



Effects of Ram Krabi-Krabong exercise program on balance and muscle strength in older adults of Thailand

Efectos del programa de ejercicio Ram Krabi-Krabong sobre el equilibrio y la fuerza muscular en adultos mayores de Tailandia

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Abstract

Purpose: The purpose of this study was to evaluate the effects of Ram Krabi-Krabong exercise program on balance and muscle strength in older adults.

Methodology: Eighteen older adults individuals aged 60-79 years from Ban Nong Bu, Sam Phrao Subdistrict, Mueang District, Udon Thani Province, participated in Ram Krabi-Krabong exercise program in a 6-week 3 days a week, 50-55 minutes per day. Their balance tests (evaluated by the single-leg standing and agility course test) and muscle strength tests (evaluated by the 30-second arm curl test and 30-second chair stand test) were measured pretest and posttest. The pair t-test was used to compare pretest and posttest within the experimental Groups. Statistical significance was set at a P value of 0.05

Results: The study revealed that after six weeks of applied rum Krabi-Krabong training, balance (one-leg stance and agility course test) and muscle strength (30-second arm curl and 30-second chair stand test) improved, with statistical significance at the .05 level.

Conclusion: These findings indicate that the applied rum Krabi-Krabong dance training program can enhance balance and muscle strength in older adults.

Keywords

Older adults, balance, muscle strength, Ram Krabi Krabong.

Resumen

Propósito: El objetivo de este estudio fue evaluar los efectos de un programa de ejercicio de Ram Krabi-Krabong sobre el equilibrio y la fuerza muscular en adultos mayores.

Metodología: Dieciocho adultos mayores, con edades entre 60 y 79 años, de Ban Nong Bu, subdistrito de Sam Phrao, distrito de Mueang, provincia de Udon Thani, participaron en el programa de ejercicio de Ram Krabi-Krabong durante 6 semanas, 3 días por semana, 50-55 minutos por día. El equilibrio (evaluado mediante la prueba de apoyo unipodal y la prueba de circuito de agilidad) y la fuerza muscular (evaluada mediante la prueba de flexión de brazos en 30 segundos y la prueba de levantarse de la silla en 30 segundos) se prueba previa y prueba posterior. Se utilizó la prueba t pareada para comparar los resultados antes y después dentro del grupo experimental. El nivel de significancia estadística se estableció en $p < 0.05$.

Resultados: El estudio reveló que, después de seis semanas de entrenamiento aplicado de Ram Krabi-Krabong, el equilibrio (apoyo unipodal y prueba de agilidad) y la fuerza muscular (flexión de brazos en 30 segundos y levantarse de la silla en 30 segundos) mejoraron significativamente a un nivel de .05.

Conclusión: Estos hallazgos indican que el programa de entrenamiento aplicado de danza Ram Krabi-Krabong puede mejorar el equilibrio y la fuerza muscular en adultos mayores.

Palabras clave

Adultos mayores, equilibrio, fuerza muscular, Ram Krabi-Krabong.

Introduction

Currently, the older adult population worldwide is continuously increasing. In 2025, the global population is projected to reach approximately 8.09 billion people, of whom about 1.2 billion, or 14.8%, will be older adults, indicating that the world has entered an aging society (Department of Physical Activity for Health, Department of Health, Ministry of Public Health, 2017). Thailand is expected to become a complete aging society by 2024, with older adults accounting for approximately 20% of the total population. This demographic transition is mainly associated with declining birth rates and increasing life expectancy, resulting in significant health and physiological challenges among older adults (Udon Thani Provincial Statistical Office, 2024).

Health problems and age-related deterioration of body systems are common among older adults. Reduced physical activity is one of the major contributing factors that increases the risk of falls, which are a common problem and a leading cause of unintentional injury and death among older adults (Chuanchai-kul et al., 2023). Aging is associated with reductions in muscle mass, muscle strength, and bone density, all of which directly affect balance and mobility required for walking, standing, and performing daily activities independently. Falls may result in serious consequences, including fractures, disability, dependence on others, and reduced quality of life.

To prevent physical decline and maintain independence, the American College of Sports Medicine (2021) recommends that older adults engage in regular physical activity. According to the FITT principle, exercise should be performed for 30–60 minutes per session, three to five days per week. Exercises that enhance balance and muscle strength are particularly beneficial, such as Tai Chi, ballroom dancing, Qigong, and traditional Thai dance (Visutthiphakdi et al., 2020). Maintaining body balance requires coordinated function between the neuromuscular and musculoskeletal systems, which play important roles in performing daily activities safely and efficiently.

