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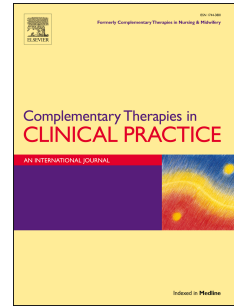
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Accepted Manuscript

The effect of Tai Chi on quality of life in male older people: A randomized controlled clinical trial

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Running Title: Tai Chi and older people

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Conflicts of Interest

No conflicts of interest are declared by the authors.

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Contributions

Study design: AT, NR;

Data collection: AT, NR;

Data analysis: SDT;

Manuscript preparation and critical revision of the content: AT, NR, PSK, TEW, PG, MV;

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Abstract

Background and purpose: Physical activity can improve the mental and physical functioning of older people. This study investigated the impact of Tai Chi exercise on the quality of life of older men.

Materials and methods: This randomized controlled clinical trial was conducted on 132 older men in an urban area of Iran. The subjects were randomly assigned into two groups: a Tai Chi intervention group and a control group ($n = 66$ per group). Quality of life was evaluated using the Leiden-Padua quality of life questionnaire before and after the intervention. Data analysis was performed using analytical statistics via the SPSS software.

Results: After eight weeks of Tai Chi exercise, the mean scores of quality of life in different areas demonstrated a statistically significant difference between the two groups ($p < 0.05$).

Conclusion: This study illustrated that the 8-week Tai Chi intervention had a positive effect on the quality of life in older men.

Key words: Older people, quality of life, Tai Chi exercise, randomized controlled trial

the globe. The rise in population longevity is often referred to as the 'graying population' or 'mandatory aging' [1-2]. Older people are often influenced by chronic diseases, social isolation and loneliness, which can have negative impacts on their quality of life [3]. Accordingly, the ageing phenomenon requires strategies for the improvement of health, rehabilitation, social welfare and quality of life amongst older people [4].

Quality of life is a complex, multidimensional concept, that includes the broad domains of physical, psychological, social and spiritual functioning and well-being [5]. The World Health Organization (WHO) has defined the quality of life as 'the individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns' [6]. Quality of life is a subjective concept, an individual's feeling of well-being and self-worth. In older people the quality of life also includes satisfaction in all areas of life such as health status, family relationships, mobility, independence, housing and education [7-9].

Promoting, ensuring and investigating the quality of life in older people is of utmost importance due to the physical, psychological and socioeconomic consequences of ageing for individuals, families and societies. Research investigating the impact of therapeutic measures for older people should incorporate the assessment of quality of life [10]. Quality of life and health status are so important that experts believe that improvements in older people's quality of life are the main focus of healthcare in the current century [11].

The ageing process is frequently associated with physiological and psychological sequelae such as chronic pain, fear of falling, continence problems, insomnia, anxiety and depression. It can lead to physical inactivity and reduced ability to engage in daily activities, which may have a negative impact on the quality of life. Certainly, it is widely recognized that individuals who engage in limited physical activities may experience fewer opportunities for wellness enhancement [14].

The World Health Organization (WHO) contends that physical activity is one solution for improving older people's health and reducing healthcare costs [15]. As the intensity and duration of exercise is important, regular and moderate exercises are often recommended. It has been shown that light, programmed lifestyle activity, which can sustain balance,

physical and mental health have been described. For example, Lok et al. (2017) reported that physical activities undertaken over a 10-week period improved the quality of life and reduced the symptoms of depression in older people [17]. Chen et al. (2012) reported how a traditional 12-week physical activity programme (Baduanjin) used with an older adult group resulted in improvements in sleep quality [18].

Tai Chi as an ancient Chinese exercise is based on the development of harmony between mind and body. According to the Chinese Yin-Yang theory, everything in nature is interrelated to two energy forces called ‘Yin and Yang’ as two halves that together promote wholeness. Tai Chi is a complementary and alternative medicine approach, which does not require special equipment. It is appropriate for older people, including those who may use a wheelchair or experience movement limitations [21]. It is a low intensity exercise, is equal to mild athletic exercise or walking at the speed of 6 km/h [19-20] and can be controlled depending on the older person’s age and abilities. Tai Chi exercise can improve cardio-pulmonary functioning and increase flexibility and muscle strength. Tai Chi uses cyclic and rhythmic movements, where each position is slowly converted to the next. It involves a series of continuous, slow movements of various parts of the body, deep breathing and the correct physical state associated with consciousness and concentration. Chan et al. (2017) reported improvements in mental health, reduction of the feelings of loneliness and increase of the overall satisfaction with life in a study of older people who were engaged in Tai Chi. Chang et al. (2017) described the improvement of the quality of life and enhanced physical functioning of older people with end stage renal disease (ESRD) after engaging in Tai Chi exercise [22]. Lee et al. (2009) reported the positive effect of Tai Chi on the quality of life in older people living in nursing homes [23]. There is however a paucity of studies that have investigated the effect of Tai Chi exercise on the quality of life among community-dwelling older people. Therefore, this study aimed to investigate the impact of Tai Chi exercise on the quality of life in older men.

