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Thai E-sarn dance on balance and muscle strength in elderly women with falls risk

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ABSTRACT

The risk of falls, which is a significant contributor to mortality among the elderly population, is increasing due to declining balance and muscle strength. A quasi-experimental design was used in this study to examine the effects of traditional Thai E-sarn on balance and muscle strength in older women living in the community. The experimental or control group consisted of 35 people. The experimental group participated in a 12-week fitness regimen utilizing Thai E-sarn. The control group avoided participating in any type of physical activity. The experimental group exhibited notable enhancements in their balance, muscle strength, and health parameters as compared to the control group. In the experimental group, the timed up and go test (TUG) score was reduced by 1.91 seconds (95%CI: 0.67 to 3.16), p=0.003, while the 30-second chair stand test (30CST) increased by 3.15 (95%CI: 1.24 to 5.04), p<0.002. Systolic blood pressure dropped by 6.58 mmHg, diastolic by 5.57, and heart rate by 5.29 beats per minute. These findings suggest regular Thai E-sarn dance may improve balance, muscle strength, and all other parameters. Additional investigation is required to elucidate the impact of exercise on enhancing the general health of older adults.

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1. INTRODUCTION

Exercise is essential for the elderly, as their physiology deteriorates, exacerbating muscle atrophy and weakness, potentially leading to a loss of functional ability [1]. The benefits of exercise are clearly evident. Exercise training, in particular, has an effect on various systems in the body, improving the musculoskeletal and cardiovascular systems [2]. This is particularly relevant to the current population, which is consistently growing older. The global population is experiencing a rapid age increase. By 2050, a substantial proportion, specifically one in six individuals worldwide, will be aged 60 and above [3]. This results in a significant increase in the population of elderly individuals, rising from 1 billion in 2020 to an astonishing 2.1 billion by 2050. Within the same time period, projections indicate a trebling of the population of those aged 80 and above [4]. This phenomenon is not exclusive to the global arena. Thailand is currently undergoing a significant increase in its elderly population. They entered the “aging society” phase in 2025 and anticipate transitioning into a "super-aged society" by 2040 [5]. As a result, a significant segment of their populace will consist of

people in their golden years [6]. Considering the above changes. The long-term care system in Thailand places great importance on supporting older adults in their local communities [7].

The aging population faces many problems related to frailty and falls. The problem is often related to sarcopenia. This is an abnormality caused by decreased muscle mass and dynapenia. Which is a symptom of muscle weakness and neuromuscular degeneration. People with these characteristics lose their physical abilities and become more dependent on others. There appears to be a noticeable correlation between loss of muscle mass and an increased chance of falling. It increased from 2 to 3. Several studies discovered a 2-fold increase in the probability of long-term fractures [8]. According to 2017 statistics, aging is the 18th leading cause of shortened life expectancy. Falls can have many negative effects. This includes physical harm, injuries, and additional work for the healthcare system. Some of the effects include limited movement. The occurrence of pressure sores and eventual death [9]. Most studies show that improving the physical health of the elderly is important. People's overall health and well-being are greatly improved through exercise [10]. To successfully reduce the risk of falls. It is important to focus on improving self-care and balance skills in older adults. However, exercise training was able to lower participants' blood pressure. This means pushing for policies that promote healthy aging, such as making exercise a sustainable habit to keep you healthy as you age as well as promoting more exercise [11].

Elderly people living in the community should be prepared to exercise so as not to deteriorate their physical condition. Exercise training should be done for thirty minutes. Three to five days a week for three months. To reduce the risk of falling. The objective of this study was to examine the effects of Thai E-sarn dance on balance and muscle strength in elderly women at risk of falling. The health of seniors determines their cardiovascular endurance, balance, and muscle strength. Several studies have shown that regular yoga exercises significantly reduce the risk of falls in elderly women [12]. Studies have shown that regular practice of Tai Chi improves balance in the elderly [13]. Moreover, these studies show that resistance training helps strengthen the legs of older adults and improve balance [14], but each type of exercise above requires different training methods. This includes complex body movements that can be difficult for older adults to remember and correct. This shows that elderly people are especially at risk for falling, certain demographic groups, and this is especially true for those who are missing a lot of action. Who belongs to a particular group? This workout plan focuses on simple movements easily remembered. The plan consists of 8 exercises, done 4 times every 10 minutes, aimed at improving balance and lower extremity strength in older adults. So as not to fall, and more than that. Regular exercise will make the elderly walk. The physical movement is easy enough. And the overall performance is better [15].