Traditional Thai martial dance, known as Ram Krabi-Krabong, has strong potential for promoting health among older adults. This activity involves whole-body movements integrating flexibility, muscular strength, coordination, and balance (Batcharoen & Saochalerm, 2020). Slow and continuous movements help improve agility and flexibility, while movements such as leg lifts and single-leg standing positions contribute to balance development. Squatting movements also help strengthen the lower-extremity muscles. In addition, the activity provides enjoyment and motivation for participants (Sengkasai, 2018). Stick exercise using a lightweight staff is another suitable form of exercise for older adults because it emphasizes stretching and strengthening of the trunk, back, and lower-limb muscles through low-intensity and safe movements.

Most previous studies have investigated either Ram Krabi-Krabong training or stick exercise separately, while limited research has integrated both approaches into a combined exercise program for older adults. Therefore, this study aimed to develop an adapted Ram Krabi-Krabong exercise program combined with stick exercise for older adults and to examine its effects on balance and muscle strength among older adults.

Method

Participants

The population consisted of 34 male and 58 female older adults aged 60–79 years from Nong Bu Village, Moo 14, Sam Phrao Subdistrict, Mueang District, Udon Thani Province.

The sample group consisted of 34 male and 58 female older adult volunteers aged 60–79 years from Nong Bu Village, Moo 14, Sam Phrao Subdistrict, Mueang District, Udon Thani Province. The sample size was determined using GPower version 3.1* (Faul et al., 2007) with an effect size of 0.50, an alpha level of 0.05, and a statistical power of 0.80, resulting in a required sample size of 16 participants. To account for possible dropouts, the sample size was increased by 10%, resulting in a total of 18 participants.

The inclusion criteria were as follows: 1). Older adults aged 60–79 years, both male and female. 2). Older adults who were in good health, had no walking difficulties, and were able to move independently. 3). Voluntary consent to participate in the study. 4). Passing the Single-Leg Balance Test at a very low level



(less than 11 seconds for both males and females) (Sports Science Division, Department of Physical Education, Ministry of Tourism and Sports, 2013) and 5). Passing the PAR-Q (Physical Activity Readiness Questionnaire). Participants were required to pass all seven items. If they answered “yes” to any item, medical consultation was recommended before participation in the program.

The exclusion criteria were as follows: 1). Older adults with neurological disorders such as stroke or paralysis, history of joint disease, movement-related pain, fractures, or knee/hip replacement. 2). Unforeseen circumstances prevent continued participation, such as illness or accidents. 3). Participants missed more than 4 out of 18 training sessions and 4). Participants are unwilling to continue participation in the study.

Ethics approved

This study received approval from the Research Ethics Review Committee of Udon Thani Rajabhat University on July 16, 2025 [approval number: 0622.7/340]. Each volunteer was informed in writing about the details, purpose, and procedures of the study and signed the consent form before participating in the research.

Procedures

The intervention used in this study was the adapted Ram Krabi-Krabong exercise program combined with stick exercise. The training program lasted 6 weeks, three days per week, with each session lasting 50–55 minutes. Each training session consisted of a warm-up session (10 minutes), the exercise program (30–35 minutes), and a cool-down session (10 minutes). The exercise program included eight movement postures: Loy Chai posture, Khuang That (spinning) posture, tucked-at-the-side posture, forward and backward thrusting posture, Yak (giant) posture, spinning kick posture, Hanuman parting the foam posture, and Candle Invitation posture (Figure 1). Each movement was performed for 6–8 repetitions, and exercise intensity was controlled using music tempo set at 50 beats per minute (BPM).

Assessment protocol

Participants’ physical fitness assessments included balance, muscle strength, and muscle endurance. All measurements were conducted at pretest and posttest of training.

Balance Assessment: Static balance was assessed using the Single Leg Balance Test (Johnson & Nelson, 1979), in which participants stood on one leg while maintaining an upright posture for as long as possible. The duration of balance maintenance without losing posture or touching the ground with the raised foot was recorded. Dynamic balance was assessed using the Agility Course Test (Sports Science Division, Department of Physical Education, Ministry of Tourism and Sports, 2019). Participants were instructed to walk as quickly as possible through a predetermined course involving directional changes and obstacle maneuvering. The total completion time was recorded, with shorter times indicating better dynamic balance performance.

