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The Efficiency of Thai Rhythm Calisthenics Movement on Salivary Alpha-Amylase and Health Performance in the Elderly

Yanyong Phanpheng Ph.D[1], Warayot Laha Ph.D[2]*

[1]*Sports and Exercise Science Program, Faculty of Science and Technology, Loei Rajabhat University 234 Loei-Chiangkhan Rd., Muangloei District, Loei, 42000, +66902565945, Thailand*

[2]*Physical Education Program, Faculty of Education, Loei Rajabhat University 234 Loei-Chiangkhan Rd., Muangloei District, Loei, 42000, +66812839792, Thailand*

Corresponding Author: Warayot Laha Ph.D, E-mail: warayot.lah@lru.ac.th

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ABSTRACT

Background: Regular physical activity reduces emotional stress that represents long-term enzyme alpha-amylase values in daily life in the elderly. **Objective:** This study examined the efficiency of Thai rhythm calisthenics movement on Salivary alpha-amylase (sAA) and health performance in 70 elderly people, aged 60 - 75 years old. **Methods:** This research is a quasi-experimental research design with two group pre-test/post-test design; Thai rhythm calisthenics movement (TCM) and brisk walking exercise (BWE). The training was undertaken three times a week over 12 weeks, 45 minutes each session, 60 - 80% of MHR for each training activity. Both groups were tested for the sAA and health performance variables composed of Physiological, Balance and Mobility assessed using standardized tests including Functional reach test (FRT), Timed up and go test, (TUG), Chair stand test (CST) and Arm curl test (ACT) for 30 seconds, 6-minute walk test (6WT). **Results:** The sAA in both groups increased in the initial stages of exercise and was likely to decrease after the follow up period ($p \leq .05$). At the end of 12 weeks, TCM decreased rapidly in the sAA level *($p \leq .05$)*. Moreover, physiological variables including HR, SBP decreased while VO2max increased higher than the pre-test ($p \leq .05$). In addition, testing FRT showed better scores for those in TCM compared to the BWE ($p \leq .001$). Also faster movement took shorter time score in the TUG after training ($p \leq .05$). 6WT, CST had a higher performance in both experimental groups *($p \leq .05$)*. **Conclusion:** This study showed that TCM can improve mental health and enhance balance and mobility among the elderly. Additionally, it helps prevent decline as well as related fall risk.

Key words: Physical Activity, Balance, Mobility, Physiological, Mental Health

INTRODUCTION

The number of people aged over 60 years is increasing faster than that of any other age group. Approximately 10% of the world's population is over the age of 60 years; this number is likely to increase to 15% by the year 2050 (Bloom & Luca, 2016). Thailand has been entering an ageing society since 2005, when the proportion of the population aged 60 years and older reached 10% of the total population (Jitapunkul & Wivatvanit, 2009). As the number of elderly people continues to increase, it can be predicted that Thailand will become an ageing society when the number of people aged 60 or older exceeds 20% of the total population in 2021. By 2031, Thailand is expected to become a super-aged society when the number of people aged 60 or older reaches 28% of the total population (Yap et al., 2005). Aging or elderly status is typically accompanied by a gradual decline in physical function, which can be attributed to physiological changes occurring in almost all organ systems. Additionally, the likelihood of falls increases and overall quality of life may be reduced (Janssen et al., 2002; Bergen et al., 2016). The causes of stress in the elderly are primarily loss of physical and psychological health due to aging (Ostrakhovitch & Tabibzadeh, 2019). Excessive stress during old age has also been reported to cause brain and physical function impairment (Everaerd et al., 2017; Pauly et al., 2019). In addition, elderly people often have decreased immune function, and it has also been reported that immune function is markedly reduced by stress (Fali et al., 2018).

