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Tai chi exercise is better than low-intensity steady-state cardio for improving physical fitness and sleep quality in the elderly

Laily Mita Andriana[1abcd], Arif Rahman Nurdianto[2ef]

[1] Department S1-Physiotherapy, Faculty of Health Sciences, Universitas Anwar Medika

[2] Medical Laboratory Technology, Faculty of Health Sciences, Universitas Anwar Medika

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Abstract

The condition of elderly is a condition with decreased function both anatomically and physiologically. The problem is the lack of participation of the elderly in exercise due to motivational factors, physical conditions, and attitudes of the elderly towards this type of exercise. This study aims to prove that tai chi is better than low-intensity steady-state cardio in improving the physical fitness and sleep quality of the elderly. The method used in this study is quantitative inferential using a two-group experimental design. This study examined as many as 40 older adults as subjects. The Physical fitness was collected using a senior fitness test instrument, and sleep quality was collected using a sleep quality questionnaire entitled the Pittsburgh Sleep Quality Index. The data analysis technique was paired sample t-test and independent t-test. The results showed that tai chi exercise was better than low-intensity steady-state cardio for increasing flexibility ($p<0,05$), muscle strength in the upper and lower extremities ($p<0,05$), and improving coordination and balance abilities ($p<0,05$). At the same time, the low-intensity steady state is better than tai chi exercise in improving cardiovascular ability ($p<0,05$). Tai chi exercise is better than the low-intensity steady-state cardio method for improving sleep quality ($p<0,05$). The conclusion is that tai chi exercise is better than the low-intensity steady state in improving physical fitness and sleep quality in the elderly group.

Keywords: elderly, low-intensity steady state, sleep, tai chi, physical fitness.

INTRODUCTION

Indonesia has experienced an increase in the number of older adults. The number of elderly in Indonesia according to census data conducted in 2018, shows that Indonesia is a country with the fifth largest number of older adults in the world, reaching 10,4% people of the total population (Retty et al., 2022). The number of older adults over 60 is expected to increase in 2020 to 27.1 million people, in 2025 to 33.7 million people and in 2035 to 48.2 million people (15.77%). This condition shows that Indonesia is transitioning towards population ageing because the percentage of the

Correspondence author: Laily Mita Andriana, Universitas Anwar Medika, Indonesia.
Email: lmitaandriana@gmail.com

population aged 60 years and overreaches more than 7% of the total population, and if it exceeds 10%, then Indonesia can be said to be a country with an ageing population (Lidya, Fitriany, & Iskandar, 2022). This illustrates a phenomenon of an increase in the life expectancy of the Indonesian population, this phenomenon occurs partly because of the success of health development in Indonesia.

The ageing process in the elderly is characterized by degenerative changes in the respiratory system, neuromuscular system, integumentary system, musculoskeletal system or in other body tissue systems (McGee, 2021b). Health problems in the elderly begin with a decline in body cells resulting in a decrease in body resistance which is one of the risk factors for the development of a disease that occurs in a person's body (Andriana & Ashadi, 2019). Health problems usually experienced by the elderly such as balance disorders, decreased cognitive function, confusion and others. Physiologically the elderly will experience a decrease in various organ functions. The decline that occurs will have an impact on the physical decline. Doing physical activity well can minimize the decline due to ageing in the elderly (Wang, Guo, Liu, Xie, & Lam, 2022). An activity that an individual does every day is part of physical activity, this activity is carried out with efforts that are tailored to the individual's abilities. The elderly will experience a decrease in physical activity, which causes a decrease in cardiorespiratory endurance which affects their fitness of the elderly (Wang et al., 2022). If the elderly do exercise well, then the elderly fitness will be achieved.

Exercise is good for the elderly to increase productivity in old age. The quality of a person's life will be good if the person is able to carry out regular physical activity. Regular exercise can also increase cardiorespiratory endurance (Kaur & Singh, 2019). Good cardiorespiratory endurance can increase the endurance of human work with great intensity for a longer duration and can slow down fatigue so that the individual can carry out activities (Ashadi, Andriana, & Pramono, 2020). Exercise is good for the elderly to increase productivity in old age. The quality of a person's

life will be good if the person is able to carry out the regular physical activity (Andriana, Ashadi, & Nurdianto, 2021).

