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Associations between tai chi practice characteristics and psychological security in older adults: A cross-sectional study

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Abstract
This study aimed to examine the relationship between Tai Chi practice characteristics and psychological security among older Chinese adults. A cross-sectional survey was conducted among 416 older adults from Tai Chi practice sites in Weifang, China. Data were collected through validated questionnaires assessing demographic variables, Tai Chi practice characteristics, and psychological security. The Kruskal-Wallis test and optimal scaling regression were applied using SPSS 26.0. Results showed that sociodemographic factors had limited predictive power for PS, with age being the only significant variable. In contrast, TCPC demonstrated a strong predictive effect, collectively explaining 57.0% of the variance in PS. Specifically, longer years of practice, higher practice frequency, longer duration, and greater exercise intensity were significantly associated with higher psychological security levels. These findings suggest that regular and sustained Tai Chi practice can effectively enhance psychological security and promote mental well-being among older adults. Tai Chi may serve as a practical, low-risk approach to support psychological health in the aging population.

Keywords: Tai Chi, practice characteristics, psychological security, older adults

1. Introduction
The issue of population aging is becoming increasingly severe. Globally, the population aged 60 and above is projected to increase from 1 billion in 2020 to 1.4 billion by 2030, representing a growth rate of 34%. By 2050, the global elderly population will more than double, reaching 2.1 billion [1]. Concurrently, China is facing more pronounced aging challenges. According to data from China's Seventh National Population Census, the population aged 60 and above has reached 264.02 million, accounting for 18.7% of the total population. The China Aging Research Center predicts that China will transition into a deeply aging society around 2040, with the aging rate exceeding 30% [2].

With advancing age, older adults face increasing psychological challenges. The prevalent societal valorization of youth has led to the frequent misperception of old age as a symbol of physical decline and functional loss [3]. This phenomenon often results in the neglect or marginalization of older persons within familial, occupational, and social contexts. Furthermore, negative stereotypes contribute to elevated psychological stress, exacerbating feelings of depression and loneliness [4]. Against the backdrop of diminishing coping capacities, enhancing psychological security (PS) has emerged as a crucial pathway to improving well-being among the elderly population.

Against this backdrop, Tai Chi, as a traditional Chinese mind-body practice integrating physical movement, breath regulation, and mental focus, offers a promising direction for improving psychological health in older adults. Characterized by slow and fluid movement patterns along with meditative concentration, it contributes to reduced anxiety and tension, enhanced emotional regulation, and ultimately improved PS and overall well-being through sustained practice [5]. Thus, Tai Chi serves not only as a form of physical exercise but also as an effective interventional approach for promoting psychological health and emotional balance.

Although previous studies have confirmed the positive effects of Tai Chi on mental health, systematic investigations examining the relationship between specific practice characteristics and PS remain limited.

Therefore, this study aims to investigate the relationship between Tai Chi practice characteristics (TCPC) and PS among older adults, which will address a significant gap in the existing research on Tai Chi in China's aging population. Through a cross-sectional design, the research will examine the underlying mechanisms connecting Tai Chi practice with PS. The findings are expected to provide evidence-based exercise prescriptions for enhancing psychological well-being in older adults, while also establishing a theoretical foundation for developing scientifically-grounded Tai Chi practice guidelines.

2. Materials and Methods

2.1 Study design, Population, and Procedures

This study employed a cross-sectional design and utilized a questionnaire survey to investigate the relationship between TCPC and PS among older adults. A purposive sampling method was adopted to recruit elderly participants from 15 Tai Chi practice sites in Weifang City, Shandong Province, China. Scientifically validated questionnaires, including the "Tai Chi Practice Characteristics Questionnaire for Older Adults" and the "Psychological Security Questionnaire," were used to assess TCPC and PS, respectively.