Two major systems are involved in the human stress response; firstly, upregulation of the hypothalamic-pituitary-adrenal (HPA) axis increases secretion of stress hormones such as cortisol, and secondly the human stress response involves the activation of the sympathetic adrenal-medullary (SAM) axis (Cohen et al., 2007; Binder & Nemeroff, 2010; Hackett & Steptoe, 2017). The development of procedures noninvasively measures differences in neuro-

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biological activity across individuals via oral fluids (saliva) (Nater et al., 2007; Granger et al., 2012). There are many advantages of using salivary biomarkers, including the rapid appearance of proteins in the saliva in response to stimuli, and the ability to easily measure salivary alpha-amylase (sAA) (Yamaguchi et al., 2003). Salivary alpha-amylase is highly correlated with plasma norepinephrine concentration and is used as an indicator of stress in the sympathetic nerve system during assessment (Kang, 2010; Kono et al., 2018). Therefore, it is important to identify the causes of stress and how they can be alleviated in order to extend the healthy life span of the elderly whose population is rapidly increasing.

Physical activity can be an effective health promotion strategies, as existing evidence supports its positive effect on physical health and mental wellbeing (Park & Han, 2003). Exercise is a way to help prevent dysfunctional organs when getting older. Maintaining function well during late life is as important as prolonging life expectancy in older adults (Santanasto et al., 2017; Isaio et al., 2019). Fernandez-Arguelles et al. (2014) reported on the effects of dance and noted that they are associated with improved balance, muscle strength, coordination, rhythm, laterality, body awareness and control. These results were found for several types of dance, many of which were derived from nations' culturally-based exercises. Thai traditional dance, or Ram Thai, is a part of Thai culture. Thai traditional dance is one of the most social forms of dance; it has been popular among Thais and foreigners since 1941 until the present day, especially among the Thai elderly population. This slow, continuous dance to Thai classical music uses consistent rhythms. The music and rhythm of Thai dance are quite similar to Tai chi; however, Thai dance uses more complex postures and focuses on coordination (Janyacharoen et al., 2013). Thai traditional dance involves activities (i.e., head and trunk rotations, weight shifts, step forward, step backward, step sideward, standing with one foot in front and one leg crossing) that constantly challenge the balance system to maintain equilibrium. In contrast, the center of gravity (CoG) is voluntarily shifted to the limits of stability. Furthermore, Thai dance also places less burden on the knees and ankles. As such, this type of dance may be particularly suited for older adults (Noopud et al., 2018). Thai traditional dance can be incorporated into the community's cultural context, daily life, and the needs of the aging. Nowadays, there are promotional campaigns to promote a variety of activities for older people, including the application of arts, calisthenics, basic movement and dance steps to be a movement activity with music (Panitjaroennam, 2003). Dancing is a complex sensorimotor rhythmic activity that integrates physical, cognitive and social elements (Keogh et al., 2009). Previous studies have found that, after practicing senior dance (Franco et al., 2020) Traditional Srichiangmai dance (Buransri & Phanpheng, 2021) Korean traditional dance (Jeon et al., 2005) and equal it helps to improve and strengthen muscular strength, which is a fundamental factor related to the ability to maintain a balanced body while moving effectively. Thai rhythm calisthenics movement it is a combination of dance patterns that apply the dance gestures in all four regions of Thailand, namely the dance moves of the North East, the Central, the North and the South regions. The dance pattern needs the movement of all parts of the body to move slowly, then it helps to improve all three systems of physical movement including central nerve system, sensory nerve system and muscular systems. These are good for core muscles which relate to balance ability. Previous studies showed that slow movement exercise can effectively stimulate core muscle functions such as Waikru Muaythai exercise (Phanpheng et al., 2020).

As mentioned earlier, the researcher had idea concept to promote the beautiful culture along with physical and mental health and became interested in developing the model of aerobic exercise with low impact and Thai rhythm calisthenics movement in all four folk regions music, which had never appeared in a research study in Thailand. Therefore, the purpose of this study is to examine the relationship between Salivary alpha-amylase as an index of stress value and in this sense, it is a stimulating activity that may promote coordination, balance, agility and gait, enhance health performance, and improve sustainable quality of life in elderly people.

METHODS

Study Design

This research is a quasi-experimental research design with two groups pre-test/post-test design. The study was conducted in three steps: (I) Pre-test; (II) Implementing the specific training program; and (III) Post-test. During the intervention period, all subjects were advised to maintain their usual lifestyle, including food consumption and daily activities. The participants understood the details of practice during the experiment and signed consent letters before participating in the research. The research was approved and supervised by the Ethics Committee in Human Research, Loei Rajabhat University, Thailand H 014/2566 (Dated 16th March 2022).