Age is a factor that can affect a person's daily activities and activities. Age can affect the quality and quantity of a person's activities, especially daily physical activities. Increasing a person's age can cause a decrease in physical capacity, including a decrease in maximum heart rate, a decrease in muscle mass and strength, and an increase in fat mass (Scheffer & Latini, 2020). Previous research stated that increasing age in the elderly causes the level of fitness or VO2 max to decrease. In this study, the fitness results of the elderly aged 60-64 years were better than the elderly aged 70-74 (Cheng et al., 2021). Likewise, other research states that increasing a person's age will affect physical activity, and the elderly will experience dependence due to the inability of the elderly to carry out daily activities. The dependence experienced by the elderly can be caused by a lack of physical activity and minimal exercise by the elderly (Wang et al., 2022).

The increasing prevalence of the elderly is a challenge for the State of Indonesia to prepare and create a healthier and more independent elderly. This requires a serious handling of a problem that tends to interfere with physical and psychological health in the elderly so that the elderly are more able to be independent without being considered a burden in a family and can improve their quality of life in the elderly (Bagiartana & Huriah, 2021). Problems that occur in the elderly who tend to have physical disorders significantly affect their health of the elderly, this needs to be considered and given special interventions because the elderly have the potential to experience physical, mental, spiritual, economic and social problems (McGee, 2021). This can become an underlying problem that often occurs in the elderly, a health problem due to a degenerative process. In addition, problems with the elderly can also have a negative impact on families who think that the elderly are a family burden, so not many in a family feel reluctant and choose to place the elderly in parental care or nursing homes (Xianjian & Datao, 2021).

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Exercise is an effective way for the elderly to maintain physical fitness. However, there are some obstacles for the elderly in carrying out sports due to physiological limitations and limited access. The most common sport given to the elderly is the low-intensity steady-state cardio method, it was stated that the elderly group who were given intervention for two months in the form of a low-intensity steady-state cardio training method experienced an increase in VO2Max by 35% (Zhao, He, Yun, Wang, & Liu, 2022).

Exercise intervention using the low-intensity steady-state cardio method is carried out by carrying out physical activity in the form of walking for 30 minutes using an intensity of 60%-69% of the maximum heart rate. However, the problem is the lack of elderly participation in the sport due to motivational factors, physical condition, and the elderly's attitude towards this type of sport. The compliance of the elderly in carrying out the given exercise therapy program influences the rehabilitation process (Jin & Shen, 2022).

Based on this, an innovation in the type of sport is needed that can increase the adherence of the elderly to exercise. The innovation of this type of sport is tai chi exercise (He et al., 2021). Tai chi is one of the modalities to improve the quality of life of the elderly. In this tai chi exercise, it is more important to balance and synchronize breathing and movement (Kurdi, Abidin, Priyanti, & Kholis, 2021). In addition, this exercise consists of movements in the hands and feet that are carried out simultaneously, slowly, with a soft rhythm and integrated with breathing to improve balance and reduce the risk of falling in the elderly (Zhou, Zhao, Fan, Li, & Chen, 2021). Tai chi is a form of exercise that is beneficial for health, which is an exercise or sports movement that combines movements body of breathing and meditation. Tai chi exercise has many benefits, including improving flexibility, body balance, quality of life, cardiorespiratory function and aerobic capacity (Liang et al., 2020).

Based on the problems that have been described, this study aims to prove that tai chi exercise is better than the low-intensity steady-state cardio

method to improve the physical fitness and sleep quality of the elderly. It is known that the research results that have been described previously are only limited to researching the improvement of elderly fitness. Therefore, this study has an element of novelty, including comparing elderly exercise and tai chi exercise to physical fitness and sleep quality. This research is expected to be useful for everyone, especially the elderly, to improve their quality of life.