2. Materials and methods

2.1. Research design.

2.2. Setting and subjects.

Older men (n=132) residing in a retirement centre in an urban area of Iran and met the study inclusion criteria were recruited. The retirement centre was an organization focused on the welfare, social and cultural needs of the community's members. This centre made efforts to improve the living and health conditions of members and defended their social rights. The inclusion criteria were subjects over 60 years of age, willing to participate in the study and ability to speak and understand Farsi. To be eligible to participate, they were to have no sensory or motor disabilities, no joint problems and not to have experienced an accident or illness, resulting in physical and/or mental harm in the previous month. In addition, they were required to have no history of depression, anxiety and substance misuse, to be cognitively able (i.e. to be able to participate in the Abbreviated Mental Test Score (AMTS) and gain a score of more than 7/10 [24]), have no history of participating in Tai Chi exercise previously, not participating currently in any sport activity, and being able to undertake a 6 -minutes' walk test (6MWT). The 6MWT evaluated the global and integrated responses of the cardiopulmonary and musculoskeletal systems of the individual undertaking the exercise. The distance of walking was nine meters and the subjects were requested to walk the maximum distance within the determined time frame. The exclusion criteria were unwilling or inability to participate in the study, dissatisfaction with collaboration in the study, death, absence for more than two exercise sessions, or a physician's diagnosis of severe physical or psychological problems.

2.3. Sample size

According to the results of similar studies [22], 95% confidence interval ($\alpha = 5\%$) and 80% power ($\beta = 10\%$) and 20% possibility of dropouts, the sample size was calculated using a sampling formula. Therefore, 132 male older people were recruited in the intervention and control groups (n= 66 in each group).

2.4. Randomization

Simple randomization was used to assign the subjects into either the intervention or control group. Individuals' names were placed in opaque envelopes and a researcher who was

It was impossible to control the subjects' awareness of the group assignment due to the nature of the intervention. However, the data analyst was unaware of the group assignment. In addition, the randomization code was available only to the research fellow who was not connected to this study.

2.6. Interventions

The intervention group participated in six primary exercises of Tai Chi over an eight-week period, with three sessions per week. Each session was facilitated by the researcher who was appropriately trained and held a valid Tai Chi practice certificate. The sessions lasted between 30 and 40 minutes. At the beginning of each session, 7-10 minutes were used for warming up and the last 7-10 minutes were spent for cooling down. Ten movements extracted from the 24 simple forms of Tai Chi Chuan (Yang style) were selected as the main motions for the intervention protocol. In the first week, the exercise programme emphasized the initial learning of movements. In subsequent sessions, the focus was on increasing motor performance and improving balance with increased attention on the individual's performance gestures. Light music was played during the exercise. The subjects were allowed to sit on a chair for short rest periods and, if needed, could use a walker or cane. The control group was asked to engage in usual daily activities and report any new activity. The Leiden Padua quality of life questionnaire (LEIPAD) [25] was filled out by the subjects or a researcher who was unaware of the random allocation of the older people. Also, the statistical analyst was not aware of the random allocation of the subjects to the groups.

2.7. Data collection

2.7.1. Demographic information

Information about age, education level, marital and employment status, physical and mental illness, drug use, smoking, and history of group exercise was recorded by the researcher at baseline.

2.7.2 Abbreviated Mental Test Score (AMTS)

The Abbreviated Mental Test Score (AMTS) was used to assess cognitive impairments. It has been derived from the longer Mental Test Score developed by Hodkinson. The AMTS is

minutes to be completed. The psychometric properties of the AMTS have been evaluated in Iran using the calculation of the Cronbach's α coefficient and has been reported as 0.90 by Foroughan et al. (2017) [26].

2.7.3 LEIPAD quality of life questionnaire

At baseline and at the end of eight weeks the LEIPAD quality of life questionnaire was completed by the subjects. Those subjects who were not literate were aided to complete the questionnaire by the researcher via interviewing.