Participants and Sample Size Determination

All participants are older people residing in Loei Province, male (n = 16) and female (n = 54) aged 60-75 years old, doing normal routines and not having regular exercise. Before implementing the exercise intervention to determine its effect on a targeted population, it was necessary to calculate the sample size. The present study used priori power analysis with the help of G*Power 3.1.9.7 software to estimate the minimum sample size for this research. The determined effect size was 0.80, α = 0.05, power = 0.8 (Noopud et al., 2018), which determined the sample size for one group to be 31, df = 29, critical value = 1.8454. The present study included the control group, so the number of subjects should be 31*2 = 62. Moreover, this research set the sample group to be a total of 70 subjects to prevent withdrawal from the study. The simple random sampling technique was applied to select the samples that were divided into two groups; the first group consisted of 35 participants performing Thai rhythm calisthenics movement, and the second group consisted of 35 participants performing brisk walking. All participants need to pass the questionnaires for examining their general

health history and physical activity readiness questionnaire (PAR–Q) specifying that they do not have any diseases involving muscle and nerve systems. The exclusion criteria were: I) engaged in any physical activity program, II) having severe health issues, III) diabetic and hypertensive case depending on the medication. The participants who could not participate throughout the research project will be removed from the experiment.

Exercise Intervention

In this study, the researchers designed both patterns of exercise as parts of a health promotion activity for the elderly in the school for older people. Both groups exercised for a 45-minute period, three times a week; totally 12 weeks. For the details and instruction of exercise, the experimental group performed Thai rhythm calisthenics movement including dynamic warm-up for 5 minutes, then began to work out for 35 minutes. There were six exercise postures for each region, each with eight beats, using 80 - 120 beats per minute (bpm) with background music, and practiced static stretching for 5 minutes. For the control group, the participants performed brisk walking beginning with warm-up, dynamic warm-up for 5 minutes, walking with normal speed for 35 minutes, and static stretching for 5 minutes (see Table 1). There were sport scientists observing and suggesting to the participants for correct positions and postures as well as breathing methods during the time of training.

Assessment Protocol

The data collection was conducted to test the variables regarding health at sports and exercise science laboratory in the Faculty of Science and Technology, Loei Rajabhat University from 08.30 - 12.00 am. The salivary alpha-amylase monitor (NIPRO, Osaka, Japan) was used to assess stress (considered as dependent variables and the experimental intervention). It was confirmed that participants did not engage in tooth brushing, smoking, eating, and drinking within 1 hour before measurement. Subsequently, subjects were instructed to take two deep breaths. Before measurement, a dedicated chip was inserted under the tongue to absorb saliva. This chip was inserted into the salivary alpha-amylase monitor and after 60 seconds, the amylase activity in the saliva was obtained. After measurement, salivary alpha-amylase was classified levels in Kilo unit per Litter (KU/L) no stress 0 to 30, mild stress 31 to 45, moderate stress 46 to 60, severe stress 61 to 200 respectively (Nagai et al., 2020).

Health performance assessment: the selected physiological variables were heart rate resting (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP). Then, the samples were examined for their body composition using Bioelectrical Impedance Analysis (BIA), in body 220 model, including body weight (Kilograms) and BMI (kg/m^2). For older people, the focus of physical fitness may shift from health promotion, disease prevention and performance enhancement to maintaining functional mobility (Rikli & Jones, 1999). The researcher evaluated the reliability within the measure (Research Assistant) to measure all two balance abilities before the actual assessment (Buransri & Phanpheng, 2021). The balance was tested using method 1 in a standing position, arms were stretched at shoulder width, reaching forward (Functional reach test, FRT) for as far as possible. Method two the fluency and balance were tested while moving (agility and dynamic balance) by sitting, standing, walking (Timed up and go test, TUG). Upon hearing the «start» signal, samples stood up from the chair, walked at as fast a distance as 8 feet, turned back, walked back and sat in the same chair. The researchers measured the timer (seconds) from getting up from the chair and until returning to the chair. In addition, the researcher tested walking ability with a 6-minute walk test, 60 meters for each of walking round, for 6 minutes. Chair stand test for 30 seconds

