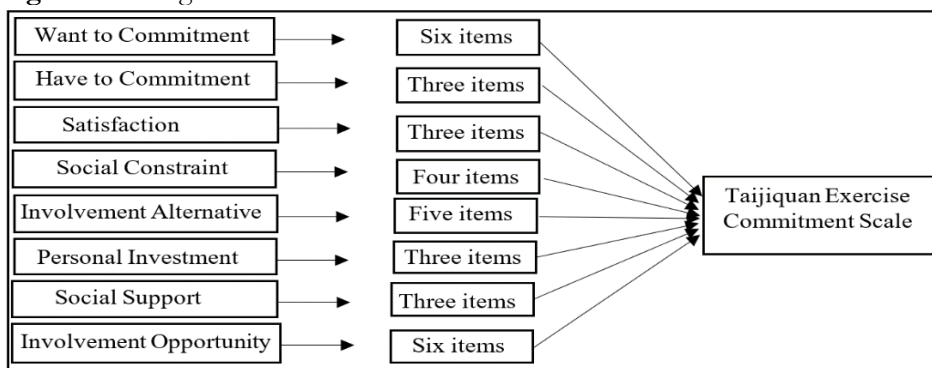
Instrument

Taijiquan Exercise Commitment Scale (TECS)

In this study, we employed the Taijiquan Exercise Commitment Scale (TECS), which was validated in Dr. SUN Xianghao's dissertation at Mahasarakham University. The TECS consists of 8 factors and 33 items designed to measure various aspects of exercise commitment within the context of Taijiquan.

The TECS encompasses the following factors: Want to Commitment (WC), Have to Commitment (HC), Satisfaction (Sat), Social Constraint (SC), Involvement Alternative (IA), Personal Investment (PI), Social Support (SS), and Involvement Opportunity (IO). Please refer to figure two for a visual representation.

Figure Two Eight Factors of Exercise Commitment Scale



Taijiquan Exercise Pattern (TEP)

Based on the Exercise Commitment model and the practice of Taijiquan, SUN Xianghao developed the Taijiquan Exercise Pattern (TEP). The TEP comprises five key aspects: intervention of Taijiquan exercise content, audio language intervention for Taijiquan exercisers, intervention of leader in Taijiquan exercise, mutual intervention among Taijiquan participants, and the monitoring record form for Taijiquan exercise.

(1) The intervention of Taijiquan exercise content. It refers to the arrangement of Taijiquan exercise content suitable for the level of the exerciser according to a certain program and stage in the Taijiquan exercise for the elderly, increasing the level and richness of the exercise content. (2) The audio language intervention for Taijiquan exercisers. It refers to two audio language interventions developed based on TECS, requiring the experimental group to listen to or follow reading the first set every at least once before Taijiquan exercise for 1-6 weeks, and the second set for 7-12 weeks. (3) The intervention of leader in Taijiquan exercise. Based on the TECS, the leader needs to make three types of Taijiquan exercise relevant cases from “self, the other, and the combination of self and the other”. Each factor produces 6 cases, $6 \times 6 = 36$ cases. They are used at 1-4 weeks, 5-8 weeks and 9-12 weeks respectively. In each time Taijiquan exercise instruction, the leader needs to select a case to explain, to guide the participants’ Taijiquan exercise. (4) The mutual intervention among Taijiquan participants. Based on the TECS, participants need to find the advantages of other participants from the three aspects of “self, others, and the combination of self and others”, and encourage other