To ensure data accuracy and the reliability of the research findings, the following inclusion criteria were established: participants had to be aged 60 years or above; they must have engaged in regular Tai Chi practice for at least three months, with a weekly practice frequency of no less than once; they were required to have normal cognitive function, indicated by a Mini-Mental State Examination score of 24 or above; and they must not have been diagnosed with severe physical illnesses, such as advanced cardiovascular diseases or musculoskeletal disorders. The exclusion criteria included experiencing major negative life events, such as bereavement, within the past six months.

Considering the advanced age of the participants, the questionnaires were administered through face-to-face interviews to ensure completeness and accuracy of the data. A total of 420 questionnaires were distributed, and 416 valid responses were collected, resulting in an effective response rate of 99%. The sample consisted of 140 males (33.7%) and 276 females (66.3%), with ages ranging from 60 to over 80 years. All data analyses were performed using IBM SPSS Statistics 26. The study strictly adhered to ethical guidelines, ensuring participants' informed consent, voluntary participation, and confidentiality of information.

2.2 Evaluation Tools

2.2.1 Tai Chi Practice Characteristics Questionnaire

The “Tai Chi Practice Characteristic Questionnaire for Older Adults” was adapted from the Survey on Participation in Physical Exercise among Urban and Rural Residents in China published by the General Administration of Sport of China (2007) [6]. This instrument collected information on participants’ sociodemographic variables, such as gender, age, education level, previous occupation, income, and living arrangements. It also assessed specific TCPC, including duration of practice in years, weekly frequency, length of each session, exercise intensity, number of routines learned, and practice modality. To ensure the reliability of the questionnaire over time, a test-retest procedure was employed. Fifty older adults were randomly selected to complete the questionnaire twice, with a two-week interval between administrations. Data were analyzed using Spearman’s rank correlation in SPSS, yielding a strong and statistically significant association between the two administrations (r_s=0.83). These findings confirm that the questionnaire demonstrates excellent temporal stability and test-retest reliability.

2.2.2 Psychological Security Questionnaire

The Security Questionnaire, developed by Chinese scholars Cong Zhong and An Lijuan [7], is a standardized instrument designed to assess individuals’ sense of PS. The questionnaire consists of 16 items divided into two dimensions: interpersonal security and certainty control. It employs a five-point Likert scale, ranging from 1 (“strongly agree”) to 5 (“strongly disagree”). The total score is obtained by summing the scores of both dimensions, with a maximum of 80 points. Higher scores indicate a stronger sense of PS, whereas lower scores reflect a weaker sense of security. In the present study, the questionnaire demonstrated excellent internal consistency, with a Cronbach’s α coefficient of 0.958, indicating high reliability.

2.3 Statistical Analysis

The collected data were analyzed using IBM SPSS Statistics 26.0. First, descriptive statistics were conducted on participants’ demographic characteristics and TCPC, calculating percentages, means, and standard deviations to summarize the overall profile of the sample. Second, the Kolmogorov-Smirnov test was used to assess the normality of continuous variables to determine whether the assumptions for parametric tests were met.

In addition, to determine whether there were significant differences in PS across sociodemographic and TCPC, the Kruskal-Wallis test was employed for preliminary between-group comparisons to analyze variations in PS among older adults with different demographic and Tai Chi practice profiles.

To further examine the relationship between TCPC and PS among older adults, an optimal scaling regression model was introduced for multivariate analysis. This method is particularly suitable for social science and health behavior research involving ordinal and categorical independent variables. The model helped identify key TCPC influencing PS in older adults. All statistical tests were two-tailed, and the level of significance was set at $p<0.05$.

3. Results

3.1. Sociodemographic Characteristics of the Sample

Table 1 summarizes the sociodemographic characteristics of the 416 older adults who participated in the study. The sample consisted predominantly of females (66.3%), with males accounting for 33.7%. Most participants were between 60 and 69 years old (65.6%), while only a small proportion (4.8%) were aged 80 or above. In terms of education, the majority had completed high school (39.9%) or middle school (31.3%), and 22.1% had attained college education or higher. Regarding monthly income, most participants earned between 1,000 and 4,999 RMB (67.2%), while 5.5% had no fixed income. About two-thirds (66.6%) lived without their children, and 70.9% had worked as formal employees prior to retirement. Overall, the sample represented a relatively well-educated, economically stable, and younger segment of the older adult population.