Developed by De Leo et al. (1998), the LEIPAD quality of life questionnaire was specifically designed for use with older people. It comprises 31 questions to assess the older people's quality of life in seven dimensions: a) physical function (five questions); b) self-care (six questions); c) depression and anxiety (four questions); d) mental function (five questions); e) social function (three questions); f) sexual function (one question) and g) life satisfaction (six questions) [25]. This questionnaire has been recommended as an international instrument with no cultural burden in all older groups and for use in various communities [27]. In Iran, this instrument has been shown to be valid and reliable [28, 29]. Its validity was assessed using the content validity method. For reliability, the Cronbach's alpha coefficient was calculated and reported as 0.83 by Ghasemi et al. (2011) [30].

2.8. Data analysis

Data analysis was conducted using the SPSS version 22 software. To analyze the data at the descriptive level, central indices such as mean and standard deviation were used. At the inferential level, independent t-test, paired t-test, Fisher exact test and Chi-square test were used for data analysis. The significant level was set as $p < 0.05$.

2.9. Ethical considerations

Ethical approval was sought and obtained from the Medical Ethics Committee affiliated with Shahed University (decree code: IR.Shahed.REC.1395.17). The trial was registered in the Iranian registry website of clinical trials (No. IRCT201703267529N12). The written informed consent form was sought from the subjects. They were assured that their

3.1. Homogeneity of the groups

According to Table 1, there were no statistically significant differences between the two groups in terms of age, the education level, marital status, housing, occupation, smoking, lifestyle, drug use, disease and history of exercise ($p>0.05$). The mean age of the subjects in both groups was 67 years. The majority of the subjects in both groups were married, either retired or unemployed, did not use tobacco and resided in their own home. In addition, they mostly took prescribed medications.

3.2. Effect of the intervention

The groups before the intervention were homogeneous in terms of the different dimensions of quality of life assessed by the LEIPAD ($p>0.05$). After eight weeks of Tai Chi exercise, there was a statistically significant difference in the mean scores of different areas of quality of life between the two groups. This indicated the beneficial effect of Tai Chi on the quality of life of the older men ($p<0.05$) (See Table 2).

4. Discussion

It was found that the Tai Chi intervention had a beneficial effect on the perception of the quality of life in the subjects. Significant changes in the older men's quality of life in the intervention group after eight weeks indicated the effectiveness of Tai Chi exercise. This finding was consistent with that reported by Chang et al. (2017), that observed improvements in the quality of life and physical functioning in patients with ESRD following a weekly short-form Yang Style Tai Chi session for 12 weeks [21]. Khazaei et al. (2015) likewise reported that physical activity had a positive and significant effect on older people's happiness, and increased their quality of life [31]. Lok et al. (2017) demonstrated that a physical activity programme consisting of warm-up, rhythmic, cool-down and free walking activities for ten weeks improved the quality of life and decreased the symptoms of depression in older people [17]. The findings of this study also were consistent with those reported by Chan et al. (2017), that examined the effects of a Tai Chi Qigong programme on older people's mental health, and reported improvements in mental health, reduction of loneliness and increased overall satisfaction with social support [22]. Lee et al. (2010) showed an increase in the quality of life as reported by older people living in nursing homes

functioning was not statistically significant, which is not consistent with the results of the current study. The difference in findings can be attributed to variations in methods, length of the intervention, subjects' characteristics and sample size.

Tai Chi exercise is a method to promote the smooth and balanced flow of energy through the body, and can help individuals achieve a more appropriate control of their bodily movements during exercise and in real life situations. Tai Chi is similar to a slow-moving dance and involves two pathways influencing mind concentration and breathing. Focusing on these two major tenets of Tai Chi makes that subjects experience an integration of meditation and body movements. Therefore, physical and psychological relaxation and finally an enhancement of balance and coordination are developed. Nevertheless, the positive effects of Tai Chi as a result of its relaxation and meditation nature are unclear, because participation in a desired group and satisfactory activities can reduce anxiety and promote comfort.

The older men in this study had no previous history of exercise activities. Also, they had no information of the identity of the research project in the retirement center before recruitment. The implementation of the group intervention was the beginning of coordination and communication with others, which increased individuals' self-esteem and feelings of empowerment. Furthermore, social participation contributed to a reduction in the feelings of loneliness in the older men.