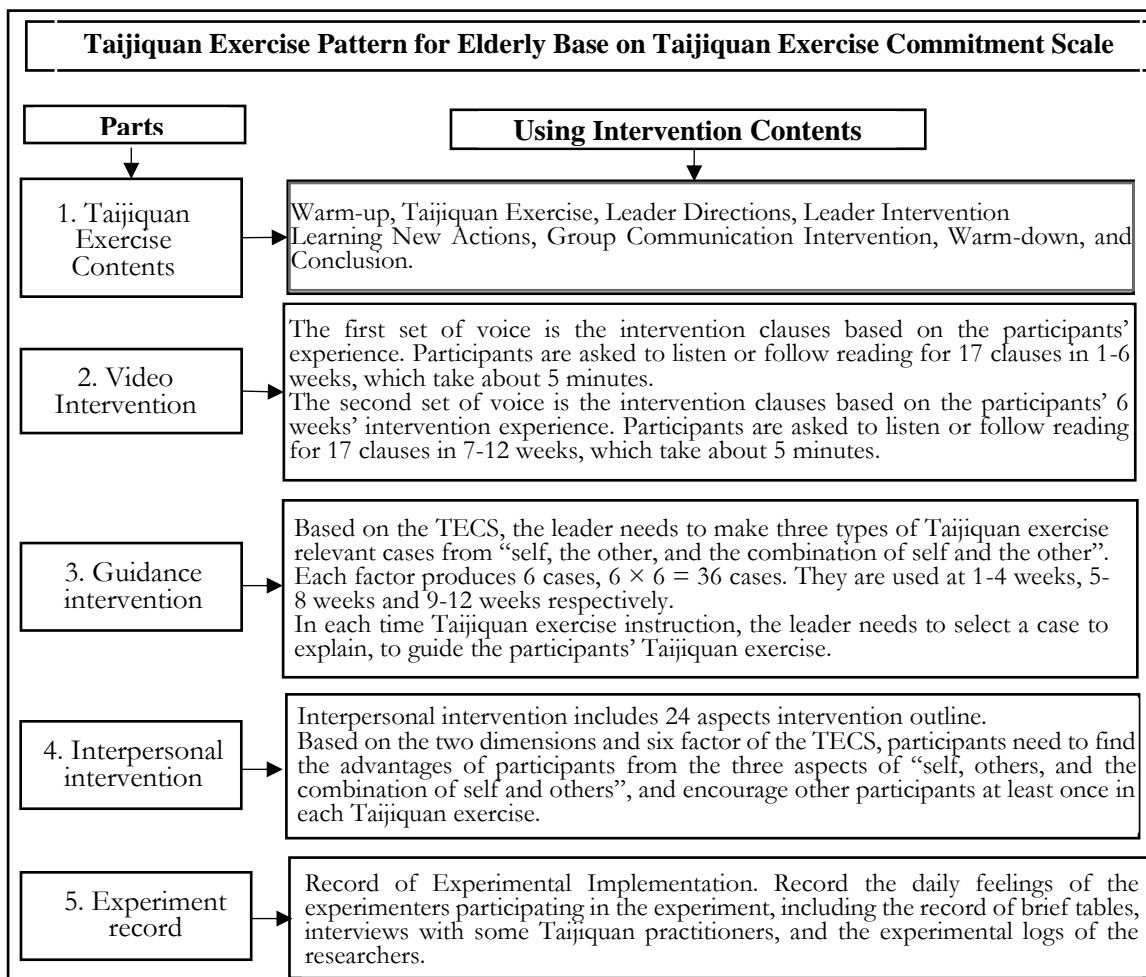
participants at least once in each Taijiquan exercise. (5) The monitoring record form for Taijiquan exercise intervention. To record and supervise the quality of participants' Taijiquan exercise. We have developed a specialized exercise record form. During the experimental process, participants need to record their actual participation in Taijiquan exercises each time.

The partial content detail of them are follow as supporting information S1.

The TEP serves as a guiding framework for the intervention group, while the control group follows the conventional Taijiquan exercise approach. The pattern outline is presented in Figure 3. Throughout the implementation experiment, the intervention group adheres to the specific intervention content outlined in the TEP.

Due to the use of positive psychological cues in this intervention experiment, except for the need for participants to increase Tai Chi content related to this experiment and participate in the experiment at the required time, which is a requirement of the participants, it will not have any negative impact on the participants.

Figure Three Taijiquan Exercise Pattern base on TECS



SPSS 23.0

The data processing and statistical analysis were conducted using SPSS 23.0.

Exercise Behavior Index

The TECS-CE serves as a valid measure of exercise behavior among the elderly, encompassing three indicators of physical activity: exercise frequency (number of sessions per week), exercise duration (length of each session), and exercise intensity. Additionally, it includes a sports persistence index. The questionnaire items pertaining to exercise behavior are as follows: (1) How frequently do you engage in Taijiquan practice each week? A) 1-3 times; B) 3-5 times; C) 5-7 times; D) More than 7 times. (2) What is the duration of each Taijiquan session? A) Approximately 30 minutes; B) Approximately 1 hour; C) 1-1.5 hours; D) More than 1.5 hours. (3) What physiological changes do you experience after engaging in Taijiquan? A) No noticeable changes; B) Mild increase in body temperature; C) Minimal sweating; D) Moderate sweating; E) Profuse sweating. (4) How long have you been practicing Taijiquan? A) Three months to one year; B) 1-3 years; C) 3-5 years; D) More than 5 years.

Results and Analysis

Descriptive Statistics of Subjects

Data of Experimental and Control Group Before Experiment

In order to recruit reasonable participants from the experimental group and the control group, and ensure the consistency of the experimental subjects in terms of Taijiquan exercise commitment and behavior before the experiment, we recruited 68 elderly Taijiquan exercisers to fill in the questionnaire **(See supporting information S2)** on Demography characteristics, Taijiquan exercise commitment and behavior, and finally selected 40 as the experimental subjects for this study,

We conducted a questionnaire survey on the Demography characteristics and exercise commitment and behavior of the recruited subjects. The descriptive statistics of the obtained data about the demographic characteristics, Taijiquan exercise behavior, and commitment data from both the Experimental and Control Groups are as follows:

Descriptive Statistics of the Demographic Characteristics

Descriptive statistical analysis of the demographic characteristics was conducted using SPSS 23.0 (as shown in Table 1).

Experimental Group: The experimental group comprised 20 individuals, including 5 men and 15 women, accounting for 25% and 75%, respectively. Among them, 8 individuals were aged 60-65, 10 individuals were aged 65-70, and 2 individuals were aged 70-75, representing 40%, 50%, and 10% respectively. All participants exercised in the Jiefang district of Jiaozuo City. In terms of monthly expenses, 18 individuals spent between 0-200 yuan per month, while 2 individuals spent between 200-500 yuan per month, accounting for 90% and 10% respectively.

Control Group: The control group consisted of 20 individuals, including 5 men and 15 women, accounting for 25% and 75% respectively. Among them, 7 individuals were aged 60-65, 10 individuals were aged 65-70, and 3 individuals were aged 70-75, representing 35%, 50%, and 15% respectively. Similar to the experimental group, all participants exercised in the Jiefang district of Jiaozuo City, China. All 20 individuals spent between 0-200 yuan per month, accounting for 100%.