Table 1: Sociodemographic characteristics of the sample

Characteristics	Detail factors	Number (n)	Percentage (%)
Gender	Male	140	33.7
	Female	276	66.3
Age (years)	60-64	148	35.6
	65-69	125	30
	70-74	82	19.7
	75-79	41	9.9
	≥80	20	4.8
Education	No education	2	0.5
	Primary school	26	6.3
	Middle school	130	31.3
	High school	166	39.9
	College and above	92	22.1
Monthly income	No fixed income	23	5.5
	<1000 RMB	24	5.8
	1000-2999 RMB	122	29.3
	3000-4999 RMB	156	37.9
	>5000 RMB	91	21.9
Living with children	Yes	139	33.4
	No	277	66.6
Occupation	Formal Employee	295	70.9
	Informal Employee	61	14.7
	Farmer	40	9.6
	No Occupation	20	4.8

3.2. Behavioral Characteristics of Tai Chi practice among older adults

Table 2 presents the behavioral characteristics of Tai Chi practice among older adults. Most participants had practiced Tai Chi for 1-5 years (39.4%), followed by 5-10 years (27.2%). More than half practiced five or more times per week (56.5%), with sessions lasting over 60 minutes (54.8%). Regarding exercise intensity, the majority reported light intensity (69%), while only a few engaged in moderate or higher levels. Nearly half of the participants (46.2%) had learned more than five Tai Chi routines, and 37.7% reported mastering over five sets. Overall, the participants demonstrated regular and long-term engagement in Tai Chi practice, though their exercise intensity tended to be light.

Table 2: Behavioral characteristics of Tai Chi practice among older adults

Variables	Detail factors	Number (n)	Percentage (%)
Years of practice (year)	<1 year	95	22.8
	1-5 year	164	39.4
	5-10 year	113	27.2
	>10 year	44	10.6
Practice frequency (time)	1-2 time	69	16.6
	3-4 time	112	26.9
	≥5	235	56.5
Practice duration (min)	<30	33	7.9
	30-60	155	37.3
	>60	228	54.8
Exercise intensity	Very light intensity	103	24.8
	Light intensity	287	69
	Moderate intensity	25	6
	Vigorous intensity	1	0.2
	Very vigorous intensity	0	0
Number of routines	1	52	12.5
	2	68	16.3
	3	58	13.9
	4	46	11.1
	>5	192	46.2
Routines mastered	1	72	17.3
	2	74	17.8
	3	60	14.4
	4	53	12.7
	>5	157	37.7

3.3. Descriptive statistics of psychological security and its two dimensions across different Sociodemographic and Tai Chi Practice Characteristics

The Kruskal-Wallis test was conducted to examine differences in PS across various sociodemographic and TCPC, as shown in Table 3. Significant group differences were observed for age (P=0.037) and occupation (P=0.024), indicating that older participants and those who were formally employed reported higher levels of PS.

Regarding TCPC, highly significant differences were found across years of practice (p<0.001), practice frequency (p<0.001), practice duration (p<0.001), exercise intensity (p<0.001), number of routines learned (p<0.001), and routines mastered (p<0.001).

Specifically, participants who had practiced Tai Chi for more than 10 years, exercised at least five times per week, practiced for over 60 minutes per session, engaged in light to moderate intensity, and had learned or mastered more than five routines reported the highest PS scores.