Table 1. Exercise intervention with four regions of Thai rhythm calisthenics program

Day	Unit of training	Thai rhythm calisthenics postures	Duration of training
Monday Wednesday Friday	Warm-up	Dynamic warm-up of major muscle groups	5 minutes
	Work out with four regions of Thai rhythm calisthenics	The North East region 1. Tha-Pankaw 4. Tha-Nokbin 2. Tha-Cherb Cherb 5.Tha-Laika 3. Tha-Ngayngerb 6.Tha-Saderd The Central region 1.Tha-Songtua 4.Tha-Yokkaw 2.Tha-Tong sa-aewb 5.Tha-Wankaw 3.Tha-Kakabat 6.Tha-Sabatkan The North region 1.Tha-Eawtua 4. Tha-Nok-Sabatpeek 2.Tha-Binlha 5.Tha-Tensao 3.Tha-Salawan 6.Tha-Kongkan The South region 1. Tha-Yoklai 4.Tha-Bidlai 2. Tha-Kumbae 5. Tha-Taetao 3.Tha-Tonmai-Lulom 6.Tha-Lerng-Rabum	- 6 exercise postures for each region, each with eight beats, using 80-120 beats per minute 20 minutes - practicing two rounds for each region.
	Cool down and stretching	Static stretching of major muscle groups	5 minutes

was conducted to test the strength and endurance of lower body test and the final test upper body muscles, the samples sat with arm curled doing arm curl test for 30 seconds, and then counted the number of times in a fully practiced posture (Liu et al., 2019; Solberg et al., 2013).

Instruments

Intensity control and energy expenditure; in both groups, intensity was controlled, 60 - 80% of maximum heart rate throughout the duration of each exercise, intensity and energy expenditure while training with Thai rhythm calisthenics movement and brisk walking group. All participants put on heart rate monitors (Polar Team Pro, Finland) in which the signal was connected to the receiver (Apple Ipad). The results were displayed on the screen while training including heart rate (bpm), percent of average heart rate (%AVG^{HR}), percent of average maximum heart rate (%AVG^{HRmax}) and energy expenditure of exercise in kilocalories (Kcal).

Statistical Analysis

Descriptive statistics were used to describe the characteristics of the sample. A normal distribution test of data using the Kolmogorov-Smirnov Statistics Test ($n > 50$) found that the data was normally distributed. Changes within the group were analysed before and after the training with the Paired t-test and the differences between the groups were analysed with independent t-test statistics at the significant level 0.05, with SPSS 17.0 (SPSS Inc. Released 2008. SPSS Statistics for Windows, Version 17.0 Chicago: SPSS Inc.).

RESULTS

Initially, the basic data analysis results of the volunteers in both groups were of average age. Most of the female groups in both groups were overweight by referring to the BMI (Asian people was ranged from 18.50 to 22.99 kg/m^2). The general data of the volunteers before exercise showed that there was no significant difference (see Table 2). In terms of adherence to the training programs, Thai rhythm calisthenics movement group attended 32.1 ± 0.3 sessions (89.16%), Brisk walking group attended 33.7 ± 0.6 sessions (93.61%) out of a total 36 sessions in the program. All participants in both groups attended more than 80% of their exercise classes. No adverse events occurred during or outside of the training sessions.

Table 3 showed that both experimental groups had increasing sAA levels in the initial stages to the 6-week follow-up period and were likely to increase in comparison to before the exercise period, in the later stages. There was significant in sAA levels tended to decline after exercise at 12 weeks respectively ($p \leq .05$). Especially, the sAA levels in the Thai rhythm calisthenics movement group decreased faster than brisk walking exercise at the end of 12 weeks.