The above descriptive statistics found that there was no difference in Demography characteristics between the experimental group and the control group.

Leader for the Experimental Group: Mr. A served as the leader for the experimental group. His resume is as follows: Mr. A is a 65-year-old male who has been practicing Taijiquan for 25 years. He specializes in Yang's Taijiquan and Chen's Taijiquan. He holds the qualification of a national-level social sports instructor and has more than 10 years of experience guiding Taijiquan exercises for the elderly. The association he belongs to has more than 500 practitioners, and he possesses strong organizational and interpersonal skills.

Table 1 Descriptive Statistics of Demographic Characteristics of the Experiment and Control Group before the Experiment N=40

Experiment Group	Control Group
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Name	Option	Frequency	Percentage (%)	Frequency	Percentage (%)
Gender	Male	5	25.000	5	25.000
	Female	15	75.000	15	75.000
Age	60-65	8	45.000	7	35.000
	65-70	10	50.000	10	50.000
	70-75	2	5.000	3	15.000
Place	Jiefang District	20	100.000	20	100.000
Spend	0-200 yuan	18	90.000	20	100.000
	200-500 yuan	2	10.000	20	100.0
Total		20	100.0	20	100.0

Descriptive Statistics of the Taijiquan Exercise Behavior

Descriptive statistics were performed using SPSS 23.0 to analyze various indicators of Taijiquan exercise behavior among the selected elderly Taijiquan exercisers in the Experimental Group. The results are presented in Table 2, which includes exercise duration, exercise frequency, exercise intensity, and exercise adherence scores.

Experimental Group: The average duration of Taijiquan exercise per session for the elderly participants was approximately 1 hour. On average, they engaged in Taijiquan exercise 3 to 5 times per week. The intensity of each Taijiquan exercise session ranged from slight sweating to moderate sweating. In the three months leading up to the experiment, the average exercise behavior indicated regular adherence to Taijiquan exercise, with a frequency of more than 3 times per week for 1 hour each session.

Control Group: Like the Experimental Group, the elderly participants in the Control Group spent an average of 1 hour per session on Taijiquan exercise. They also participated in Taijiquan exercise 3 to 5 times per week on average. The intensity of their Taijiquan exercise sessions ranged from slight sweating to moderate sweating. In the three months prior to the experiment, the average exercise behavior indicated regular adherence to Taijiquan exercise, with a frequency of more than 3 times per week for 1 hour each session.

The above descriptive statistics found that there was no difference in Taijiquan exercise behavior between the experimental group and the control group.

Table 2: Descriptive Statistical Analysis of the Taijiquan Exercise Behavior of the Experiment and Control Group before the Experiment N=20

	Options	Exercise Duration (H)	Exercise Frequency (T)	Exercise Intensity	Exercise Adherence
Experiment Group	M	2.300	2.350	3.150	1.850
	SD	0.733	0.587	0.813	0.875
Control Group	M	2.000	2.050	3.100	1.850
	SD	0.725	0.795	0.788	0.875

Descriptive Statistical Analysis of the Taijiquan Exercise Commitment

Descriptive statistics were performed using SPSS 23.0 to analyze the indicators of Taijiquan exercise commitment among the elderly participants in the Experimental Group before the experiment. The results are presented in Table 3.

Experimental Group: The factor score for "Want to Commitment" among the elderly Taijiquan exercisers was 3.533, falling between the categories of "general" and "agreed." The score for "Have to

Commitment" was 3.850, slightly less than the level of "agreed." The score for "Satisfaction" was 3.733, also slightly less than "agreed." For "Social Constraint," the score was 2.538, between "general" and "disagree." The score for "Involvement Alternative," representing the willingness to substitute, was 2.410, slightly higher than "disagreement." The average value of "Personal Investment" expressed by the elderly Taijiquan exercisers was 4.033, which matched the level of "agreed." The score for "Social Support" was 3.883, slightly less than "agreed." Lastly, the score for "Involvement Opportunity" among the elderly Taijiquan exercisers was 4.000, corresponding to "agreed."

Control Group: The factor scores for "Want to Commitment" among the elderly Taijiquan exercisers was 3.542, falling between "average" and "agreed." The score for "Have to Commitment" was 3.867, slightly less than "agreed." The score for "Satisfaction" was 3.733, slightly less than "agreed." For "Social Constraint," the score was 2.550, between "average" and "disagree." The score for "Involvement Alternative," representing the willingness to substitute, was 2.380, slightly greater than "disagreement." The average value of "Individual Investment" expressed by the elderly Taijiquan exercisers was 4.033, which was approximately equal to "agreed." The score for "Social Support" was 3.867, slightly less than "agreed." Lastly, the score for "Involvement Opportunity" among the elderly Taijiquan exercisers was 3.983, approximately equal to "agreed."

The above descriptive statistics found that there was no difference in Taijiquan exercise commitment between the experimental group and the control group.

