# Effect of Applied Muay Thai Exercise on Balance Performance on the Elderly with Risk of Falling: A Randomized Controlled Trial

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## Abstract

Introduction: Due to advances in medical technology, the longevity of human within the world has increased. The most common problem of the elderly is the increased risk of falling. Muay Thai has been applied to be one of exercises for increasing physical fitness in Thai population. However, its effect on balance performance in the elderly is still unclear. Thus, purpose of this study was to investigate the effect of the Applied Muay Thai exercise on balance performance in the elderly with a high risk of falling.

Methods: Thirty-six older adults aged 60-75 years were randomly assigned into two groups: experimental group received Applied Muay Thai exercise (n = 18) and control group received booklet of fall prevention (n = 18). Dynamic balance performance measured by using the Timed Up and Go test and static balance performance measured by using the Sharpened Romberg test were investigated before and after 4 weeks of intervention.

Results: The results showed that the Applied Muay Thai exercise group had significantly improved in static balance during close eyes and dynamic balance when compared with the control group ($p < 0.05$). While static balance during open eyes had no a significant difference between the groups ($p > 0.05$).

Conclusions: The Applied Muay Thai exercise may be an alternative exercise for increasing balance performance in older adults with a risk of falling.

Keywords: Applied Muay Thai, Balance, risk of falling, Older adults

## Introduction

Due to advances in medical technology, the longevity of human has increased (1). Older people encounter many health problems such as disability dependency (2) and increased risk of falling (3). These cause of hospitalisation, other complications, and death. Although there is no consensus regarding any interventions suggested as the most effective for preventing falling in the elderly, an exercise has been recommended to be a simple way to decrease falling (4). Muay Thai is a traditional Thai material art which is not only learnt as self-defensive but also amusement. Muay Thai movements include punches, elbows, knees, and kicks. Hence, Muay Thai promotes mental health, efficacious musculoskeletal and Cardiovascular system, and decreases stress (5). Moreover, Muay Thai also may affect an increased balance performance because of its poses and rhythm (6). In spite of Muay Thai popularly applied to be an exercise in many exercise classes of young adults, there is a lack of study about effect of Muay Thai exercise on balance performance appled to the elderly with risk of falling.

## Method

The study design was a assessor-blinded randomized controlled trial and was conducted at Physical Therapy Laboratory, Mae Fah Luang University, Thailand. This study was approved by the Ethics Committee of School of Health Science at Mae Fah Luang University, and all participants provided their written informed consent prior to participation. Thirty-six older adults, aged between 60-75 years, with a risk of falling who lived in Chiang Rai were recruited to this study. The eligible participants were independent ambulation, had Berg Balance Scale less than 46 scoresand had Mini–Mental State Examination (MMSE) less than 25 scores. They did not have major problems in musculoskeletal, neurological system, and cardiovascular systems that impeded performing the exercise. They were excluded if they had diabetic retinopathy, upper and lower limbdeformities, resting hart rate more than 150/90 mmHg with uncontrolled the symptom, diabetes mellitus, and were not able to attend the intervention more than 80 percent. The pparticipants were measured the outcomes including static balance (Sharpened Romberg during opened- and closed–eye conditions) and dynamic balance (Timed-Up-and-GO) before randomization. All participants were randomly assigned into two groups: experimental group received Applied Muay Thai exercise for 40 minutes/session, 3sessions/week over 4 weeks or a control group received a booklet for fall prevention. After 4 weeks of intervention, all participants were measured the outcomes again.

## Statistical Analyses

The SPSS package version 24 was used to analyze the data. There are shown as mean ± SD. A paired t-test was used for comparing pretest and posttest within groups, while a one-way analysis of covariance (ANCOVA) was used to find difference between groups after adjusted all of baselines. Statistical significance was set at $p<0.05$.