METHOD

The method used in this study is quantitative inferential using a two-group experimental design. This study compared two groups that were given intervention in the form of different exercises to determine the physical fitness and sleep quality of the elderly. The research subjects used were older adults in Wonoayu District, Sidoarjo Regency. The sampling technique used is simple random sampling. The number of samples was obtained through the Pocock formula, so the minimum sample obtained was 20 subjects for each intervention. So it can be concluded that the total research subjects used were 40 elderly subjects. The determination of research subjects was based on the inclusion and exclusion criteria of the l.study. The inclusion criteria set included older adults over 60 years, female, not bound by work (retired), having a sedentary lifestyle, and not experiencing musculoskeletal disorders/ being injured.

Table 1. Exercise program

	Duration		Intensity	
	Tai chi	LISS cardio (walking 30min)	Tai chi	LISS cardio (walking 30min)
Warming-Up	10 min	10 min	50% HRmax	50% HRmax
Main exercise	30 min	30 min	60%-69% HRmax	60%-69% HRmax
Cooling down	10 min	10 min	50% HRmax	50% HRmax

Based on table one explains the tai chi training program and the LISS method, in the table, it is explained that where each group referred to frequency, intensity, type, and time (FITT) with a frequency of 3 times a week. Intensity 60%-69% of maximal heart rate. Duration (time) 50 minutes and the type of low-impact exercise. The workout details include a 10-minute warm-up phase, a 30-minute main phase, and a 10-minute cool-

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down phase. The intervention was carried out for eight weeks or two months with a frequency of exercise 3 times a week.

Physical fitness was collected using the senior fitness test instrument. The five functional tests include the chair stand test. This requires the elderly to repeatedly stand up and sit down on a chair for 30 seconds. This reflects lower body strength. The arms curl test. This requires the elderly to repeatedly lift a 5 lb (2.27 kg) weight (for women) for 30 seconds. This reflects upper body strength. The 6-minute Walk Test. This is measured in the distance (m) and reflects aerobic endurance. The Chair Sit and Reach Test. This is measured in the distance (cm) and reflects lower body flexibility. The 8-Foot Up And Go Test. This is measured in time (seconds) and reflects agility and dynamic balance.

Sleep quality was collected using a sleep quality questionnaire instrument entitled the Pittsburgh Sleep Quality Index. The procedure for filling out this questionnaire was carried out before the intervention was given and after the intervention was given. The intervention was carried out for two months with a frequency of exercise three times per week. Thus the researchers set exclusion criteria which aim to avoid biased data. The exclusion criteria set were as follows, namely, the subject was declared drop out if he did not take part in the intervention even though it was only one time face-to-face, took sleeping pills or experienced musculoskeletal injuries/disorders, CHF, joint pain, chest pain, dizziness, angina during exercise, Blood pressure > 160/100.

Study Procedure

The data collection procedure was carried out in three stages. The three stages include the pre-test stage, the intervention stage, and the post-test stage. The following are the stages of data collection which are explained in detail:

1. The research subjects were divided into two treatment groups in the first stage. The first group was given treatment in the form of tai chi exercise, and the second group was given treatment in the form of low-intensity

steady-state cardio training using a variety of walking core exercises for 30 minutes.

2. Before being given treatment, research subjects were directed to collect initial data (pre-test). The instruments used were the senior fitness test which served as a measure of the physical fitness of the elderly, and the Pittsburgh Sleep Quality Index Questionnaire (PSQI), which served as a measure of the sleep quality of the elderly. Data on physical fitness and sleep quality were collected using the MS application. Excel.
3. The next stage is the intervention stage, according to the exercises given to each group. Interventions were based on Frequency, Intensity, Time, and Type (FITT). In terms of frequency, the intervention was carried out for two months with a training frequency of three times per week. Based on this, the total number of exercises carried out by the research subjects was 12 times. Discussing intensity and discussing intensity must be distinct from the exercise program. Details of the exercise program can be seen in table one. The aspect of duration, the total duration of the exercise between the two exercises is 50 minutes. Details of the duration of the exercise between the two exercises can be seen in table one. In terms of the type of exercise, the two exercises have the same type of exercise, namely the type of exercise using the aerobic energy system (utilizing cardiovascular abilities), but the difference is the variety of exercises. Tai-chi exercise is an exercise using an aerobic energy system that utilizes all limbs (upper and lower extremities). Meanwhile, the low-intensity steady-state cardio exercise uses variations of the core exercise, walking for 30 minutes, which utilizes the limbs of the lower extremities only.
4. Subjects who had been given the intervention for two months were then directed to carry out the final data collection stage (post-test). The data taken is the physical fitness data of the elderly and sleep quality data. The data that has been collected is stored in the ms application. Excel.
5. The final stage is the analysis of the initial data (pre-test) and final data (post-test). Data analysis uses the SPSS application, which functions to