Table 3: Descriptive Statistics of the Taijiquan Exercise Commitment of the Experiment and Control Group before the Experiment N=20

Options		WC	HC	SAT	SC	IA	PI	SS	IO
Experiment Group	M	3.533	3.850	3.733	2.538	2.410	4.033	3.883	4.000
	SD	0.431	0.768	0.689	1.139	0.963	0.620	0.767	0.595
Control Group	M	3.542	3.867	3.733	2.550	2.380	4.033	3.867	3.983
	SD	0.548	0.625	0.598	0.554	0.875	0.648	0.566	0.527

Data of Experimental and Control Group after Experiment

Following the 12-week experiment, a questionnaire survey was conducted to collect data on the Taijiquan exercise behavior and Taijiquan exercise commitment of the elderly participants in both the experimental and control groups. The descriptive statistics of the collected data are presented below:

Descriptive Statistics of Taijiquan Exercise Behavior

SPSS 23.0 was utilized to examine various indicators of Taijiquan exercise behavior among the elderly participants after the experiment, including Exercise Duration, Exercise Frequency, Exercise Intensity, and Exercise Adherence. The descriptive statistical results are summarized in Table 4.

Experimental Group: The average duration of each Taijiquan exercise session for the Experimental Group was 1 to 1.5 hours. The participants engaged in Taijiquan exercise 5 to 7 times per week, indicating the exercise frequency. The intensity of each Taijiquan exercise session ranged from slight to moderate sweating, representing the exercise intensity. Over the last three months, the Experimental Group demonstrated an average adherence to regular Taijiquan exercise of more than 3 times per week, with each session lasting 1 to 2 hours.

Control Group: The average duration of each Taijiquan exercise session for the Control Group was less than 1 to 1.5 hours. The participants engaged in Taijiquan exercise less than 5 to 7 times per week, reflecting the exercise frequency. The intensity of each Taijiquan exercise session for the Control Group ranged from slight to moderate sweating, similar to the Experimental Group. However, over the last

three months, the Control Group exhibited a lower average adherence to regular Taijiquan exercise, with less than 3 sessions per week, each lasting 1 to 2 hours.

Table 4: Descriptive Statistics of Taijiquan Exercise Behavior in the Experimental and Control Group (Before the Experiment) (n=20)

Options	Exercise Duration		Exercise Frequency		Exercise Intensity		Exercise Adherence	
		(H)		(T)				
Experiment Group	M	2.950		3.050		3.100		2.050
	SD	0.759		0.887		0.852		0.866
Control Group	M	1.850		1.850		3.100		1.850
	SD	0.745		0.875		0.788		0.875
N		20		20		20		20

Descriptive Statistics of Taijiquan Exercise Commitment

The indicators of Taijiquan exercise commitment were examined using SPSS 23.0 after the experiment. These indicators include "Want to Commitment," "Have to Commitment," "Satisfaction," "Social Constraints," "Involvement Alternative," "Personal Investment," "Social Support," and "Involvement Opportunity." The descriptive statistical results are presented in Table 5.

Experimental Group: The factor score for "Want to Commitment" among the Taijiquan exercisers in the experimental group was 3.942, indicating agreement. The score for "Have to Commitment" was 4.183, slightly higher than the degree of agreement. The score for "Satisfaction" was 4.083, representing agreement. The score for "Social Constraint" was 2.288, close to disagreement. The score for "Involvement Alternative" was 2.160, slightly higher than disagreement. The average value for "Personal Investment" expressed by the Taijiquan exercisers in the experimental group was 4.35, indicating a higher degree of agreement. The score for the "Social Support" factor was 4.183, slightly greater than agreement. Overall, the Taijiquan exercisers in the experimental group exhibited a score of 4.300, slightly higher than agreement.

Control Group: The factor score for "Want to Commitment" among the Taijiquan exercisers in the control group was 3.567, slightly less than agreement. The score for "Have to Commitment" was 3.883, slightly less than agreement. The score for "Satisfaction" was 3.767, also slightly less than agreement. The score for "Social Constraint" was 2.525, indicating less agreement. The score for "Involvement Alternative" was 2.370, slightly more than disagreement. The average value for "Personal Investment" expressed by the Taijiquan exercisers in the control group was 4.067, reflecting agreement. The score for the "Social Support" factor was 3.900, slightly less than agreement. The overall score for the Taijiquan exercisers in the control group was 3.992, slightly less than agreement.

Table 5: Descriptive Statistics of Taijiquan Exercise Commitment in the Experimental and Control Group (Before the Experiment) (n=20)

Options		WC	HC	SAT	SC	IA	PI	SS	IO
Experiment Group	M	3.942	4.183	4.083	2.288	2.160	4.350	4.183	4.300
	SD	0.680	0.798	0.732	1.027	0.860	0.713	0.721	0.542
Control Group	M	3.567	3.883	3.767	2.525	2.370	4.067	3.900	3.992
	SD	0.525	0.651	0.553	0.567	0.950	0.706	0.668	0.573

Comparison Analysis

In this section, we conducted independent sample t-tests on the exercise behavior and commitment of both the experimental and control groups, both before and after the experiment.

Comparison Analysis of Taijiquan Exercise Commitment and Behavior between Experimental and Control Group before Experiment

We utilized the independent sample t-test to investigate the differences in WC, HC, Sat, SC, IA, PI, SS, and IO between the groups. Table 6 presents the results, indicating that there were no significant differences in WC, HC, Sat, SC, IA, PI, SS, and IO among the different groups ($p > 0.05$). This suggests that the groups demonstrated consistency in WC, HC, Sat, SC, IA, PI, SS, and IO.

