

Effect of modified Khon dance performance on functional fitness in older Thai persons

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Abstract

Purpose – Aging population is on the rise around the world. Strategies to improve quality of life in this population are being implemented. Exercise is one of those strategies that has been proven to be effective as it produces many health benefits. The purpose of this paper is to determine the effects of Khon exercise on functional fitness in older persons.

Design/methodology/approach – In total, 44 older people aged 60–65 years were recruited through a senior club in an urban area. They were divided into two groups: the Khon exercise group (performed exercise for 12 weeks, 60 min/day, 3 times/week) and the control group (engaged in routine physical activity). The Senior Fitness Test, which consisted of chair stand, arm curl, 2-min step, chair sit and reach, back scratch, 8-ft up and go, and body mass index, was performed before and at 12 weeks after the exercise.

Findings – After 12 weeks of training, significant differences in chair stand, 2-min step, chair sit and reach, and 8-ft up and go tests were noted between the exercise and control groups.

Originality/value – These findings showed that Khon exercise has positive effects on lower body strength and flexibility, aerobic endurance and balance. Hence, it is recommended for health promotion among older persons.

Keywords Older persons, Khon exercise, Functional fitness

Paper type Research paper

Introduction

Recently, the number of older population has increased substantially in most countries and regions, and the growth is projected to accelerate in the coming decades[1]. Degeneration in various systems, particularly the musculoskeletal system, typically occurs among older people. Moreover, muscular strength is significantly reduced in older adults, with an incidence of 30–50 percent in those aged 30–80 years. Decreased muscle strength can be attributed to the decrease in muscle mass and the number of muscle fibers. In addition, problems with muscular flexibility and a correspondingly decreased range of motion are also observed[2, 3]. These results affect mobility and balance and are associated with a high risk of falls. Therefore, health promotion among older persons is crucial. Furthermore, reduced cardiovascular system efficiency, as characterized by lower maximal oxygen uptake, which decreases 0.5–1.0 percent per year, affects prolonged and moderate- to high-intensity activities. These deteriorations and reduced physical capacities decrease

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functional fitness and alter the activities of daily living and quality of life. To perform normal activities of daily living safely and independently, older persons require good functional fitness, including musculoskeletal fitness, cardiorespiratory endurance, balance ability and body composition.

Exercise is beneficial to our body systems and is a safe and sustainable promotion of functional fitness[4]. The exercise guidelines for older persons recommend using moderate intensity, a minimum of 30 minutes per day, three to five days per week for improving aerobic fitness[5]. The most common recommendations are conventional exercises, such as walking, running, cycling, and weight training. However, according to a 2011 Thai survey on population behavior in playing sports and performing physical exercise, the rate of performing exercise among older people was extremely low. Physical inactivity could be due to several causes; the most common barrier to physical activity is “not enough time”[6]. Similar to a structured exercise, lifestyle intervention has positive effects on physical activity; however, it has superior benefits in terms of removing exercise barriers[7]. Therefore, applying a local art or cultural activity to exercise, which promotes enjoyment and is accessible to older persons, may help improve functional fitness.

Khon is a unique dance performance in Thailand. The characters are divided into four types: the hero, the heroine, the giant and the monkey. It is a traditional dance drama performed with strong and elegant postures that integrates several performing arts and involves the story of *Ramakien* (Thai version of the *Ramayana epic*)[8, 9]. The essence of the story is about overcoming evil with good. Most of the parts of the story revolves around the battles between the protagonists (the hero and the monkey: soldiers of hero) and antagonists (the giant). Performers, especially the martial performers, have to undergo a basic training for muscle strength, flexibility, and balance to achieve strong, aggressive and elegant postures[8, 9]. In this study, we developed Khon exercise and determined the effects on functional fitness in older persons.

Subjects and methods

Study design

The study used a quasi-experimental with non-randomized control group pretest and posttest design.