2. METHOD

2.1. Study design

This study aimed to investigate the impact of Thai E-sarn dance on the fall risk among senior women in the vicinity of Khok Si Health Promoting Hospital. The study employed a quasi-experimental design. The objective was to investigate the impact of the intervention. The study was conducted in the Mueang District of Khon Kaen Province, Thailand. We scheduled the study to commence on September 1, 2023. The scheduled conclusion date was December 30, 2023. The methodology encompassed two sets of participants. Every group participated in both pre-test and post-test design.

2.2. Research subjects

The study determined the sample size required for evaluating mean differences [16]. The values were fixed at $\beta = 0.20$ and $\alpha = 0.05$. The treatment group's mean was 8.04 with a standard deviation (SD.) of 1.14, whereas the control group's mean was 9.55 with an SD of 2.94, according to previous studies [17]. After taking these things into account, we decided that each group would need 35 individuals. We carefully selected three communities that possessed comparable demographic and geographic traits, particularly in relation to their senior populations, to minimize confounding factors. employing a method of random selection. One hamlet served as the control group, and another as the experimental group. We employed the method of random sampling to arrive at this conclusion. The study applies the following standards to determine inclusion and exclusion.

a. Inclusion criteria:

- Older adults residing in the study area for more than one year.
- Older adults at risk of falling are identified based on the timed up and go test score ≥ 12 seconds.

b. Exclusion criteria:

- Older adults who have sustained fractures or other injuries within the past year.
- Older adults with significant balance issues may encounter difficulties in safely participating in the exercise program.

2.3. Intervention

Aim of this study was to investigate impact of Thai E-sarn dance exercise on balance and muscle strength in elderly women with falls risk. Three-month program established by the Ministry of Public Health. The program applies between Thai E-sarn dance and standard exercise. Traditional song 70 beat was use in exercise program. The subjects were scheduled to meet at the village hall. Once everyone was present, the exercise leader led the elderly in exercises. Participants in exercise program engaged in 40-minute exercise sessions, taking place five days a week, from 5:00 PM to 6:00 PM. The program is provided in the following:

The participants in experimental group received 10-minute warm-up exercise prior to commencing their training schedule. The provided routine comprises total of eight-step exercises, wherein each exercise is executed in eight steps. Resulting in total duration of 10 minutes.

a. Squat and arm swings: Align feet equidistantly with the breadth of your shoulders, assume a crouching position, and stretch arms forward. While maintaining an upright position, perform upward and lateral rotations of your arms. Execute 8 iterations; alternate between sides.
b. Arm raises and leg raises: In supine position, the feet should be positioned shoulder-width apart, while the arms should be held at the sides. Raise one arm in vertical position while simultaneously elevating the other leg with a flexed knee. Maintain this position momentarily before reverting back to the initial position. Perform a total of eight repetitions by alternating sides.
c. Torso twist lunges: Start with one leg extended out behind you and lower into a lunge while twisting your upper body to match the direction that leg is pointing. Stand up and repeat with the opposite leg extended. Do 8 reps total, alternating legs each time.
d. High knees: Stand with your feet shoulder-width apart and run-in place, bringing your knees up towards your chest. Continue for 30 seconds.
e. Arm circles and hip circles: Align oneself by placing the feet at a distance equivalent to the breadth of one's shoulders and extending the arms laterally. Make little circular movements using both arms, and then alternate between them. Following that, place your hands on your hips and construct small patterns using your hips. Execute a sequence of alternating arm and hip circles for a period of 30 seconds per cycle.
f. Arm swings and toe taps: Position yourself with your feet positioned at the width of your shoulders and rotate your arms in a backward direction, then rotate them forward while tapping your toes on the ground. Perform the task eight times.
g. Jumping jacks and arm swings: Stand with feet close together and arms apart. Spread your fee to the width of your shoulders while lifting your arms above your head. Then bring your feet together and arms to the side. Do this action eight times.
h. Knee raises with arm claps: Standing with feet about shoulder-width apart and arms fully extended out to the side, raise one knee up towards the chest and clap the hands above the head. Repeat with the other leg. Continue the motion back and forth for 30 seconds.
   - Follow step ii once for a duration of 10 minutes.
   - Take a 5-minute break.
   - Follow step ii twice for a duration of 20 minutes.
   - Following the exercise session, participants were provided with a ten-minute cool-down period.