Furthermore, we employed the independent sample t-test to analyze the differences in exercise adherence, frequency, duration, and intensity between the control and experimental groups before and after the experiment. Table 6 shows that there were no significant differences in exercise adherence, frequency, duration, and intensity between the subjects in the control and experimental groups before and after the experiment ($p > 0.05$). This implies that the subjects in both groups exhibited consistency in exercise adherence, frequency, duration, and intensity before and after the experiment. Therefore, there were no significant differences in the exercise behavior of the subjects.

Table 6: Results of the T-test for Independent Samples on Taijiquan Exercise Commitment and Behavior between Experimental and Control Groups (Before and After the Experiment)

	Group (Mean \pm SD)		<i>t</i>	<i>P</i>
	Control Group (n=20)	Experimental Group (n=20)		
WC	3.542 \pm 0.548	3.533 \pm 0.431	0.053	0.958
HC	3.867 \pm 0.625	3.850 \pm 0.768	0.075	0.940
Sat	3.733 \pm 0.598	3.733 \pm 0.689	0.000	1.000
SC	2.550 \pm 0.554	2.538 \pm 1.139	0.044	0.965
IA	2.380 \pm 0.875	2.410 \pm 0.963	-0.103	0.918
PI	4.033 \pm 0.648	4.033 \pm 0.620	0.000	1.000
SS	3.867 \pm 0.566	3.883 \pm 0.767	-0.078	0.938
IO	3.983 \pm 0.527	4.000 \pm 0.595	-0.094	0.926
Exercise Adherence	1.850 \pm 0.875	1.850 \pm 0.875	0.000	1.000
Exercise Frequency	2.050 \pm 0.759	2.350 \pm 0.587	-1.398	0.170
Exercise Duration	2.000 \pm 0.725	2.300 \pm 0.733	-1.301	0.201
Exercise Intensity	3.100 \pm 0.788	3.150 \pm 0.813	-0.198	0.844

* $p < 0.05$ ** $p < 0.01$

Comparison Analysis of Taijiquan Exercise Commitment and Behavior between the Experimental and Control Group after Experiment

Exercise Commitment: The T-test for independent samples was employed to investigate the differences between the experimental and control groups in WC, HC, Sat, SC, IA, PI, SS, and IO. As shown in table 7, after the experiment, the samples exhibited significant differences ($p < 0.05$) for WC, HC, Sat, SC, IA, PI, SS, and IO, indicating notable variations between the groups after the experiment.

Specifically: After the experiment, WC displayed a significant level of 0.01 ($t = -5.120$, $p < 0.0001$), with the average value of the control group (3.57) significantly lower than that of the experimental group (4.41). HC showed a significant level of 0.01 ($t = -5.001$, $p < 0.000$), with the average value of the control group (3.88) significantly lower than that of the experimental group (4.68). Sat showed a significant level of 0.01 ($t = -3.698$, $p = 0.001$), with the average value of the control group (3.77) significantly lower than that of the experimental group (4.45). SC showed a significant level of 0.01 ($t = 7.324$, $p < 0.000$), with the average value of the control group (2.52) significantly higher than that of the experimental group (1.45). IA showed a significant level of 0.01 ($t = 3.050$, $p = 0.005$), with the average value of the control group (2.37) significantly higher than that of the experimental group (1.63). PI showed a significant level of 0.01 ($t = -3.343$, $p = 0.002$), with the average value of the control group (4.07) significantly lower than that of the experimental group (4.65). SS showed a significant level of 0.01 ($t = -4.056$, $p < 0.000$), with the average value of the control group (3.90) significantly lower than that of the experimental group (4.57). IO showed a significant level of 0.01 ($t = -3.982$, $p < 0.000$),

with the average value of the control group (3.99) significantly lower than that of the experimental group (4.58). Exercise Behavior: The independent sample T-test was used to examine the differences in exercise adherence, frequency, duration, and intensity between the control and experimental groups after the experiment. As shown in table 7, after the experiment, there was no significant difference in exercise intensity between the control and experimental groups ($p>0.05$), indicating consistency in exercise intensity after the experiment. Moreover, after the experiment, the subjects in the control and experimental groups showed significant differences in exercise adherence, frequency, and duration ($p<0.05$), highlighting notable variations between the two groups.

Specifically: After the experiment, exercise adherence and frequency for the control and experimental groups exhibited a significant level of 0.01 ($t=-2.891$, $p=0.006$ in the control group; $t=-4.307$, $p<0.001$ in the experimental group), with the average value of the control group (1.85) significantly lower than that of the experimental group (2.65 and 3.05, respectively). Exercise duration for the control and experimental groups displayed a significant level of 0.01 ($t=-4.625$, $p<0.001$), with the average value of the control group (1.85) significantly lower than that of the experimental group (2.95).

Table 7: presents the T-test analysis results of Taijiquan Exercise Commitment and Behavior between the Experimental and Control Group after the Experiment.