This study used a RCT design, but it could still have some limitations, which should be considered during the interpretation of findings. For instance, this study was conducted only on older men and had a short follow-up assessment period. Also, the subjects could not be blinded to the intervention. Since the timeframe for the evaluation of outcome variables was limited, no subsequent follow-up assessments of the quality of life was performed. Additionally, the self-report method of measurement in this study could be influenced by poor reporting, recall bias, or social desirability. While the older men could not be blinded to the intervention, they were instructed not to discuss Tai Chi exercise with others. However, it was impossible to control all subjects' communications and some of them might have discussed it with those in the control group.

5. Conclusion

The results of this study suggested that Tai Chi exercise had a statistically significant effect on the improvement of self-rated quality of life in older men. Therefore, it can be a beneficial

noncompetitive and cost-effective sport. It is also appropriate for those older persons who are unable to get involved in extreme sports' activities due to their physical conditions.

Future studies need to replicate this study with a sample of female older people living in different types of community settings such as nursing homes or long term care facilities. Future studies can examine the effect of Tai Chi exercise on different aspects of older people's quality of life in long terms intervals. More studies are required to improve our understandings of biological mechanisms by which Tai Chi exercise influences the quality of life. An assessment of outcome variables by an instructor, through video checking, or interviewing by staff or family members can yield more accurate data. It is suggested to compare Tai Chi exercise with other complementary and alternative medicine methods and physical training in terms of their effects on the quality of life of older people. Other studies are required to examine the effect of Tai Chi on factors influencing various aspects of older people's physical and mental health including balance or cognitive functioning.

Supplementary Materials

Supplementary data associated with this article can be found in attachments. This data includes the Consort 2010 Checklist. (*Supplementary Materials*)

Required permissions were obtained from the Ethics Committee affiliated with Shahed University. The aim and nature of the study were explained to older people and written informed consent form was signed by them.

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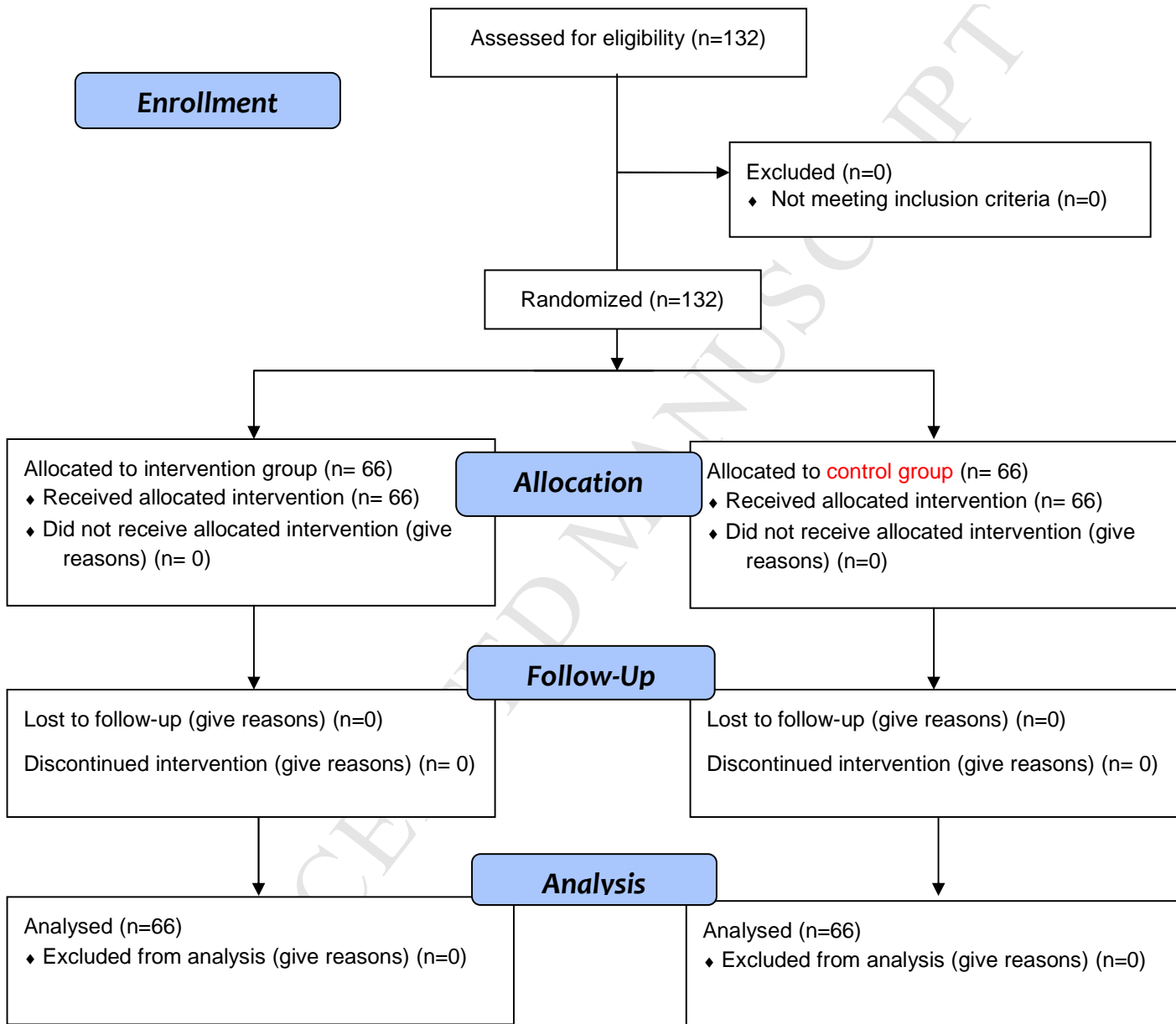
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Characteristics	Total (n = 132)	Intervention group (n = 66)	Control group (n = 66)	Statistical test and <i>p</i> -value*
Age(year) Mean ± SD	67.46 ± 0.35	67.91 ± 4.42	67.02 ± 3.61	t=-1.270 df=130 <i>p</i> =0. 200
Education level, n (%)				Fisher's exact test
Primary school	88(66.67%)	45(68.2%)	43(65.2%)	df=1
Secondary school	44(33.33%)	21(31.8%)	23(34.8%)	<i>p</i> =0. 850
Marital status, n (%)				Fisher's exact test
Married	121(91.7%)	60(90. 9%)	61(%92.4)	df=1
Widow	11(8.3%)	6(9.1%)	5(%7.6)	<i>p</i> =0.990
Experience of sport activities, n (%)				Fisher's exact test
Yes	51(38.6%)	27(40.9%)	24(36.4%)	df=1
No	81(61.4%)	39(59.1%)	42(63.6%)	<i>p</i> =0. 720
Smoking, n (%)				Fisher's exact test
Yes	12(9.1%)	7(58.3%)	5(41.7%)	df=1
No	120(90.9%)	59(49.2%)	61(50.8%)	<i>p</i> =0. 760
Number of children Mean ± SD	3.19 ± 1.17	3.33 ± 1.26	3.06 ± 1.06	Mann-Whitney U =1946.50 <i>p</i> =0. 270