process the data that has been collected. Data is collected, tabulated, and processed using statistical formulas so that conclusions can be drawn and answers to research questions can be compiled. The research results are presented in tabular form and explained in narrative form to make it easier for the reader to understand the results.

RESULT

Table 2. Descriptive characteristic of the subject

Variable	The groups of intervention	
	Tai Chi	Low-intensity steady state
Age		
60-64	45%	50%
65-70	35%	40%
71-75	10%	10%
Body mass index		
<18,5	30%	40%
18,5 - 24,9	20%	25%
25,0 – 29,9	40%	30%
>30	10%	5%
Physical activity level		
Light	80%	75%
Moderate	20%	25%
Heavy	0%	0%
Sitting time/ day		
1-2 hours/day	10%	20%
3-4 hours/day	10%	5%
>5 hours/day	80%	75%

Based on the data displayed in table two describes the characteristics of the research subject. Table one explains the average age, body mass index, physical activity level, duration of sitting/day, and calorie intake/day.

Table 3. Senior test fitness of tai chi group intervention

Variable	Tai Chi		Paired sample t-test
	Pre-test	Post-test	
Chair Sit And Reach Test (CSART)			
Under average	55%	20%	0,000
Normal	45%	60%	
Above average	0%	20%	
Chair Stand Test (CST)			
Under average	60%	20%	0,000
Normal	40%	70%	
Above average	0%	10%	
Arm Curl Test (ACT)			
Under average	50%	10%	0,000
Normal	40%	60%	
Above average	10%	40%	
8-Foot Up And Go Test (8 FUGT)			
Under average	70%	40%	0,000
Normal	30%	50%	
Above average	0%	10%	
6-Minute Walking Test			
Under average	30%	0%	0,000
Normal	60%	70%	
Above average	10%	30%	

The data shown in table three explains the percentage of senior fitness tests in the group given the tai chi intervention. In table three, it is explained that the tai chi intervention group experienced an increase in their flexibility ability (Chair sit and reach test) ($p<0,05$), in that group also experienced an increase in leg muscle strength (chair stand test) ($p<0,05$), in addition to an increase in arm muscle strength (arm curl test) ($p<0,05$), the intervention also resulted in an increase in coordination and agility skills (8-foot up and go test) ($p<0,05$), as well as an increase in cardiovascular endurance (6-minute walking test) ($p<0,05$). The effect can be seen through the increase that occurs before the intervention (pre-test) and after the intervention (post-test).

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Table 4. Senior fitness test of low-intensity steady-state cardio group intervention

Variable	Low-intensity steady-state cardio		Paired sample t-test
	Pre-test	Post-test	
Chair Sit And Reach Test (CSART)			
Under average	60%	40%	0,666
Normal	40%	60%	
Above average	0%	0%	
Chair Stand Test (CST)			
Under average	50%	30%	0,000
Normal	40%	60%	
Above average	10%	10%	
Arm Curl Test (ACT)			
Under average	50%	40%	0,333
Normal	30%	30%	
Above average	20%	30%	
8-Foot Up And Go Test (8 FUGT)			
Under average	60%	30%	0,000
Normal	40%	50%	
Above average	0%	20%	
6 Minute Walking Test (6 MWT)			
Under average	20%	0%	0,000
Normal	60%	20%	
Above average	10%	80%	

Based on the data shown in table four explains the percentage of senior fitness tests in the group given the low-intensity steady state (LISS) intervention. In table four, it is explained that the LISS method intervention group did not experience an increase in their flexibility ability (Chair sit and reach test) ($p>0,05$) this is because the LISS method only focused on cardiovascular endurance, in that group also experienced an increase in leg muscle strength (chair stand test). There was no increase in arm muscle strength (arm curl test) ($p>0,05$), the intervention also resulted in an increase in coordination and agility skills (8-foot up and go test) ($p<0,05$) and an increase in cardiovascular endurance (6-minute walking test) ($p<0,05$). The effect can be seen through the increase that occurs before the intervention (pre-test) and after the intervention (post-test).