Participants

In total, 44 older persons aged 60–65 years old were recruited through a senior club in Pathum Thani province, Thailand. Participants who had no regular exercise in the previous six months, no mobile aid or device, normal balance and mobility screening based on the 8-ft up and go test, and passed the Physical Activity Readiness Questionnaire were included. Participants in the exercise group who were absent for > 7 times or 20 percent of the exercise class were excluded. All participants provided a written informed consent. The participants were divided into two groups after controlling for age, sex, weight, height, and 8-ft up and go test: Khon exercise group (performed exercise for 12 weeks, 60 min/day, 3 times/week) and control group (engaged in routine physical activity at home and performed usual activities at a senior club, such as singing, handicraft class, and basic computer and internet course).

Intervention

Khon exercise involves four easy movements: giant marching: standing with feet shoulder width apart, toes turned out to the sides, both hands placed on the hips, and alternating foot lift; side lunge: standing with feet shoulder width apart, toes turned out to the sides, both hands placed on the hips, and alternating side step and leg flexion-extension; knee lifting: standing with feet shoulder width apart, both hands placed on the hips, and alternating hip

and knee flexion (90 degrees); and forward-backward weight shifting: standing with feet shoulder width apart and staggered, leaning forward with slight knee flexion, and leaning backward with knee extension (Figure 1). The arm and trunk move during shoulder and elbow flexion and abduction and trunk lateral flexion. All movements were performed with Thai traditional music. The index of congruence of the Khon exercise in five professionals was 0.86 and the test-retest reliability was 0.98. The exercises were performed under the supervision of a single instructor. The exercise sessions started with a 15-min warm-up followed by 30-min of Khon exercise and a 15-min cool down exercise. The participant's heart rates were measured using the POLAR Team (POLAR®). The mean heart rate during the exercise was 112.62 beats per minute or 49.52 percent of heart rate reserve.

Data collection

Functional fitness was assessed twice (i.e. before and after 12 weeks of exercise) using the Senior Fitness Test battery[10]. Test-retest reliability estimates exceeded 0.80, and criterion-related validity coefficients for the test items exceeded 0.70[11]. Before the test, the participants performed a 10-min warm-up, including stretching. Test demonstration and two trials were performed. The Senior Fitness Test consisted of the following items: chair stand test was used to assess lower body strength based on the number of full stands completed in 30 s with arms folded across the chest; arm curl test was used to assess upper body strength based on the number of bicep curls completed in 30 s using a hand weight of 5 pounds for women and 8 pounds for men; 2-min step test was used to assess aerobic endurance based on the number of full steps completed in 2 minutes; each knee was raised to a point midway between the patella and iliac crest; chair sit and reach test was used to assess lower body flexibility; in a sitting position and with the legs extended, the participants were instructed to reach their toes, and the distance between the extended fingers and the tip of the toes (in cm) was recorded; back scratch test was used to assess upper body flexibility; one hand reached over the shoulder and one up the middle of the back, and the distance between the extended middle fingers (in cm) was recorded; 8 feet up and go test was used to assess dynamic balance; the time (in s) required from getting up



Figure 1.
Leg movements of
Khon exercise

from a seated position, walking 8 feet, and returning to a seated position was recorded; and body mass index (BMI) was calculated by dividing weight (in kg) by the square of the height (in m²) to assess the body composition. The height was measured using Nagata; BW-1116MH (© Nagata Scale, Taiwan), and weight was measured OMRON; HBF-214 (© Omron Corporation, Japan).

Data analysis

Statistical analysis was performed using the IBM SPSS Statistics version 23.0. Data are shown as the mean with standard deviations. The Shapiro-Wilk test was used to assess data normality. Differences in physical characteristics between groups were compared with independent *t*-tests. Paired *t*-tests were used to compare the functional fitness in the exercise and control groups before the training with that after 12 weeks of training. Analysis of covariance was used to compare the functional fitness between the exercise and control groups, with the baseline value as the covariate (ANCOVA). *p* < 0.05 was considered statistically significant.

Ethical considerations

The study was approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (COA No. 016/2016).

Results

The participants' baseline characteristics are presented in Table I. The mean age of participants in the Khon exercise group was 62.36 ± 2.1 years and that of the control group was 63.27 ± 2.0 years. No significant differences in baseline physical characteristics, including age, sex, height, weight, balance and mobility score between the Khon exercise and control groups were observed.