The analysis with pair t-test revealed that both groups' resting heart rate and systolic blood pressure decreased. While, maximum oxygen uptakeVO^{2max} increased significantly when comparing between before and after exercises ($p < 0.05$). However, when analyzing between groups using independent t-test statistics, using the mean values of change in physiological, there were no significant differences between the experimental groups. In addition, both groups were able to stabilize from the functional reach test and the strength of the lower body with the 30-second chair stand test which was statistically improved within the group when comparing between before and after exercise ($p < 0.05$) and when analyzing between groups using independent t-test statistics, using the mean of the change in balance ability, and the strength of the lower body. It was found that the experimental group exercising with respect to Thai rhythm calisthenics movement had a statistically significant increase in their balance ability ($p < 0.001$). While, the timed up and go test decreased the mean time of testing in both groups, there was no statistically significant difference between the experimental groups. In addition, walking efficiency was found in the 6-Minute walk test. Both groups were able to walk statistically significantly ($p < 0.05$) longer distances, respectively.

DISCUSSION

This research has integrated the knowledge of the Art of Thai Rhythm Calisthenics movement. It is a combination of dance patterns that applies the dance gestures in all four regions of Thailand. The pattern of dance to create low impact aerobics forms of exercise that are novel, safe, fun, challenging and suitable for health promotion activities of the elderly. The exercise style emphasizes various movement skills,

Table 2. Participant characteristics

General information of participants	Thai rhythm calisthenics movement (n=35)	Brisk walking (n=35)	p-value
Gender (male: female)	7 : 28	9 : 26	-
Age (year)	63.64±4.6	64.20±4.5	0.671
Height (cm)	153.60±4.2	153.84±4.0	0.804
Weight (kg)	60.79±10.0	61.26±9.5	0.516
Body mass index (kg/m^2)	25.79±3.1	25.94±2.5	0.631
Percent of average heart rate (%AVG^{HR})	67.21±12.9	66.06±12.2	0.829
Percent of maximum heart Rate (%AVG^{HRmax})	74.42±16.8	74.10±16.1	0.713
Energy expenditure (Kcal)	281.71±21.4	283.20±21.4	0.622

The data are presented by means±SD

Table 3. Represents the comparison of the mean values and standard deviations of the variables in variable between before and after 12-week of experiment groups

Variable	Thai rhythm calisthenics movement (*n*=35)			Brisk walking (*n*=35)			*p*-value
	Pretest	Follow up	12 weeks	Pretest	Follow up	12 weeks	
Salivary alpha-amylase sAA (KU/L)	110.9±81.1	125.40±83.1	116.6±84.3	112.2±83.9	119.27±83.3	121.2±83.9	0.029*
Physiological							
Weight (kg)	60.78±10.1		59.94±8.0	61.04±9.7		60.22±9.0	0.481
Body mass index (kg/m^2)	25.79±3.1		25.65±2.9	25.94±2.5		25.62±2.3	0.513
Heart rate resting (bpm)	79.51±5.7		77.40±4.1	78.80±4.9		77.60±4.3	0.015*
Systolic blood pressure (mm/Hg)	128.4±9.1		126.9±8.8	129.3±9.5		126.3±8.2	0.047*
Diastolic blood pressure (mm/Hg)	77.33±7.9		75.78±7.0	76.11±8.1		77.89±7.6	0.408
Maximum oxygen uptake; VO^{2max} (ml/kg/min^2)	26.27±1.3		28.07±2.9	26.40±1.1		29.29±3.1	0.029*
Health performance							
Functional reach test (cm.)	14.22±1.3		19.90±1.9	13.85±1.3		16.2±1.9	0.001*†
Timed up and go test (second)	7.52±2.3		7.07±2.1	7.49±2.4		7.31±2.8	0.037*
Chair stand test 30 second (reps)	14.83±1.2		19.77±1.9	15.57±0.8		18.20±1. 6	0.046*
Arm curl test 30 seconds (reps)	18.07±0.8		19.50±1.3	18.47±0.8		19.27±1.6	0.611
6-Minute walk test (meter)	469.23±51.3		485.85±54.9	476.07±49.9		491.00±53.0	0.043*

*Means there was a significant difference from before the experiment at the 0.05

†Means differences from the experimental group were statistically significant at the 0.001

combining the movement of all parts of the body to move slowly. A previous review of the literature on the subject took a physiological approach, investigating the evidence-based findings on how different types of music affect physical results, such as strength, gait, endurance, performance and motor skill acquisition (Ghosh, (2020). The prevailing belief is that music facilitates exercise performance by reducing the sensation of fatigue, increasing psychological arousal, promoting relaxation and improving motor coordination. The music's 32-count phrasing makes program design and instructing so much easier and the outcome is more professional music styles. The music industry has been an integral part of the continued success of group exercise. Thai rhythm calisthenics movement style is a national sporting heritage of Thailand. And the researcher has studied the effect of exercise training on alpha-amylase in saliva and health performance in the elderly by comparing with exercise styles by brisk walking, which is the introduction of both forms of exercise activities as part of promoting physical activities in the Elderly School Loei, Thailand. The research findings can be discussed as follows.

