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Original Article

Cardiopulmonary effects of traditional Thai dance on menopausal women: a randomized controlled trial

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Abstract. [Purpose] This study evaluated the effects of Thai dance on cardiopulmonary factors in menopausal women. [Subjects] Sixty-six menopausal women aged 40 years or more. [Methods] Subjects were randomly assigned to either the Thai dance or control group. The Thai dance group performed a traditional Thai dancing exercise program for 60 minutes, 3 times per week for 6 weeks. The control group received general health guidance. The 6-minutewalk test, peak expiratory flow, forced vital capacity, forced expiratory volume in one second, maximal voluntary ventilation, and chest expansion were assessed at baseline and at the end of the study. [Results] Sixty-six menopausal women were eligible. At the end of the study, all variables were significantly better in the Thai dance group than the control group. Moreover, all variables improved significantly compared to baseline in the Thai dance group but not in the control group. For example, the mean 6-minutewalk test result in Thai dance group at the end of the study was 285.4 m, which was significantly higher than that at baseline (254.8 m) and the control group at baseline (247.0 m). [Conclusion] A 6-week Thai dance program improves cardiorespiratory endurance in menopausal women.

Key words: Exercise, Cardiorespiratory endurance, Lung function

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INTRODUCTION

Menopause is the cessation of a woman's reproductive ability and usually occurs in the late 40s to early 50s[1–4)]. Menopause is more precisely defined as the permanent cessation of the primary functions of the ovaries. A lack of estrogen, the primary female sex hormone, results in physical and mental changes following menopause.

Several mental changes may occur in menopausal women, such as depression, moodiness, frustration, decreased self-confidence, memory loss, and loss of libido or reduced sexual response. In addition, menopausal women may experience hot flashes, osteoporosis, and pulmonary embolism[5–8)]. Estrogen replacement therapy may increase the incidence of newly diagnosed asthma and chronic obstructive airway diseases[9)]. The lung capacity of menopausal women older than 40 years normally decreases 30–50 mL annually[9, 10)].

Meanwhile, regular exercise may increase the strength and endurance of breathing and blood circulation[9)]. Traditional Thai dance is an aerobic exercise characterized by a smooth, regular, and gentle rhythm. Thai dance is reported to improve the physical functions of dancers, even in the elderly[11–13)]. Thai dance may enhance blood circulation by regular aerobic exercise. Moreover, the poses of Thai dance involving the arm and chest muscles may improve lung capacity. Traditional dance exercises are more suitable for women than men[12)]. However, data on the effects of Thai dance on menopausal women as well as its effects on cardiopulmonary function are scarce. Therefore, the present study evaluated the effects of group Thai dance exercise on cardiopulmonary function in menopausal women.

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SUBJECTS AND METHODS

This randomized controlled trial of menopausal women evaluated menopausal women at the Elderly Club of Ban Non Muang Community, Sila Sub-district, Muang District, Khon Kaen, Thailand. Women aged 40 years or more whose menstruation had already paused for at least 6 consecutive months were recruited. Subjects were excluded if they had any of the following: neurological diseases such as epilepsy; myasthenia gravis; cardiovascular diseases such as coronary heart disease; uncontrolled diabetes mellitus; uncontrolled hypertension; asthma; chronic obstructive pulmonary disorder (COPD); bone and joint diseases such as osteoporosis; rheumatoid arthritis; and physical defects that caused difficulty standing or walking, moving or balancing, communicating, or performing regular exercise.

The details of the research methodology were explained to all subjects beforehand. All subjects were willing to participate voluntarily and were able to drop out from the study at any time.

Eligible subjects were randomly assigned to the Thai dance group or control group. The Thai dance group performed a traditional Thai dance exercise program for 60 minutes, 3 times per week for 6 weeks. Meanwhile, the control group did not receive any exercise program but instead received general health guidance.

Subjects in the Thai dance group performed Thai dance together. The Thai dance exercise was divided into a 10-minutewarm-up and muscle stretching, 40 minutes of Thai dance, and 10 minutes of cool-down stretching. The standard Thai dance performed consisted of traditional songs and postures. Experts in Thai dancing trained volunteers 3 times per week for 2 months; these volunteers subsequently led dances to facilitate the study intervention. The Thai dance leaders and physical therapists oversaw all subjects throughout the study. All subjects performed Thai dances together under the observation and care of the leaders and physical therapists. Thai dance songs have a slow tempo; the posture changes are correspondingly slow but continuous. The postures of Thai dance included arm raising/lowering/bending/stretching, alternately raising the right and left arms, raising and lowering the legs, stretching the knees, standing on the toes and feet, and turning around.