Table 4. Comparison of senior fitness test between tai chi & low-intensity steady state group

Variable	Percentage of improvement		Mean difference	Independent samples t-test
	Tai Chi Gymnastic	Low-intensity steady state		
Chair Sit And Reach Test (CSART)	73,5%	20%	53,5% ± 0,777	0,000
Chair Stand Test (CST)	69%	31,3%	38,7% ± 0,688	0,000
Arm Curl Test (ACT)	62%	20,8%	41,2% ± 0,333	0,000
8-Foot Up And Go Test (8 FUGT)	63,9%	21,6%	42,3% ± 0,533	0,000
6 Minute Walking Test (6 MWT)	30%	70,7%	40,7% ± 0,233	0,000

Table four explains the difference between tai chi training and the low-intensity steady-state cardio method for increasing the physical fitness of the elderly. Based on the data displayed in table four, it can be explained as follows;

a. There is a difference between tai chi training and low-intensity steady-state cardio-increasing flexibility (CSART). Tai chi exercise is better than the low-intensity steady state method in increasing the flexibility of the elderly.
b. There is a difference between tai chi training and the low-intensity steady-state cardio method of increasing arm muscle strength (ACT). Tai chi exercise is better than the low-intensity steady state method in increasing arm muscle strength in the elderly.
c. There is a difference between tai chi training and the low-intensity steady-state cardio method of increasing leg muscle strength (CST). Tai chi exercise is better than the low-intensity steady state method in increasing the leg muscle strength of the elderly.
d. There is a difference between tai chi training and the low-intensity steady-state cardio method of improving coordination and agility (8 FUGT). Tai chi exercise is better than the low-intensity steady state method in improving the coordination and agility of the elderly.
e. There is a difference between tai chi training and the low-intensity steady-state cardio method to increase cardiovascular endurance (6 MWT). The low-intensity steady-state cardio method is better than the

tai chi exercise in increasing the cardiovascular endurance of the elderly.

Table 5. Sleep quality index of tai chi group intervention

Sleep Quality Index	Tai chi		Paired sample t-test
	Pre-test	Post-test	
Good	30%	75%	0,000
Bad	70%	25%	

Based on table five describes the sleep quality index in the group given the tai chi exercise intervention. In the table, there was an increase in the sleep quality of the subjects who were given the intervention in the form of tai chi exercises.

Table 6. Sleep quality index of low-intensity steady-state cardio group intervention

Sleep Quality Index	Low-intensity steady-state exercise		Paired sample t-test
	Pre-test	Post-test	
Good	45%	70%	0,000
Bad	55%	30%	

Table six describes the group's sleep quality index given the low-intensity steady-state cardio intervention method. In the table, there was an increase in the sleep quality of subjects who were given an intervention in the form of a low-intensity steady-state method.

Table 7. Comparison of sleep quality index between tai chi & Low-intensity steady state cardio group

Variable	Percentage of improvement		Mean difference	Independent samples t-test
	Tai Chi Gymnastic	LISS		
Sleep quality index	66,7%	32,6%	34,1% ± 0,111	0,444

Table seven explains the differences between tai chi exercises and the low-intensity steady-state method in improving sleep quality. Tai chi exercise is better than the low-intensity steady-state method for improving sleep quality.

DISCUSSION

Based on the data and facts obtained during the study, the average age of the elderly studied is above 60 years. Based on the facts that have been found that most of the elderly studied have low activity levels, this is supported by the data on average sitting time/day duration of more than five hours/day. It is known that physical activity is positively correlated with metabolic syndrome and cardiovascular disorders often experienced by Indonesian people, especially the elderly. Previous research has mentioned that a sedentary lifestyle and the absence of control of calorie intake can potentially increase body weight, fat profile, and the incidence of metabolic syndrome (Andriana, Ratna Sundari, Muliarta, Ashadi, & Nurdianto, 2022).