	Group (Mean \pm SD)		<i>t</i>	<i>P</i>
	Control Group (n=20)	Experimental Group (n=20)		
WC	3.567 \pm 0.525	4.408 \pm 0.514	-5.120	0.0001**
HC	3.883 \pm 0.651	4.683 \pm 0.296	-5.001	0.0001**
Sat	3.767 \pm 0.553	4.450 \pm 0.614	-3.698	0.001**
SC	2.525 \pm 0.567	1.450 \pm 0.330	7.324	0.0001**
IA	2.370 \pm 0.950	1.630 \pm 0.524	3.050	0.005**
PI	4.067 \pm 0.706	4.650 \pm 0.333	-3.343	0.002**
SS	3.900 \pm 0.668	4.567 \pm 0.308	-4.056	0.0001**
IO	3.992 \pm 0.573	4.583 \pm 0.336	-3.982	0.0001**
Exercise Adherence	1.850 \pm 0.875	2.650 \pm 0.875	-2.891	0.006**
Exercise Frequency	1.850 \pm 0.875	3.050 \pm 0.887	-4.307	0.0001**
Exercise Duration	1.850 \pm 0.745	2.950 \pm 0.759	-4.625	0.0001**
Exercise Intensity	3.100 \pm 0.788	3.100 \pm 0.852	0.0001	1.000

* $p<0.05$ ** $p<0.01$

Comparison Analysis of Taijiquan Exercise Commitment and Behavior of the Control Group before and after the Experiment

Exercise Commitment: The independent sample t-test was conducted to examine the differences in WC, HC, Sat, SC, IA, PI, SS, and IO of the subjects in the control group before and after the experiment. As presented in Table 8, there were no significant differences in WC, HC, Sat, SC, IA, PI, SS, and IO ($p>0.05$) for the subjects in the control group before and after the experiment. This indicates that the subjects in the control group exhibited consistency in WC, HC, Sat, SC, IA, PI, SS, and IO before and after the experiment.

Exercise Behavior: The independent sample t-test was employed to analyze the differences in exercise adherence, exercise frequency, exercise duration, and exercise intensity of the subjects in the control group before and after the experiment. According to Table 8, there were no significant differences in exercise adherence, exercise frequency, exercise duration, and exercise intensity ($p>0.05$) for the subjects in the control group before and after the experiment. This suggests that the subjects in the control group

displayed consistency in exercise adherence, exercise frequency, exercise duration, and exercise intensity before and after the experiment.

Table 8: Results of the T-test Analysis on Taijiquan Exercise Behavior of the Control Group before and after the Experiment

	Group (Mean \pm SD)		<i>t</i>	<i>P</i>
	Control Group (n=20)	Experimental Group (n=20)		
WC	3.542 \pm 0.548	3.567 \pm 0.525	-0.147	0.884
HC	3.867 \pm 0.625	3.883 \pm 0.651	-0.083	0.935
Sat	3.733 \pm 0.598	3.767 \pm 0.553	-0.183	0.856
SC	2.550 \pm 0.554	2.525 \pm 0.567	0.141	0.889
IA	2.380 \pm 0.875	2.370 \pm 0.950	0.035	0.973
PI	4.033 \pm 0.648	4.067 \pm 0.706	-0.156	0.877
SS	3.867 \pm 0.566	3.900 \pm 0.668	-0.170	0.866
IO	3.983 \pm 0.527	3.992 \pm 0.573	-0.048	0.962
Exercise Adherence	1.850 \pm 0.875	1.850 \pm 0.875	0.0001	1.000
Exercise Frequency	2.050 \pm 0.759	1.850 \pm 0.875	0.772	0.445
Exercise Duration	2.000 \pm 0.725	1.850 \pm 0.745	0.645	0.523
Exercise Intensity	3.100 \pm 0.788	3.100 \pm 0.788	0.0001	1.000

* $p < 0.05$ ** $p < 0.01$

Comparison Analysis of Taijiquan Exercise Commitment of the Experimental Group before and after the Experiment

Exercise Commitment: The independent sample t-test was conducted to examine the differences in WC, HC, Sat, SC, IA, PI, SS, and IO of the subjects in the experimental group before and after the experiment. As shown in Table 9, the subjects in the experimental group displayed significant differences in WC, HC, Sat, SC, IA, PI, SS, and IO ($p < 0.05$) before and after the experiment. This indicates that the subjects in the experimental group exhibited variations in WC, HC, Sat, SC, IA, PI, SS, and IO before and after the experiment.

Specific analysis reveals that: Before and after the experiment, the subjects in the experimental group demonstrated a significant level of 0.01 for WC ($t = -5.830$, $p = 0.000$), with the average value before the experiment (3.53) significantly lower than the average value after the experiment (4.41). HC showed a significant level of 0.01 ($t = -4.527$, $p = 0.000$), with the average value before the experiment (3.85) significantly lower than the average value after the experiment (4.68). Sat also displayed a significant level of 0.01 ($t = -3.472$, $p = 0.001$), with the average value before the experiment (3.73) significantly lower than the average value after the experiment (4.45).

Furthermore, before and after the experiment, the subjects in the experimental group exhibited significant differences in SC ($t = 4.100$, $p = 0.000$), IA ($t = 3.180$, $p = 0.003$), PI ($t = -3.917$, $p = 0.000$), SS ($t = -3.698$, $p = 0.001$), and IO ($t = -3.820$, $p = 0.001$), indicating variations in the average values before and after the experiment.

Exercise Behavior: The independent sample t-test was utilized to examine the differences in exercise adherence, exercise frequency, exercise duration, and exercise intensity of the subjects in the experimental group before and after the experiment. As observed from Table 9, there were no significant differences in exercise intensity ($p > 0.05$) for the subjects in the experimental group, implying consistency

in exercise intensity. However, significant differences were observed in exercise adherence, exercise frequency, and exercise duration ($p < 0.05$) between before and after the experiment.