This study was approved by the Human Research Ethics Committee of Khon Kaen University (No. HE542336) and conformed to the principles of the Declaration of Helsinki and Good Clinical Practices (ICHGCP). Each subject provided written informed consent prior to enrollment.

The following data were collected from all subjects before and after the 6-week intervention: weight, height, heart rate, blood pressure, 6-minute walk test (6MWT) distance, lung function test, and chest expansion. A Dinamap 1846 SX (Louisville, Kentucky, USA) was used to measure blood pressure and heart rate.

The 6MWT indicates the cardiovascular endurance of the heart and blood vessels[14, 15]. Measurements were performed by a single investigator throughout the study.

Lung function tests involved office spirometry (CONMED pony FX, Italy) by an experienced physiotherapist[12, 16]. Before operating the spirometer, the subjects were given an explanation about the operation of related tools that measured different values. Then, all components of the spirometer were checked to ensure they were in good working condition. Each subject was asked to hold the flow sensor, and the date, ID number, age, height, and gender were entered into the spirometer.

To measure vital capacity (VC), the researcher pressed the VC button followed by the start button. The subject then took the mouthpiece in her mouth and put a clip on her nose. The subject inhaled and exhaled normally 3 times, and then inhaled and exhaled deeply. The forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), and peak expiratory flow (PEF) were recorded. Finally, the maximum voluntary ventilation (MVV) was measured.

For MVV measurement, each subject was asked to breathe through the spirometer as deeply and rapidly as possible for 15 seconds. The maximum of the respiratory muscles was recorded.

A reproducible test was accepted according to the ATS guidelines[16]. The values are expressed as a percentage of the predicted normal value according to the European Respiratory Society (ERS) criteria[17].

Chest expansion was measured in centimeters by using a tape measure placed circumferentially around the chest wall at the second, fourth, and sixth intercostal spaces[18].

Data are presented as mean ± SD. The results of the 6MWT, lung function test, and all variables between groups were compared by the Wilcoxon rank-sum test. Meanwhile, the signed-rank test was used to compare the differences of all variables between baseline and the end of study in each group. All analyses were performed with STATA version 10.1 (College Station, TX, USA). The level of significance was set at $p< 0.05$.

RESULTS

There were 80 menopausal women at the Elderly Club of Ban Non Muang. Among them, 66 met the inclusion criteria and were randomized to either the Thai dance or control group. Thus, there were 33 subjects in each group. None of the subjects received estrogen therapy. Two subjects in the Thai dance group did not complete the study protocol, and one subject in control group did not undergo the lung function test. Therefore, there were 31 and 32 subjects in the Thai dance and control groups, respectively.

The mean ± SD ages of the Thai dance and control groups were 54.6 ± 6.4 and 53.7 ±7.8 years, respectively. There were no significant differences between groups at baseline, including weight, height, body mass index, blood pressure, and heart rate (Table 1).

There were no significant differences in 6MWT, PEF, FVC, FEV1, MVV, or chest expansion between groups at baseline (Tables 2–4). However, all variables were significantly higher in the Thai dance group than the control group. Furthermore, all variables increased significantly in the Thai dance group after the intervention.

Table 1. Anthropometric and baseline characteristics

Variable	Control group n = 32	Thai dance group n = 31
Age (years)	53.7 ± 7.8	54.6 ± 6.4
Weight (kg)	59.2 ± 7.2	61.1 ± 7.5
Height (cm)	155.4 ± 5.2	154.3 ± 5.6
BMI (kg/m^2)	24.5 ± 2.6	25.7 ± 2.8
SBP (mmHg)	126.9 ± 12.8	125.5 ± 10.8
DBP (mmHg)	82.6 ± 8.6	83.2 ± 11.5
HR (beat/minute)	88.1 ± 9.5	87.8 ± 12.6

Values are mean ± SD. BMI: body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure, HR: heart rate

Table 2. Comparison of variables between the control group (*n*=32) and Thai dance group (*n*=31)

Variable	Group	Baseline	Six weeks
6MWT (m)	Control	252.8 ± 40.3	247.0 ± 50.2
	Thai dance	254.8 ± 37.3	285.4 ± 38.8*#
PEF (L)	Control	8.1 ± 1.1	7.8 ± 1.2
	Thai dance	8.2 ± 1.4	8.9 ± 1.3*#
FVC (L)	Control	4.0 ± 0.8	4.0 ± 0.9
	Thai dance	4.1 ± 0.6	4.5 ± 0.4*#
FEV_1 (L)	Control	3.7 ± 0.9	3.6 ± 0.9
	Thai dance	3.7 ± 0.3	3.9 ± 0.4*#
MVV (L/min)	Control	127.6 ± 26.8	124.6 ± 30.5
	Thai dance	126.8 ± 16.9	139.4 ± 17.0*#