Table 3: Descriptive statistics of psychological security and its two dimensions across different sociodemographic and Tai Chi practice characteristics

Characteristics	Detail factors	Psychological Security (M ± SD)	H	P
Gender	Male	64.15±1.07	0.23	0.63
	Female	64.78±0.74		
Age (years)	60-64	62.05±1.08	10.2	0.037
	65-69	64.66±1.14		
	70-74	66.54±1.26		
	75-79	67.90±1.51		
	≥80	67.70±2.11		
Education	No education	54±2	4.18	0.38
	Primary school	65.88±2.49		
	Middle school	63.98±1.12		
	High school	64.39±0.92		
	College and above	65.57±1.34		
Monthly income	No fixed income	62.61±2.48	4.13	0.37
	<1000 RMB	65.58±2.44		
	1000-2999 RMB	63.36±1.12		
	3000-4999 RMB	65.42±0.97		
	>5000 RMB	64.93±1.37		
Living with children	Yes	64.81±0.96	0.05	0.82
	No	64.44±0.77		
Occupation	Formal Employee	65.56±0.71	9.41	0.024
	Informal Employee	61.85±1.49		
	Farmer	62.95±2.2		
	No Occupation	61.40±2.56		
Years of practice (year)	<1	56.35±135	100.02	<0.001
	1-5	62.45±0.95		
	5-10	71.25±0.67		
	>10	73.05±1.09		
Practice frequency (time)	1-2	50.99±1.33	154.7	<0.001
	3-4	60.11±1.05		
	≥5	70.68±0.57		
Practice duration (min)	<30	45.70±1.93	125.58	<0.001
	30-60	60.32±0.91		
	>60	70.18±0.59		
Exercise intensity	Very light intensity	54.51±1.33	77.11	<0.001
	Light intensity	67.77±0.58		
	Moderate intensity	68.8±2.34		
Number of routines	1	51.27±1.54	150.92	<0.001
	2	55.88±1.43		
	3	63.21±1.24		
	4	66.78±1.38		
	>5	71.12±0.66		
Routines mastered	1	53.74±1.39	154.01	<0.001
	2	56.81±1.33		
	3	64.1±1.26		
	4	69.04±1.27		
	>5	71.85±0.69		

3.4 Effects of demographic characteristics and Tai Chi practice characteristics on psychological security in older adults

The optimal scaling regression model was further applied to examine the relationship between sociodemographic characteristics and PS. As shown in the model summary, the regression model yielded a modest predictive relationship (R=0.285) and explained 8.1% of the variance in PS (R^2=0.081, Adjusted R^2=0.059), indicating a relatively low explanatory power. The ANOVA results showed that the overall model was statistically significant (F=3.59, p<0.001), suggesting that sociodemographic factors collectively contributed to variations in PS among older adults.

As presented in Table 4, among the sociodemographic predictors, age emerged as the only significant variable (p<0.001), indicating that PS tended to increase with advancing age. Other factors, including gender, education level, income, living arrangement, and occupation, did not show significant associations with PS (p>0.05). This result implies that while demographic characteristics may have some collective explanatory power, individual effects except for age are relatively weak in predicting older adults' PS.

In contrast, when TCPC were included as predictors, the regression model demonstrated a strong predictive

relationship (R=0.755) and explained 57.0% of the variance in PS (R^2=0.570, Adjusted R^2=0.555), indicating good model fit and explanatory power. The ANOVA results further confirmed that the overall model was statistically significant (F=37.99, p<0.001), suggesting that TCPC jointly exerted a significant predictive effect on PS among older adults.

As shown in Table 4, several Tai Chi practice variables made significant contributions to the prediction of PS. Practice frequency (p<0.001), practice duration (p<0.001), exercise intensity (p<0.001), and years of practice (P=0.01) were all significant predictors, indicating that longer experience, higher frequency, longer duration, and greater intensity of Tai Chi participation were associated with higher levels of PS. In contrast, the number of routines learned and routines mastered did not show significant effects (p>0.05), suggesting that the depth and regularity of practice may play a more critical role than the sheer number of movements learned. These findings highlight the psychological benefits of sustained and consistent Tai Chi engagement among older adults.