The control group remained in their usual habits, thereby establishing a standard against which the other groups could be assessed. The participants were deliberately deprived of access to information and were not included in any deliberations related to the experimental workout routine. Additionally, this measure ensured that their actions remained unchanged despite the effects of the program.

2.4. Measurement tools and materials

Measurement tools included: i) Stopwatch and automatic digital blood pressure monitor undergo calibration every six months to guarantee precision. ii) The timed up and go test (TUG): This test has a high reliability score intraclass correlation coefficient (ICC) of 0.97 for assessing mobility in older adults living in the community [18]. The criterion validity between the TUG and Berg Balance Scale was a strong negative correlation (Spearman $\rho = -0.756$) [19]. An interpretation of greater than 12 seconds indicates an increased risk of falling. iii) The 30-Second Chair Stand Test (30CST) demonstrates high reliability with an intraclass ICC of 0.97 [20]. The 30CST demonstrated concurrent validity with the Modified 30-Second Sit-to-Stand Test (m30STS), with a Spearman $\rho = 0.737$ [21]. A score of less than 8 repetitions is considered indicative of an increased risk of falls. iv) Case Report Form: A form is used to collect detailed participant information, including: demographics: gender, age, marital status, education level, and occupation; TUG results; 30CST results; and blood pressure and heart rate monitoring.

2.5. Data collection

Participants visited a health center for data collection prior to and following a three-month intervention as part of the study. Participants were interviewed briefly to gather demographic information, including but not limited to age, marital status, level of education, and occupation. An evaluation of physical performance was carried out by a registered nurse. The TUG comprised a chair and a timer, during which participants rotated, ascended, and returned to a seated position. The 30CST entailed alternating between sittings and standing for 30 seconds; the number of repetitions was documented. In order to measure blood pressure and pulse rate, participants were required to rest for a duration of five minutes prior to undergoing three distinct assessments on the right arm. Following this, the average blood pressure was calculated and recorded. The study initially collected data from the intervention group, and subsequently, the following day, data was gathered from the comparative group.

2.6. Data analysis

The Shapiro-Wilk test was employed to evaluate the conformity of continuous variables to the normal distribution. STATA Version 16 was utilized for data analysis. The analysis incorporated descriptive statistics and demographic data. An independent t-test was employed to compare the baseline variables and outcome characteristics between the experimental and control groups. A paired t-test is used to assess variations in outcome variables within groups. Statistical significance was determined using a significance level of 0.05.

3. RESULTS AND DISCUSSION

3.1. Results

The demographic data for participants is divided into two groups: treatment (Tx) and control (CON). The majority of participants are between 60 and 69 years old, with 62.86% in the Tx group and 71.43% in the CON group. Both groups are married, with 91.43% in the Tx group and 85.71% in the CON group. Education is predominantly primary school, with a smaller percentage attending high school. Housewives are the majority, with a smaller percentage engaged in farming. The distribution of occupations is similar between the two groups, see Table 1.

The baseline characteristics of the Tx group and the CON group were found to be similar for many measures prior to the commencement of the investigation. There were no statistically significant differences observed in the average scores of both cohorts in physical examinations, including the TUG and the 30CST. Moreover, there were no significant differences identified across the groups in terms of systolic and diastolic blood pressure and heart rate data, see Table 2.

The average TUG score decreased in the Tx group, resulting in a statistically significant reduction to 11.56 seconds. On the other hand, the control group exhibited a constant TUG score of 13.47 seconds ($p = 0.003$, 95% CI: 0.67 to 3.16 seconds). The Tx group also had much better lower leg strength, as shown by their average score of 17.06 on the 30CST, compared to the control group's score of 13.91 ($p = 0.002$, 95% CI: -5.04 to -1.24). Additionally, the Tx group showed a significant reduction in systolic and diastolic blood pressure and heart rate, see Table 3.