Changes in functional fitness in the two groups are shown in Table II. After 12 weeks, there was a significant difference between the two groups (*p* < 0.05) in terms of chair stand, 2-min step, chair sit and reach, and a decrease in 8-ft up and go test results with improvements in the Khon exercise group compared to the control group. There were no significant differences in arm curl, back scratch, and BMI. In addition, statistically significant changes from the baseline in 2-min step (+26.40 percent), chair sit and reach (+69.95 percent), 8-ft up and go (−7.65 percent) and BMI (−2.43 percent) were found in the Khon exercise group, whereas no significant changes were found in the control group (*p* < 0.05).

Discussion

Khon exercise was employed to combine art, culture, and exercise for health promotion among older persons. This mode of exercise improved lower extremity strength and flexibility,

Characteristics	Control (<i>n</i> = 22)	Khon exercise (<i>n</i> = 22)	<i>p</i> -value
Age (years)	63.27 ± 2.0	62.36 ± 2.1	0.15
Sex			
Female	18 (81.82%)	19 (86.36%)	0.68
Male	4 (18.18%)	3 (13.64%)	
Height (m)	1.54 ± 0.7	1.52 ± 0.7	0.52
Weight (kg)	57.85 ± 8.7	61.69 ± 11.7	0.23
8-ft up and go (s)	5.57 ± 0.5	5.61 ± 0.5	0.80

Note: Values are mean ± SD

Table I.
Physical
characteristics
of the participants
at baseline

Table II.
Functional fitness
of the two groups
before and after
12 weeks of exercise

Variables	Group	Before	After 12 weeks	% change	pair <i>t</i> -test	ANCOVA
					<i>p</i> -value	<i>p</i> -value
Chair stand (times)	Khon exercise	18.18 ± 4.17	19.27 ± 3.15	6.00	0.10	0.00**
	Control	16.50 ± 3.39	16.14 ± 3.15	-2.18	0.29	
Arm curl (times)	Khon exercise	20.36 ± 3.67	20.45 ± 3.67	0.44	0.90	0.87
	Control	20.14 ± 4.68	19.82 ± 4.57	-1.59	0.37	
2-min step (steps)	Khon exercise	75.91 ± 18.72	95.95 ± 12.17	26.40	0.00*	0.00**
	Control	74.82 ± 14.03	74.41 ± 10.03	-0.55	0.81	
Chair sit and reach (cm)	Khon exercise	9.55 ± 6.11	16.23 ± 6.49	69.95	0.00*	0.00**
	Control	10.50 ± 8.33	9.99 ± 7.35	-4.86	0.50	
Back scratch (cm)	Khon exercise	-7.48 ± 8.67	-7.11 ± 11.35	4.95	0.82	0.83
	Control	-3.75 ± 10.67	-4.09 ± 9.72	-9.10	0.67	
8-ft up and go (s)	Khon exercise	5.62 ± 0.56	5.19 ± 0.58	-7.65	0.00*	0.01**
	Control	5.54 ± 0.56	5.54 ± 0.80	0.00	0.97	
Body mass index (kg/m ²)	Khon exercise	27.15 ± 4.49	26.49 ± 3.90	-2.43	0.04*	0.86
	Control	24.49 ± 2.94	24.07 ± 3.17	-1.71	0.09	

Notes: Values are the mean ± SD. *Significantly different from baseline ($p < 0.05$); **Significantly different from the control group ($p < 0.05$)

aerobic endurance and dynamic balance. These results are essential for performing independent activities of daily living and increasing mobility in older adults. Improvements in strength and flexibility of the lower extremity could be associated with leg muscle contraction due to body weight during exercise. Moreover, previous reports have shown that muscular strength has a significant influence on flexibility[12, 13]. In contrast, no significant change in upper extremity capacity was found as the exercise involves forces that are substantially greater in the lower body than in the upper body. Muscle degeneration occurred more frequently in the lower than in the upper extremity. Hence, increased lower extremity strength is an essential consideration. These results were similar to those of various dance studies and those of studies on other forms of step exercise that focused on leg movements. Granacher *et al*[14] and Hackney *et al*[15] reported that ballroom dance significantly improves lower extremity strength. Hallage *et al*[16] and Teixeira *et al*[17], noted that, respectively, step aerobics and square-stepping exercise could improve lower limb capacities.