## Result

Older adults with a risk of falling living in Tambon Pa Sang, Tambon Mae Salong Nai, Tambon Mae Kham, and Tambon Sai Num Kham Mae Chan District of Chiang Rai Province 942 people are interesting in this study. Sixty-five people met the inclusion criteria. Thirty-four subject (experimental group) received Applied Muay Thai exercise and thirty-one subject (control group) received booklet. But subject in experimental group 16 people and control group 13 people were excluded from the study. Because the mission was not able to participate in the study. So, eighteen people in the experimental group and eighteen people control group. See Figure 1.

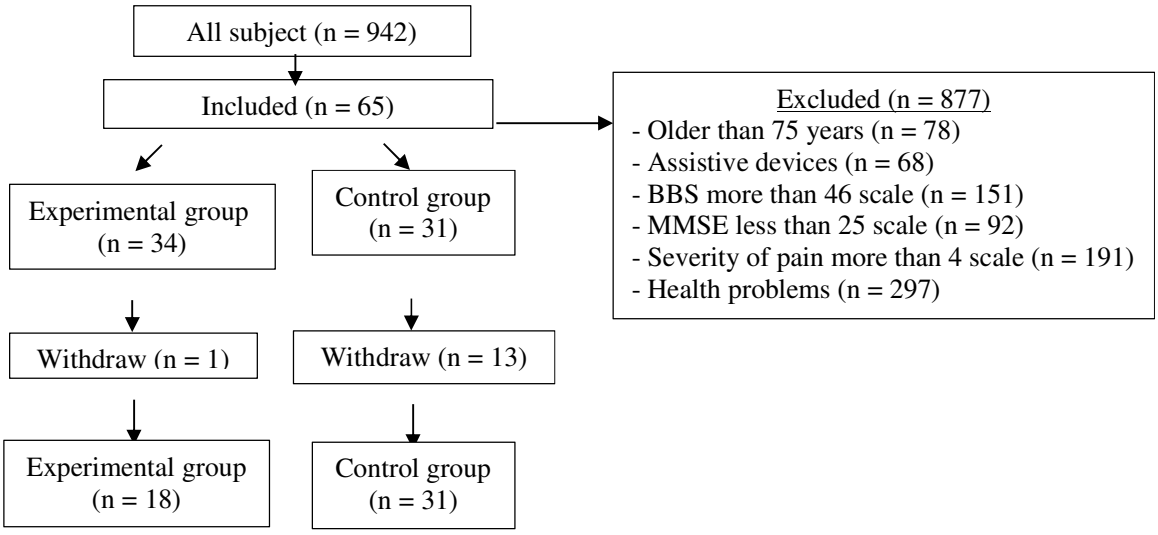


Figure 1 Summary of participants

Baseline Characteristics

Table 1 presents the baseline characteristics in older adults with a risk of falling aged 60-75 years. There were no significant differences between the control group and the experimental group.

Table 1 baseline characteristics

| Baseline characteristics | | Experimental group (n = 18) Mean (SD) | Control group (n = 18) Mean (SD) | **p** value |
|---|---|---|---|---|
| Age (year) | | 66.33 (4.33) | 67.33 (4.04) | 0.274 |
| Male/female (persons) | | 1/17 | 3/15 | 0.288 |
| Weight (kg) | | 55.83 (10.59) | 56.72 (8.07) | 0.779 |
| Height (cm) | | 154.89 (5.71) | 154.28 (6.06) | 0.757 |
| Body mass index (kg/m$^2$) | | 23.17 (3.58) | 23.78 (2.61) | 0.565 |
| The severity of pain (score) | | 0.83 (1.42) | 0.83 (1.47) | 1.000 |
| Mini Mental State Examination (score) | | 28.33 (1.50) | 27.78 (1.87) | 0.331 |
| Time Up and Go (second) | | 8.47 (1.07) | 9.34 (1.64) | 0.067 |
| Sharpened Romberg (second) | Open eyes | 45.99 (18.09) | 53.37 (10.10) | 0.140 |
| | Close eyes | 28.79 (23.40) | 15.73 (13.74) | 0.049* |

* P value < 0.05, ** P value < 0.001

Outcome data within group

Table 2 presents outcome data within group. The experimental group had significantly improved in static balance (open eyes) when compare within group (p=0.013) and control group had no significantly improved when compare within group (p=0.913). When compare static balance (close eyes) the experimental group had significantly improved when compare within group (p=0.006) and control group had no significantly improved (p=0.399). When compare dynamic balance the experimental group had significantly improved when compare within group (p=0.002) and control group had no significantly improved (p=0.670).