Note. The significance level was set as $p < 0.5$

Parameters	Time	Group (n = 132)	Mean ±SD	t-test	P-value*
Physical function	Before intervention	Intervention Control	10.84±1.98 10.78±2.04	0.17	0.86
	After intervention	Intervention Control	12.53±1.50 10.85±2.01	5.43	0.001
Self-care	Before intervention	Intervention Control	16.62±1.49 16.45±1.72	0.59	0.55
	After intervention	Intervention Control	17.53±0.91 16.85±1.54	3.09	0.002
Depression and anxiety	Before intervention	Intervention Control	8.60±1.97 8.40±2.14	0.54	0.58
	After intervention	Intervention Control	10.45±1.11 8.50±2.12	6.63	0.001
Mental function	Before intervention	Intervention Control	11.42±2.12 11.48±2.10	-0.16	0.87
	After intervention	Intervention Control	12.95±1.51 11.45±2.00	4.84	0.001
Social function	Before intervention	Intervention Control	5.90±1.76 6.06±1.46	-0.53	0.59
	After intervention	Intervention Control	7.41±1.05 6.08±1.40	6.16	0.001
Sexual function	Before intervention	Intervention Control	2.98±1.31 3.09±1.28	-0.46	0.64
	After intervention	Intervention Control	3.92±0.99 3.14±0.15	6.16	0.001
Life satisfaction	Before intervention	Intervention Control	10.66±2.46 10.46±2.34	0.47	0.63
	After intervention	Intervention Control	13.92±1.73 10.48±2.34	3.97	0.001
Quality of life	Before intervention	Intervention Control	66.24±9.76 65.52±10.63	0.40	0.68
	After intervention	Intervention Control	78.27±5.74 65.73±11.09	9.57	0.001

Note. The significance level was set as $p < 0.5$



- Tai Chi intervention can improve the quality of life of male older people.
- Tai Chi intervention is a mild exercise, does not have negative side effects on older people's health and can be performed using limited exercise facilities.
- Healthcare professionals are recommended to investigate the use of this safe and non-pharmacologic method, along with other interventions, to improve the quality of life in older people.

ACCEPTED MANUSCRIPT