Table 4: Results of optimal scaling regression analysis of demographic and Tai Chi practice characteristics on psychological security in older adults

Predictor	Beta	Std. Error	DF	F	P
Age	0.233	0.059	3	15.422	<0.001
Gender	0.101	0.071	1	2.038	0.154
Education	0.101	0.11	2	0.832	0.436
Income	-0.06	0.134	1	0.201	0.654
Living arrangement	0.062	0.055	1	1.291	0.256
Occupation	-1.152	0.098	2	2.388	0.093
Years of practice	0.106	0.049	2	4.686	0.01
Practice frequency	0.202	0.053	2	14.842	<0.001
Practice duration	0.225	0.068	2	10.832	<0.001
Exercise intensity	0.181	0.053	3	11.689	<0.001
Number of routines	0.14	0.127	3	1.216	0.303
Routines mastered	0.153	0.134	2	1.309	0.271

4. Discussion

This study examined the relationship between TCPC and PS among older adults. The findings revealed that sociodemographic factors had a relatively weak explanatory power for PS, with age emerging as the only significant predictor. In contrast, TCPC demonstrated a much stronger predictive effect, collectively explaining more than half of the variance in PS. Specifically, longer years of practice, higher practice frequency, extended duration, and greater exercise intensity were significantly associated with higher levels of PS. These results suggest that consistent and sustained engagement in Tai Chi plays a crucial role in enhancing older adults' sense of psychological stability and safety.

Specifically, age has been identified as the strongest demographic predictor of PS among older adults. This result is consistent with the study by Zhao *et al*., who noted that as individuals age, they gradually develop more mature psychological adaptation and emotion regulation abilities [8]. This process enables older adults to regulate emotional responses more effectively and maintain psychological balance. Furthermore, research also indicates that with increasing age, individuals generally accumulate more life experience and self-acceptance, thereby enhancing emotional resilience and improving their ability to cope with uncertainty while maintaining psychological stability and a sense of security [9, 10].

Furthermore, older adults who engage in exercise with higher frequency, longer duration per session, greater intensity, and more years of practice demonstrate significantly higher levels of PS. This finding aligns with the research by Alzahrani *et al*., who indicated that regular Taekwondo aerobic training can effectively enhance an individual's PS and alleviate psychological stress [11]. Simultaneously, a cross-sectional study from Finland also revealed that individuals who exercise at least two to three times per week exhibit significantly lower levels of depression, anger, cynicism, and stress compared to those who exercise less frequently or not at all. Collectively, these studies support the positive role of regular physical activity in promoting psychological health and a sense of security [12].

Theoretically, this effect induced by Tai Chi may stem from both physiological and psychosocial mechanisms. On one hand, the slow rhythm and focused movements of Tai Chi can activate the parasympathetic nervous system, reduce physiological arousal levels, and enhance self-regulation, thereby promoting emotional calmness and a sense of security [13, 14]. On the other hand, regular group practice can strengthen social connections and interpersonal trust, fostering a sense of belonging and PS in individuals [15]. Therefore, older adults who engage in regular and long-term Tai Chi practice tend to develop stronger internal stability and PS, reflecting the holistic benefits of Tai Chi across physical, psychological and social dimensions.

The findings of this study provide both theoretical and practical insights. Theoretically, they extend the understanding of mind-body exercise by suggesting that Tai Chi practice may enhance PS, an important but often overlooked aspect of mental well-being in older adults. This implies that long-term and mindful physical activity can help maintain emotional stability and resilience. Practically, the results indicate that encouraging older adults to take part in regular Tai Chi practice may be a simple, safe, and effective way to support their mental health.

Despite its valuable findings, this study has certain limitations, such as its cross-sectional design and reliance on self-reported data. Future research could employ longitudinal or experimental approaches to further clarify the causal relationships between Tai Chi practice and PS in older adults.

5. Conclusion

This study demonstrated that TCPC have a significant and positive association with PS among older adults. While sociodemographic factors showed limited explanatory power, age was found to be the strongest demographic predictor, suggesting that psychological stability may increase with aging. In contrast, consistent and sustained Tai Chi practice, particularly longer years of experience, higher frequency, longer duration, and appropriate intensity, was strongly linked to higher levels of PS. These findings highlight the value of

Tai Chi not only as a form of physical activity but also as an effective approach to promoting psychological well-being in the aging population.

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