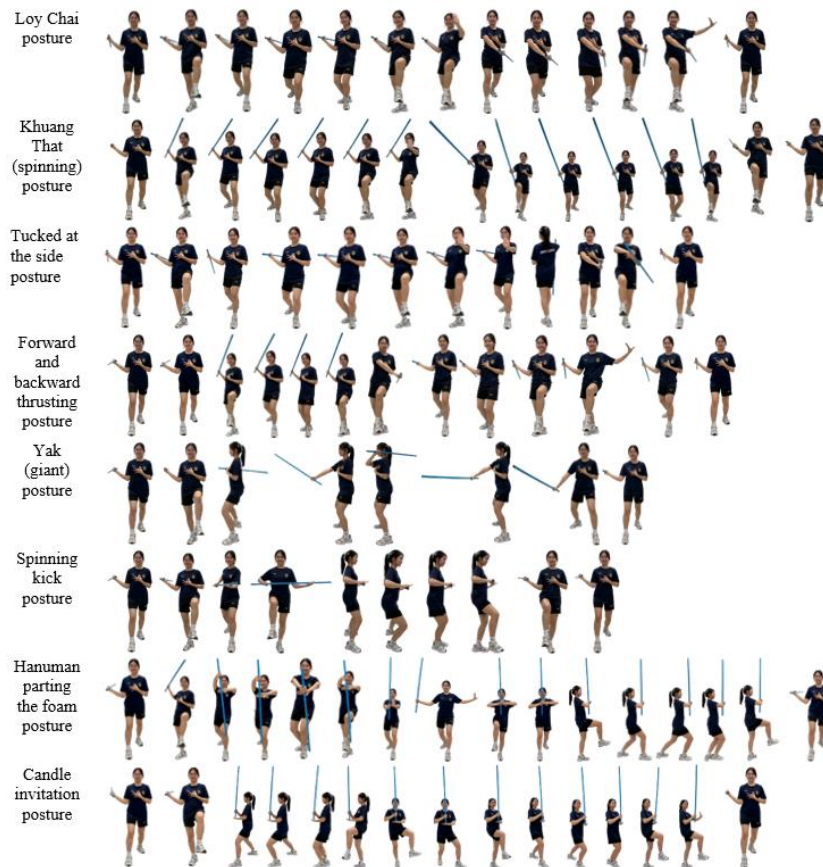
Muscle Strength and Endurance Assessment: Lower-body muscle strength and endurance were assessed using the 30-second chair sit-to-stand test (Im et al., 2019). Participants were instructed to rise from a chair to a full standing position and return to a seated position repeatedly within 30 seconds. Upper-body muscle strength and endurance were assessed using the 30-second arm curl test (Signorile, 2011). Participants performed repeated elbow flexion movements using dumbbells (2 kg for females and 4 kg for males) within 30 seconds.

Data analysis

Descriptive statistics, including mean and standard deviation, were used to analyze demographic data. The Shapiro–Wilk test was used to examine the normality of data distribution because it is more appropriate for small sample sizes. The results indicated that the data was normally distributed. Therefore, within-group comparisons were analyzed using paired t-tests. Effect size (Cohen’s d) was calculated to determine the magnitude of change following the intervention. Statistical significance was set at $p < .05$. Data was analyzed using IBM SPSS Statistics for Windows, version 21.0 [IBM Corp. Released 2012].



Figure 1. Ram Krabi-Krabong Exercise Program



Results

The mean and standard deviation of the general data of the experimental group showed that, consisting of 17 females and 1 male, their age was 65.44 ± 5.35 years, height was 154.72 ± 5.18 centimeters, weight was 59.56 ± 10.89 kilograms, body mass index (BMI) was 24.91 ± 4.21 kg/m², resting heart rate was 74.44 ± 11.01 beats/minute, systolic blood pressure was 121.67 ± 19.38 mmHg, diastolic blood pressure was 74.44 ± 8.87 mmHg, and body fat percentage was $32.29 \pm 6.03\%$, as shown in Table 1.

Table 1. Mean and standard deviation of the general data of the experimental group.