Previous research has shown that body functionality negatively correlates with the body's metabolic ability. Based on this, it can be concluded that increasing age decreases the body's physiological functions/abilities (Kehler & Theou, 2019). It is characterized by a decrease in muscle mass, an increase in fat mass, an increase in lipid profile, a decrease in bone density, and a decrease in heart rate. Based on this, if the elderly group does not improve their lifestyle, it will impact their quality of life (Moghetti, Bacchi, & Donà, 2019). The decline in the quality of life experienced by the elderly can have an impact on their immunity aspect of the elderly. A compromised immune system can impact the health status of the elderly. The elderly become susceptible to degenerative and non-degenerative diseases (Panda, 2020).

Complaints often obtained by the elderly are about the quality of sleep. A previous study showed that sleep quality positively correlates with elderly sleep quality (Katzmarzyk, Ross, Blair, & Després, 2020). Based on this statement, it can be said that a decrease in the quality of life of the elderly can cause a decrease in the quality of sleep in the elderly. Therefore, to improve the sleep quality of the elderly, it is necessary to adopt a good lifestyle (Mainous, Tanner, Rahmanian, Jo, & Carek, 2019). The increasing prevalence of the elderly is a challenge for the State of Indonesia to prepare and create a healthier and more independent elderly.

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The findings in the research results state that tai chi exercise is better than the low-intensity steady-state cardio method in increasing the flexibility of the elderly. Tai chi exercises are more effective in increasing the flexibility of the elderly because the movements performed in tai chi exercises involve all limbs and require flexibility skills (Liu et al., 2019). A previous study states that a real decrease in function in the elderly is a decrease in muscle strength which will result in a decrease in the ability of muscle flexibility, which will affect the ability to maintain postural balance or body balance (Ko, Lee, Hsu, & Huang, 2022).

Taichi exercises increase the ability of muscles to extend/stretch as much as possible so that the body can move with a maximum range of motion without discomfort/pain (Sánchez-Tocino et al., 2022). Increased flexibility is closely related to soft tissues, such as ligaments, tendons, muscles, and bone structure (Xinzheng, Fanyuan, & Xiaodong, 2022). The increase in muscle flexibility is also related to the extensibility of the musculotendinous (Tan et al., 2022). Muscle flexibility plays an important role for all age levels, considering that the older a person gets, the less flexibility they have as a result of decreased muscle elasticity and increased joint stiffness in activities (Tang et al., 2022).

This research also concluded that it was said that tai chi exercise is better than the low-intensity steady state method in increasing arm muscle strength and leg muscle strength in the elderly. Tai chi exercises are known to increase upper and lower body strength. The core muscles located in the back and abdomen are the focus of tai chi exercises (Jin & Shen, 2022). Regular tai chi movements are equivalent to brisk walking and weight training in strengthening and increasing musculoskeletal strength. Tai chi is a combination of meditation, breathing control and specific stretching exercises that involve a variety of hand and foot movements at a steady pace involving large muscles. It not only builds the legs, arms, and body through various movements but also strengthens the internal organs and the central nervous system by using slow and deep abdominal breathing and concentration of the mind (Zhao et al., 2022). This sport consists of

various movements to train body coordination, balance, flexibility, and breathing (Ko, Lee, Hsu, & Huang, 2022).

In the elderly, there is a decrease in muscle strength, an increase in reaction time, a decrease in flexibility, and a decrease in muscle functional ability. As a result of this condition, the elderly often experience balance problems when standing and are prone to falling. Optimization of musculoskeletal abilities and motor responses, as well as sensory input, can be done by actively doing regular, directed, and programmed movement exercises (Wang et al., 2022). Previous research has stated that with poor balance, the body will experience disturbances in perceiving the base of support or the foundation on which to stand. Decreased musculoskeletal conditions also affect muscle and postural abilities. Changes in posture affect changes in the centre of gravity (COG) of the body to the fulcrum. Based on the data obtained, tai chi exercise is better than the low-intensity steady-state cardio method in improving the coordination and agility of the elderly (Xianjian & Datao, 2021).