Specific analysis shows that: Before and after the experiment, the subjects in the experimental group displayed a significant level of 0.01 for exercise adherence ($t = -2.891$, $p = 0.006$), with the average value before the experiment (1.85) significantly lower than the average value after the experiment (2.65). Exercise frequency also showed a significant level of 0.01 ($t = -2.943$, $p = 0.006$), with the average value before the experiment (2.35) significantly lower than the average value after the experiment (3.05). Similarly, the duration of exercise exhibited a significant level of 0.01 ($t = -2.755$, $p = 0.009$), with the average value before the experiment (2.30) significantly lower than the average value after the experiment (2.95).

Table 9: Results of the T-test Analysis on Taijiquan Commitment and Exercise Behavior of the Experimental Group before and after the Experiment

	Group (Mean \pm SD)		<i>t</i>	<i>P</i>
	Control Group (n=20)	Experimental Group (n=20)		
WC	3.533 \pm 0.431	4.408 \pm 0.514	-5.830	0.0001**
HC	3.850 \pm 0.768	4.683 \pm 0.296	-4.527	0.0001**
SAT	3.733 \pm 0.689	4.450 \pm 0.614	-3.472	0.001**
SC	2.538 \pm 1.139	1.450 \pm 0.330	4.100	0.000**
IA	2.410 \pm 0.963	1.630 \pm 0.524	3.180	0.003**
PI	4.033 \pm 0.620	4.650 \pm 0.333	-3.917	0.0001**
SS	3.883 \pm 0.767	4.567 \pm 0.308	-3.698	0.001**
IO	4.000 \pm 0.595	4.583 \pm 0.336	-3.820	0.001**
Exercise Adherence	1.850 \pm 0.875	2.650 \pm 0.875	-2.891	0.006**
Exercise Frequency	2.350 \pm 0.587	3.050 \pm 0.887	-2.943	0.006**
Exercise Duration	2.300 \pm 0.733	2.950 \pm 0.759	-2.755	0.009**
Exercise Intensity	3.150 \pm 0.813	3.100 \pm 0.852	0.190	0.850

* $p < 0.05$ ** $p < 0.01$

Discussion

Previous studies have consistently demonstrated that exercise commitment plays a crucial role in predicting exercise behavior and can serve as a reliable indicator of psychological motivation (Chen & Li, 2005). Researchers have often utilized exercise commitment as an intervention strategy to enhance exercise frequency, persistence, and reduce exercise dropout among exercisers. For instance, Yuan et al. (2020) employed a social cognitive model (SCM) to examine the continuous intention of older adults in virtual reality leisure activities using digital devices. Additionally, Weiss and Halupnik (2013) applied sport commitment structures in the field of strength and conditioning. Building upon these foundations, the present study leveraged the Taijiquan exercise pattern developed by Dr. Sun Xianghao, employing the Taijiquan Exercise Commitment Scale (TECS) to conduct intervention experiments with two groups of elderly individuals. The 12-week intervention experiment yielded the following results.

Prior to the experiment, there were no significant differences in Taijiquan exercise behavior or commitment between the experimental and control groups. However, after the experiment, notable differences emerged in Taijiquan exercise behavior and commitment between the two groups. Specifically, the control group displayed no significant differences in exercise behavior or commitment before and after the experiment, while the experimental group exhibited significant variations in both exercise behavior and commitment before and after the experiment.

Practical Implications

The statistical results of the data after the 12-week Scientific control show that TEP can help improve the commitment and behavior of the elderly Taijiquan exercisers. TEP has positive significance in maintaining the adherence of elderly people to Taijiquan exercise and reducing withdrawal, and can help with government departments to promote Taijiquan exercise in response to the aging population.

Numerous studies have confirmed the benefits of Taijiquan as an active physical activity for promoting the health of the elderly and supporting medical treatment. For example, Lomas-Vega et al. (2017) reported high-quality evidence indicating a medium protective effect of Taijiquan in reducing fall incidence over the short term, and a small protective effect over the long term. Similarly, Cai et al. (2022) found that Taijiquan improved various health outcomes, including fasting insulin, diastolic blood pressure, body mass index (BMI), and quality of life in patients with type 2 diabetes mellitus.

However, the prevalence of sedentary lifestyles among the elderly poses a significant threat to their health. Some elderly individuals struggle to adhere to Taijiquan exercise or may even withdraw from it. For instance, Matsuura (2019) highlighted instances where patients expressed dissatisfaction with the teaching methods of Taijiquan instructors and reported low overall enjoyment of the interventions.

Therefore, this study confirms the effectiveness of the TEP in promoting exercise commitment and behavior among elderly Taijiquan exercisers through controlled experiments. Given China's rapidly aging population, these findings hold significant value for the widespread promotion of Taijiquan exercise activities. The study provides valuable insights for government agencies in their planning and design of health, medical, and recreational programs for the elderly. It is recommended that community managers and Taijiquan instructors promote this pattern within communities to enhance the health levels of the elderly.

Study Limitations and Future Research

During the 12-week Scientific control, we identified issues including the age span of the subjects, group size, season (temperature), and TEP itself, warranting improvements in future research.