Baseline Data	(\bar{X})	S.D.
1. Gender	Male = 1 person, Female = 17 persons	
2. Age (years)	65.44	5.35
3. Height (cm)	154.72	5.18
4. Weight (kg)	59.56	10.89
5. Body Mass Index (kg/m ²)	24.91	4.21
6. Resting Heart Rate (beats/min)	74.44	11.01
7. Systolic Blood Pressure (mmHg)	121.67	19.38
8. Diastolic Blood Pressure (mmHg)	74.44	8.87
9. Body Fat Percentage (%)	32.29	6.03

A comparison of pretest and posttest outcomes within the experimental group revealed significant improvements in balance and muscle strength variables following the 6-week intervention program. Static balance measured by the single-leg standing test significantly improved ($p < .05$), while dynamic balance measured by the agility course test also showed significant improvement ($p < .05$). In addition, upper-body muscle strength assessed by the 30-second arm curl test and lower-body muscle strength assessed by the 30-second chair sit-to-stand test demonstrated statistically significant improvements after the intervention ($p < .05$), as shown in Table 2.

Effect size analysis revealed moderate-to-large effects of the intervention on balance and muscle strength outcomes (Cohen's $d = 0.85\text{--}1.42$), indicating meaningful practical improvements among participants.

Table 2. Comparison of mean balance and muscle strength within the experimental group

	pretest		posttest		t	p	Cohen's d
	\bar{x}	SD	\bar{x}	SD			
Balance							
1. Single-leg standing test)Sec.(	10.97	6.78	31.69	20.19	-4.728	.001*	1.42
2. agility course test)Sec.(	19.20	2.79	16.28	2.34	6.371	.001*	1.13
Muscle strength and Endurance							
1. 30-second arm curl test)Reps.(	18.83	4.79	27.66	7.41	-3.620	.002*	0.85
2. 30-second chair sit-to-stand test (Reps.(	13.27	4.02	16.33	3.18	-6.016	.001*	0.92

* $p < .05$

Discussion

Participants in the program demonstrated significant improvements in balance and muscle strength following the 6-week adapted Ram Krabi-Krabong training program. However, because this study used a single-group pretest–posttest design without a comparison group, the findings should be interpreted with caution. The improvements observed in this study suggest that the exercise program may contribute to enhancing physical performance among older adults.

Both static and dynamic balance showed noticeable improvement after the intervention. The adapted Ram Krabi-Krabong program consisted of eight continuous movement patterns characterized by slow, rhythmic, and coordinated motions similar to traditional Thai martial dance movements. These movements required continuous postural control, weight shifting, knee flexion and extension, and directional changes while maintaining body stability. Such movement patterns may help stimulate neuromuscular coordination and postural control mechanisms associated with balance performance. Previous studies have reported that rhythmic and functional movement exercises can improve balance and postural stability in older adults (Tanimoto et al., 2009; Radnor et al., 2020; Rahman & Shaheen, 2010; Van Dieën et al., 2015; Jeong & Yoo, 2020; Wandee et al., 2025).

In addition, the training program involved repeated lower-extremity movements such as stepping, squatting, and multidirectional weight transfer, which continuously activated major muscle groups including the quadriceps, hamstrings, and gluteal muscles. These functional movement patterns may contribute to improvements in muscle strength and muscular endurance through repeated muscle activation and body-weight resistance. The moderate-to-large effect sizes observed in this study further support the practical significance of these improvements. These findings are consistent with previous studies reporting that exercise programs involving resistance, functional movement, and multidirectional activities can improve muscle strength in older adults (Liu & Latham, 2009; Wandee et al., 2025; Chabairam et al., 2026).

Furthermore, the slow, continuous, and rhythmic characteristics of adapted Ram Krabi-Krabong movements, including rotations, lateral stepping, forward stepping, and controlled weight transfer, may support dynamic balance by enhancing coordination between the neuromuscular and musculoskeletal systems. These movement characteristics require concentration, movement accuracy, and continuous postural adjustments during activity. Previous studies have similarly demonstrated that culturally adapted movement programs, such as folk dance and traditional movement exercises, can improve balance, mobility, and functional performance among older adults (Keogh et al., 2009; Eyigor et al., 2009; Thonglong et al., 2025).

Nevertheless, this study has several limitations that should be acknowledged. The sample size was relatively small, and there was no control group for comparison, which may limit the generalizability of the findings. Therefore, future studies should include larger sample sizes and randomized controlled designs to confirm the effectiveness of adapted Ram Krabi-Krabong exercise programs in older adults.



Conclusions

This study demonstrates that the Krabi-Krabong exercise program is improving physical fitness, particularly balance and muscle strength, which are essential components for daily living and fall prevention. Therefore, this program can be applied as a practical approach to promote health and enhance physical fitness in populations with similar characteristics. The combination of exercise and cultural elements makes sports traditional performances an interesting and sustainable activity for improving the health and quality of life of the older adults.

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