Table 1. Demographic characteristics of participants

Characteristics		Tx group		CON group	
		n=35	%	n=35	%
Age	60-69	22	62.86	25	71.43
	70-79	11	31.43	9	25.71
	80-89	2	5.71	1	2.86
Marital status	Married	32	91.43	30	85.71
	Widowed	3	8.57	5	14.29
Education	Uneducated	2	5.71	1	2.86
	Primary school	29	82.86	29	82.86
	High school	4	11.43	5	14.28
Occupation	Housewife	29	82.86	30	85.71
	Farmer	6	17.14	5	14.29

Table 2. A comparison between the Tx group and the CON group before the experiment

Variables	Mean±SD		Mean difference	95% CI		p-value
	Tx group	CON group		Lower	Upper	
TUG	13.70±2.69	13.64±3.09	-0.06	-1.44	1.32	0.933
30CST	14.60±4.41	13.77±3.99	-0.83	-2.84	1.18	0.413
Systolic blood pressure	139.94±13.96	138.91±16.62	-1.03	-8.35	6.29	0.780
Diastolic blood pressure	83.83±10.85	84.26±13.26	0.43	-5.35	6.21	0.883
Heart rate	78.31±9.91	77.69±8.57	-0.62	-5.05	3.79	0.777

A comparison between the Tx group and the CON group following the experiment provided a comprehensive account of alterations in several parameters over a span of 3 months. The Tx group showed a substantial reduction in the average TUG score from 13.70 seconds at the beginning to 11.56 seconds after 3 months ($p < 0.001$, 95% CI: 1.09 to 3.18), suggesting better mobility. In a similar vein, the 30CST exhibited a noteworthy rise in the average score among the Tx group ($p < 0.001$, 95% CI: -2.79 to -2.12). Furthermore, the Tx group experienced significant reductions in average systolic and diastolic blood pressure, as well as heart rate. However, the control group did not exhibit significant alterations in TUG time or 30CST distance after a period of three months, despite large elevations in systolic blood pressure and heart rate, see Table 4.

Table 3. A comparison between the Tx group and the CON group after the experiment

Variables	Mean±SD		Mean	95% CI		p-value
	Tx group	CON group	difference	Lower	Upper	
TUG	11.56±2.64	13.47±2.59	1.91	0.67	3.16	0.003
30CST	17.06±4.21	13.91±3.73	-3.15	-5.04	-1.24	0.002
Systolic blood pressure	129.91±10.08	136.49±14.34	6.58	0.66	12.48	0.030
Diastolic blood pressure	77.43±8.48	83.00±10.10	5.57	1.12	10.02	0.015
Heart rate	71.51±8.61	76.80±10.00	5.29	0.83	9.74	0.021

Table 4. A comparison within the Tx group and the CON group after the experiment

	Variables	Mean±SD		Mean	95% CI		p-value
		Baseline	After 3 months	diff.	Lower	Upper	
Tx group	TUG	13.70±2.69	11.56±2.64	2.14	1.09	3.18	<0.001
	30CST	14.60±4.41	17.06±4.21	-2.46	-2.79	-2.12	<0.001
	Systolic blood pressure	139.94±13.96	129.91±10.08	10.03	4.36	15.70	0.001
	Diastolic blood pressure	83.83±10.85	77.43±8.48	6.40	1.45	11.35	0.013
	Heart rate	78.31±9.91	71.51±8.61	6.80	2.21	11.39	0.005
CON group	TUG	13.64±3.09	13.47±2.59	0.17	-0.50	0.83	0.617
	30CST	13.77±3.99	13.91±3.73	-0.14	-0.83	0.54	0.673
	Systolic blood pressure	138.91±16.62	136.49±14.34	2.42	-6.08	10.93	0.566
	Diastolic blood pressure	84.26±13.26	83.00±10.10	1.26	-4.27	6.78	0.647
	Heart rate	77.69±8.57	76.80±10.00	0.89	-3.47	5.24	0.682

3.2. Discussion

The objective of this study was to investigate the impact of Thai E-sarn dance on the equilibrium skills of elderly adults in the community. The findings demonstrated notable enhancements in balance, concomitant with heightened muscular strength, as well as decreases in both blood pressure and heart rate. The discussion will progress in the following order: balancing ability, strength of muscles, blood pressure, and heart rate.