Cardiorespiratory fitness is one of the indicators of the ability to perform activities of daily living. Appropriate exercise allows improvements in the cardiorespiratory system, which in turn helps develop and maintain fitness levels. For the older population, an appropriate exercise program should follow the exercise guideline for older people in the American College of Sports Medicine guideline for exercise prescription[5]. The exercise should be aerobic with moderate intensity (49.52 percent of heart rate reserve) and performed for 30 min/day and 3 days/week for 3 months to achieve greater improvements in cardiorespiratory system. Our results showed greater improvements in aerobic endurance in the Khon exercise group. Previous dance studies involving Cantonese pop dance and Turkish folklore dance reported significant increases in aerobic capacity[18, 19]. Moreover, Hand *et al*[20] showed that cycle ergometry or treadmill at 65–80 percent of the maximum work rate for 30 min and 3 days/week for 12 weeks increases aerobic endurance. Gudlaugsson *et al*[21] and Sousa *et al*[22] reported that combined resistance training and aerobic exercise could improve functional fitness in older persons.

Balance is extremely vital in performing activities of daily living. Balance impairment is associated with a high risk of falls that could result in severe injury among older persons. Our study showed that the Khon exercise improves dynamic balance based on the 8-ft up and go test. In previous studies, similar findings were found for a variety of dances, such as ballroom, tango and traditional dances. Dancing is performed with an upright posture and

requires long periods of unilateral stance and the transfer of the center of gravity outside the base of support[23]. Kshtriya *et al.*[24] reported that dance or movement therapy is associated with improvements in sensorimotor functions, especially those related to balance and motor performances.

In our study, Khon exercise showed no significant effect on body composition. Hence, the moderate-intensity exercise performed 3 days/week for 12 weeks may be insufficient to achieve significant improvements in BMI. This result is similar to most dance studies; two to three days a week for 8–12 weeks showed no influence on BMI[23]. Hallage *et al.*[15] also showed that step-aerobic at 50–70 percent of heart rate reserve and performed 3 days/week for 12 weeks did not improve body composition. However, a previous study demonstrated that multimodal training, with an emphasis on daily endurance training with high intensity (strength training 2 days/week for 6 months), decreases BMI[21].

Although our findings showed benefits on physical performance, our study involved a novel exercise for older persons. Thus, in this preliminary study, healthy older adults that had no mobility and balance problems were included. The participants should pass the Physical Activity Readiness Questionnaire and balance screening tool before engaging in the exercise program. The timed single-leg stand test and functional reach test are easy screening tests. These take less time and require no equipment for application on older people or for other type of studies. For safety and fall prevention, the participants should wear pants and sporting shoes during the Khon exercise. Warm up, cool down, and stretching are important for preventing muscle injury. Water should be provided before, during, and after exercise to prevent dehydration.

This study has a few limitations. First, we studied older persons who volunteered to participate in the study. Older adults are emotionally sensitive and an exercise group requires the cooperation. Thus, the allocation of participants is a major limitation. Second, the participants were independent older persons. Therefore, generalizing the results toward older adults with other health conditions should be carefully conducted. Future research should consider several conditions, such as impaired balance, history of falls, diabetes, hypertension and older age. Khon exercise intervention should adjust the workload of arm movements for improving upper extremity performance. Moreover, a comparison of the Khon exercise with other modes of exercise is warranted.

Conclusion

Khon exercise could result in better functional fitness. It improved lower extremity muscle strength and flexibility, aerobic endurance and balance in older Thai persons. The exercise, which is a form of lifestyle intervention, is enjoyable, involves simple movements, no equipment, and can be performed anywhere. Moreover, the exercise is related to the local art and culture, which in turn may encourage exercise participation. This study demonstrated that exercise, when presented as a form of lifestyle intervention in combination with art and culture, effectively improved functional fitness. Thus, incorporating activities derived from shared cultural practices that require several lower extremity muscles, such as the giant marching and side lunge movements, into a health promotion program for older persons may help improve their well-being.

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