In addition to increasing muscle flexibility, tai chi exercises will affect the body's balance ability. Increased sensory input, increased motor response and an increase in musculoskeletal strength will affect the ability of the muscles to support the body (Cheng et al., 2021). These changes, of course, will affect the postural condition and the ability of the elderly to maintain their body balance against the fulcrum. The condition of increasing visual, vestibular, and somatosensory abilities will certainly improve balance in the elderly (Zhou et al., 2021).

Doing sports that are programmed and carried out sustainably will bring many benefits, including increasing muscle strength and training the heart, lungs, and blood circulation ability to work effectively and efficiently (cardiovascular fitness) (Andriana et al., 2022). Based on the data and facts that have been obtained during the study, it is stated that the low-intensity steady-state cardio method is better than the tai chi exercise in increasing the cardiovascular endurance of the elderly.

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The low-intensity steady-state cardio method is an exercise method that uses an aerobic energy system. When exercise involves not only the musculoskeletal system, it also other systems such as the cardiovascular system, respiratory system, excretory system, nervous system, and others (Huang et al., 2022). Aerobic exercise provides enough movement to keep your body functioning for at least 30 minutes at a time. Aerobic training has the effect of increasing fat oxidation in skeletal muscle as a result of adaptation reactions, including an increase in mitochondrial volume and lipolysis of adipose tissue into fatty acids, transport of fatty acids into cells, intramuscular lipolysis of triglycerides into fatty acids, and transport of fatty acids into mitochondria (Cavar et al., 2019).

Based on previous research Brito et al., (2019), low cardiorespiratory fitness can worsen the risk of heart death. Physical exercise can be aerobic exercise is closely related to VO2Max. Physical activity provides the most benefit, and that fitness level can prevent diseases that result in death. The optimal physical condition for each individual is influenced by cardiorespiratory endurance, which is the ability to perform moderate to high-intensity exercise (Santos, Matzenbacher, Albarello, & Halmenschlager, 2019).

An increase in the number of elderly due to an increase in life expectancy will certainly cause several problems in the health sector, one of which is sleep disorders. Increasing age affects the decrease in sleep periods. The declining physical abilities of the elderly cause changes in sleep quality in the elderly. It has decreased physical ability due to decreased ability of organs in the body (Kuo et al., 2022). Tai chi exercise is better than the low-intensity steady-state cardio method for improving sleep quality. Tai chi exercise can stimulate a decrease in sympathetic nerve activity and an increase in parasympathetic activity, which affects the decrease in the hormone adrenaline, norepinephrine and catecholamines and vasodilation in blood vessels. Zhang et al. (2022) This further results in smooth oxygen transport throughout the body, especially the brain, so it can lower blood pressure and pulse to normal. Tai chi movement can increase

the release of noradrenaline, lower cortisol levels, and decrease sympathetic nerve activity, which results in a stable heart rate and blood pressure lowering sympathetic and parasympathetic nerve activity into balance and harmony (Wan et al., 2022). Thus stabilizing blood pressure. This condition will increase the relaxation of the elderly. In addition, the optimal secretion of melatonin and the effect of beta-endorphins helps increase the fulfilment of the sleep needs of the elderly (Wang et al., 2022).

CONCLUSION

Tai chi exercise was better than the low-intensity steady-state cardio for increasing flexibility, muscle strength in the upper and lower extremities, and improving coordination and balance abilities. At the same time, the low-intensity steady state is better than tai chi exercise in improving cardiovascular ability. Tai chi exercise is better than the low-intensity steady-state cardio method for improving sleep quality. The conclusion is that tai chi exercise is better than the low-intensity steady state in improving physical fitness and sleep quality in the elderly group. This research implies that sports activities carried out in a programmed manner aim to achieve physical fitness and improve sleep quality, which will impact increasing body abilities and improving the quality of life of the elderly.

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