Table 2 Outcome data within group

| Outcome | Experimental group | | | | | Control group | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre-test Mean (SD) | Post-test Mean (SD) | 95% CI | t value | **p** value | Pre-test Mean (SD) | Post-test Mean (SD) | 95% CI | t value | **p** value |
| Time Up and Go | 8.47 (1.07) | 7.93 (0.88) | -0.85 (0.22-) | -3.63 | 0.002* | 9.34(1.64) | 9.43 (1.43) | -0.32 (0.50) | 0.43 | 0.670 |
| Sharpened Romberg (Open eyes) | 45.99 (18.09) | 58.46 (6.17) | 3.03 (22.09) | 2.78 | 0.013* | 53.37(10.10) | 52.91 (13.39) | -9.18 (8.26) | -0.11 | 0.913 |
| Sharpened Romberg (Close eyes) | 28.79 (23.40) | 39.35 (22.03) | 3.54 (17.59) | 3.17 | 0.006* | 15.73(13.74) | 16.91 (14.63) | -1.70 (4.07) | 0.87 | 0.399 |

* P value < 0.05, ** P value < 0.001

Table 3 Outcome data between groups

| Outcome | | Experimental group Mean (SD) | Control group Mean (SD) | 95% CI | F value | P value |
|---|---|---|---|---|---|---|
| Time Up and Go | | 8.25 (0.15) | 9.11 (0.15) | 0.40 (1.31) | 14.73 | 0.001** |
| Sharpened | Open eyes | 58.43 (2.53) | 53.03 (2.53) | -2.01 (12.80) | 2.20 | 0.15 |
| Romberg | Close eyes | 36.73 (2.51) | 25.11 (2.51) | 4.18 (19.05) | 10.09 | 0.01* |

* P value < 0.05, ** P value < 0.001

Outcome data between groups

Table 3 presents outcome data between groups. The experimental group had improvements in Static balance during eyes closed and dynamic balance when compare control group ($p<0.05$). However, there was no between-group difference of static balance during eyes opend ($p>0.05$).

Discussion

The purpose of this study was to investigate the effects of the Applied Muay Thai exercise on balance performance in older adults with a risk of falling. The results showed that the experimental group had significantly improved in static and dynamic balance when compare with the control group ($p < 0.05$).

Balance training can perform by reduce base of support e.g. tandem stance and single leg stance, progress the program to be harder, change center of gravity or center of mass, and stand on heel alternate with stand on foot tip (7). According to this study, the pattern and the movements are conform to reduced base of support training by reaching and turning around. In addition to the Applied Muay Thai Exercise perform 12 sessions or about 8 hours which is consistent

with previous study. They recommended that exercise to reduce the risk of falling in the elderly should do more than three times per week or more than 2 hours a week (8).

Elements in the postural control are controlled with 3 main systems include Central Vestibular system, Visual system, and Proprioceptive system (9). Applied Muay Thai Exercise promoted proprioceptors because it had external stimulation, motivation, using memory, acceleration, and rhythm (10).

During opened-eyes, the key system of balance is Visual system because the human eyes is used to look up to 75 percent of all exposure (9). During closed-eyes, Proprioceptive system is the key to perform balance. Due to this study, effects of balance during closed-eyes had significantly improved when compare to the control group that means the proprioception was improved. To compare during opened-eyes had no significantly improved, since it does not use proprioception as a key system.

## Conclusions

The results of this study showed that 4-week Applied Muay Thai exercise improves static and dynamic balances in older adults with a risk of falling.

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