3.2.1. Balance ability

After a three-month participation in the exercise program, the EX-group exhibited a statistically significant decrease in the average TUG test completion time in comparison to the CON group. In keeping with the findings of previous study conducted by Buransri and Phanpheng [22], which also discovered that a traditional Srichiangmai dance program that lasted for twelve weeks led to a significant improvement in balance among elderly citizens who resided in the community. The results of this study are consistent with the results of previous studies. Implementation of this intervention has the potential to reduce age-related deficits in mobility and balance. As a result, the chance of falling is reduced. This would be a good result, according to Noopud *et al.* [23]. Our study found that increasing the performance of older women in TUG through participation in Thai dance. The potential mechanism of Thai E-sarn dance involves steps 4–8. These exercises focus on more controlled movement. This will allow for a greater range of movement and requires coordination between different parts of the body, increasing flexibility and coordination between different parts of the body. This exercise will help improve the development of neuromuscular coordination [24]. In addition, the use of changes Rhythm in dance routines also increases cognitive engagement and stimulates reflexes [25]. Also, dance relies heavily on weight transfer. This increases muscle strength and promotes balance [26]. Additionally, dancing improves agility, allowing a person to maintain quick and precise movements. Finally, dancing increases autonomic awareness. This means perceiving the spatial orientation of the body. This results in improved consciousness and improved motor coordination [27].

3.2.2. Muscle strength

The EX-group showed a significant increase in performance during the 30CST, a test assessing muscle strength. There was a significant increase in the EX-group compared to the CON group, in line with the findings of Vaccaro *et al.* [28], demonstrating the benefits of dance therapy. The EX-group in the current study

participated in a dance therapy program. Danced four times a week for six months. According to 30CST's findings, the intervention significantly improved performance. Mobility compared to control muscle exercise group working dynamics in this group confirmed the effectiveness of dance exercises to enhance performance. They found that a 12-week Thai rhythmic exercise program improved the performance of older adults at 30CST [29]. Additionally, a report by Douka *et al.* [30] found that participation in traditional dance styles aimed at aging over 32 weeks resulted in increased performance at 30CST. Thai E-sarn dance consists of 8 steps, specifically steps 1-4. This exercise uses the body's natural resistance to stimulate muscle contraction. Cell contractility is enhanced. This results in a significant increase in muscle strength [31] and an improvement in neuromuscular efficiency [32].

3.2.3. Blood pressure and heart rate

Thai E-sarn dance is a type of continuous exercise that involves moving the body continuously for 40 minutes. This extended period of activity is thought to stimulate cardiovascular adaptation. This results in increased cardiovascular endurance. Participating in a Thai E-sarn dance class holds the promise of improving cardiovascular health. This is noted by a significant reduction in blood pressure and heart rate. Consistent with a previous study by Zheng and Cao *et al.* [33], this study found that the beneficial effects of plaza dancing on heart rate and blood pressure decreased after 24 weeks of intervention in the plaza dancing group. Thai E-sarn dancing may help improve cardiovascular health. Two different routes this increases the activity of the parasympathetic nervous system. As a result, blood vessels expand. Blood pressure and heart rate decrease [34]. It also stimulates the release of nitric oxide (NO), which increases vasodilation and reduces blood pressure and heart rate [35].

The study recommends that educational awareness initiatives be implemented with specialized training programs. Implementation of community-based programs and partnerships with health care professionals are also important. By implementing these measures, we are confident that senior Thai E-sarn dancers will maintain their health and continue to participate in this traditional heritage.

4. CONCLUSION

Thai E-san dance improves balance. Muscle strength, blood pressure, and resting heart rate. These findings suggest that healthcare providers can incorporate Thai E-sarn dance into treatment programs. Especially the elderly who are at risk of falling. Thai E-sarn dance's long-term usefulness as a preventative health intervention for the elderly needs further study.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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Saowaluk Seedaket			✓	✓		✓			✓		✓			
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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

ETHICAL APPROVAL

The study proposal was approved by the Human Research Ethics Committee Office of Sirindhorn College of Public Health, with the order assigned to HE652088 on February 8, 2023.

DATA AVAILABILITY

The authors confirm that the data supporting the findings of this study are available within the article.

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