Firstly, the age span of the participants in the experimental group was relatively wide, ranging from 60 to 75 years old. This age variation resulted in noticeable differences in physical fitness levels among the participants. The one-hour exercise duration might not have been equally suitable for all participants, impacting the overall exercise quality. Future studies should consider more homogeneous age groups to ensure consistent exercise capabilities among participants. Secondly, the size of each elderly group was relatively large, consisting of 20 individuals. A more manageable group size, preferably around 10 people, might be more conducive to effective interventions and interactions between participants and instructors. Smaller groups could allow for more personalized attention and tailored interventions, leading to better outcomes. Thirdly, it is crucial for researchers to take into account the influence of external factors such as weather, seasons, and environmental conditions during the experiment. For instance, conducting the experiment during summer might yield different results compared to winter conditions. Therefore, future research should consider conducting the intervention during different seasons to assess its consistency and effectiveness across various environmental factors.

Regarding the TEP itself, certain aspects need refinement for improved effectiveness. Firstly, as the physical function of elderly individuals varies, some terms used in the experiment might not be universally suitable. To enhance the relevancy of the TEP, researchers should tailor certain phrases according to the specific physical conditions and needs of the elderly participants. For instance, phrases

such as "Exercising Taijiquan gives me the opportunity to improve my health and fitness" should be adapted based on individual fitness levels. Secondly, the intervention design should not solely focus on language use but also encompass the physical aspects of exercise. This includes designing exercise venues, providing suitable equipment and clothing, and improving hardware facilities to create a more conducive and enjoyable exercise environment for the elderly participants. Lastly, the intervention model should extend beyond the confines of centralized exercise interventions during the study. Future research should explore the implementation of interventions in the elderly participants' daily lives to foster lasting Taijiquan exercise commitment and behavior. This might involve integrating Taijiquan exercises into daily routines or encouraging self-practice to ensure sustained exercise engagement.

In conclusion, while the current study provides valuable insights into the effectiveness of TEP in promoting exercise commitment and behavior among the elderly, it also highlights several limitations that need to be addressed in future research. By refining the intervention design, considering external factors, and tailoring the approach to individual needs, TEP can be further optimized to enhance the health and well-being of elderly Taijiquan practitioners effectively.

References

- Cai, Y, Liu, X, Zhao, A, Mao, J, Guo, X, & Li, G, et al. (2022). Effects of tai chi on health outcomes in patients with type 2 diabetes mellitus: a systematic review and meta-analysis. *中医科学杂志(英文)*(002), 009.
- Corbin, C. B., Nielsen, A. B., Borsdorf, L. L., & Laurie, D. R. (1987). Commitment to physical activity. *Obesity Reviews*, 3(3), 257–271.
- Chen, S., & LI, S. (2005). Research on Effects of Sport Commitment and Exercise Condition on Exercise Adherence of College Student. *Journal of Beijing Sport University*.
- Chairat Choosakul, Naruepon Vongjaturapat, Fuzhong Li & Peter Harmer (2009) The Sport Commitment Model: An Investigation of Structural Relationships with Thai Youth Athlete Populations, *Measurement in Physical Education and Exercise Science*, 13:3, 123-139,
- Li, F. (2016). The public health benefits of Tai Ji Quan—Addressing the unmet needs of aging populations in the 21st century. *Journal of Sport and Health Science*, 5(3), 304–307.
- Lightfoot, J. T., De Geus, E. J., Booth, F. W., Bray, M. S., Den Hoed, M., Kaprio, J., ... & Bouchard, C. (2018). Biological/genetic regulation of physical activity level: consensus from GenBioPAC. *Medicine and science in sports and exercise*, 50(4), 863.
- Lomas-Vega, R., E Obrero-Gaitán, Molina-Ortega, F. J., & Del-Pino-Casado, R. (2017). Tai chi for risk of falls. A meta-analysis. *Journal of the American Geriatrics Society*.
- Martin, K. A., & Hausenblas, H. A. (1998). Psychological commitment to exercise and eating disorder symptomatology among female aerobics instructors. *The Sport Psychologist*, 12(2), 180-190.
- Matsuura, G. Y. (2019). The Effects of Tai Chi Training on Reducing Barriers to Exercise for a Person with Parkinson's Disease (Doctoral dissertation, Azusa Pacific University).
- Stevens, J. A., Voukelatos, A., & Ehrenreich, H. (2014). Preventing falls with Tai Ji Quan: A public health perspective. *Journal of Sport and Health Science*, 1, 6.
- Sun Xianghao, (2020). Developing the pattern of Taijiquan exercise of elderly by using the sport commitment model. Mahasarakham University doctoral dissertation, Thailand.
- Wilson, P. M., Rodgers, W. M., Carpenter, P. J., Hall, C., Hardy, J., & Fraser, S. N. (2004). The relationship between commitment and exercise behavior. *Psychology of Sport and Exercise*, 5(4), 405–421.
- Waldron, J. J., & Troupe, N. (2008). Applying the sport commitment model to strength and conditioning. *Strength & Conditioning Journal*, 30(2), 79-82.

Supporting Information

- S1 The five key aspects of Taijiquan Exercise Pattern. They are the intervention of Taijiquan exercise content, audio language intervention for Taijiquan exercisers, intervention of leader in Taijiquan exercise, mutual intervention among Taijiquan participants, and the monitoring record form for Taijiquan exercise.
- S2 Questionnaire. The questionnaire of investigation on the current situation of Taijiquan exercise and commitment of the elderly.