Values are mean ± SD. 6MWT: six-minute walk test, PEF: peak expiratory flow, FVC: forced vital capacity, FEV_1: forced expiratory volume in one second, MVV: maximal voluntary ventilation.
*Significantly differentfrom baseline in Thai dance group ($p<0.05$).
#Significantly different from control group at 6 weeks ($p<0.05$)

Table 3. Comparison of variables between the control group (*n*=32) and Thai dance group (*n*=31)

Variable	Group	Baseline	Six weeks
PEF (%pred.)	Control	79.8 ± 7.3	77.2 ± 8.4
	Thai dance	78.9 ± 7.5	85.8 ± 7.9*#
FVC (%pred.)	Control	86.1 ± 14.7	85.4 ± 12.3
	Thai dance	85.1 ± 9.7	90.2 ± 9.6*#
FEV_1 (%pred.)	Control	80.3 ± 12.4	79.6 ± 13.3
	Thai dance	78.9 ± 14.8	86.9 ± 12.5*#
MVV (%pred.)	Control	81.4 ± 10.9	78.8 ± 10.8
	Thai dance	82.6 ± 11.5	88.2 ± 9.8*#

Values are mean ± SD. 6MWT: six-minute walk test, PEF: peak expiratory flow, FVC: forced vital capacity, FEV_1: forced expiratory volume in one second, MVV: maximal voluntary ventilation.
*Significantly different from baseline in Thai dance group ($p< 0.05$).
#Significantly different from control group at 6 weeks ($p< 0.05$)

Table 4. Comparison of chest expansion measurements between the control group (*n*=32) and Thai dance group (*n*=31)

Variable	Group	Baseline	Six weeks
Upper chest (cm)	Control	2.4 ± 0.3	2.3 ± 0.3
	Thai dance	2.4 ± 0.3	2.7 ± 0.2*#
Middle chest (cm)	Control	2.4 ± 0.2	2.3 ± 0.2
	Thai dance	2.5 ± 0.3	2.7 ± 0.2*#
Lower chest (cm)	Control	2.6 ± 0.1	2.6 ± 0.1
	Thai dance	2.7 ± 0.2	2.9 ± 0.2*#

Values are mean ± SD. *Significantly different from baseline in Thai dance group ($p< 0.05$).
#Significantly different from control group at 6 weeks ($p< 0.05$)

DISCUSSION

The results of the present study show that the 6-week Thai dance program significantly improved the 6MWT result, lung function test results, and chest expansion in menopausal women in comparison to the baseline as well as the control group post-intervention.

The 6MWT, an indicator of cardiorespiratory endurance, increased significantly after the Thai dance program. These findings corroborate those of a previous study of elderly subjects[12] that also shows Thai dance exercises for 6 weeks improve endurance. Similarly, aerobic exercise also increases the 6MWT result in patients with ankylosing spondylitis and COPD[19, 20]. Therefore, the Thai dance protocol used in the present study may be equivalent to an aerobic exercise protocol.

The Thai dance exercise also significantly improved all lung variables function (Tables 3 and 4), corroborating a previous study evaluating 6 weeks of water exercise[13]. The water exercise and Thai dance exercise are similar with respect to the utilization of the arm and chest muscles. Moreover, the arm and chest movements of Thai dance are similar to those of proprioceptive neuromuscular facilitation that aims to improve pulmonary function[21]. In that study, a 4-week course of proprioceptive neuromuscular facilitation significantly increased VC from 4.7 to 5.2 L, whereas the FVC increased from 4.1 to 4.5 L in the present study. It should be noted that the VC in the current study population is lower than that in the proprioceptive neuromuscular facilitation study, possibly due to the older age of the present cohort.

MVV, an indicator of the efficiency of breathing exercise and cardiac muscle strength, also increased significantly after the Thai dance exercise but not in the control group (Tables 2 and 3). As mentioned above, aerobic exercise improves this factor[19]. The improvement of MVV in the present study may also be explained by the subjects' greater chest expansion at the end of study (Table 4). Greater chest expansion indicates stronger diaphragm and intercostal muscles, consequently improving breathing[19]. Therefore, menopausal women should be encouraged to perform any aerobic exercise to improve their lung function. Otherwise, their lung capacity may decrease naturally. Accordingly, in the control group, the 6MWT, PEF, FEV1, and MVV tended to decrease at the end of the study (Tables 2 and 3).

In conclusion, 6 weeks of Thai dance improves cardiorespiratory endurance and lung function capacity in menopausal women.

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