The data suggest that both forms of exercise, aerobic, directly affect neurotransmitters that respond to emotional stress. During the 6-week follow-up period of an exercise program, it was observed that both groups showed an increase in sAA levels (125.40 KU/L, 119.27 KU/L) compared to before exercising, when they engaged in physical activities in the initial stages. The reason for this increase is due to the activation of the sympathetic nervous system during the early stages of the program, which caused physical and mental stress from the unfamiliar activities. It has a stimulating effect on the nervous system. Sympathetic provides secretion of neurotransmitter catecholamines, stimulating sAA secretion, thereby affecting the increase in sAA levels, which in later stages 12 weeks the sAA level tends to decrease (116.6 KU/L) with regular exercise and are familiar with musical rhythms. The findings show that the Thai rhythm calisthenics movement have a positive effect on body and mind are responding to adapting from constant physical activity. This has a positive effect on the adaptation of the nervous system. Moving in sync with music and meditation are effective ways of directly affecting the nervous system's response. Dancing or listening to music can trigger emotional happiness, which is crucial in managing long-term emotional stress among the elderly. Additionally, previous research has demonstrated that consistent exercise accompanied by rhythmic music resulted in a significant decrease in sAA levels in the 10 weeks following exercise. (Yektayar et al., 2012). In this research, we have obtained experimental results that are consistent with Wood et al. (2016) and Von Dawans et al. (2012) showing a significant decrease in sAA levels after 12 week moderate-intensity aerobic exercise

can lead to improved health outcomes for older adults. On the other hand, it was said that increased levels of Salivary alpha-amylase resulted in cumulative stress, an indicator of health conditions. Our study also suggests that psychological stress increases the risk of cardiovascular disease (CVD) (Anderson & Durstine, 2019) which in turn causes vascular dementia (Cohen et al., 2007; Min et al., 2021) increased risk developing mild cognitive impairment (MCI) (Wilson et al., 2007), dementia (Johansson et al., 2010) and ischemic stroke (Yun et al., 2022). This research has shown that changes in sAA levels can be linked to various health conditions and performance outcomes in elderly individuals. The study found that low levels of sAA were associated with better muscle strength and physical performance in older adults.

The physical fitness data report of the two experimental groups after 12 weeks showed that physiology in relation to the body composition, consisting of body weight and body mass index, compared to before the experiment has a tendency to decrease and was not found to be significantly different after exercise. The change of variables related to body composition shows that both forms of exercise have the activation of large muscles for continuous movement, and the circulation of all muscle groups (Bouaziz et al., 2017). It can be said that this form of exercise is aerobic exercise, which is a process that uses the energy system of the body at a time level. And the right weight to use energy from fat for combustion as energy, which is related to weight loss (Otten et al., 2017). In addition, the side variable physiological is related to the cardiovascular system, and has the ability to work better. In this study, we found that after exercise, the heart rate and systolic blood pressure decreased when comparing to before exercise. According to the change, it can be explained that exercise that can maintain the level of heart rate percent of maximum heart rate ($\%AVG^{HRmax}$ =74.42, 74.10) and control the proportion of respiration will have a good effect on the heart, circulatory system and respiration. In this study, it was found that both subjects had a reduced heart rate and systolic blood pressure. The method of exercising with Thai rhythm calisthenics movement is using the rhythm of the music (80 - 120 bpm) which has the relationship of the rhythm of body movement continuously. Music can help you execute movements at the proper speed. The highlight of the choreography design allowed the researcher to determine that a variety of dance exercises can be a fun and engaging way to increase physical activity, and the variety of movements involved can help keep workouts interesting and challenging. By mixing up the types of Thai dance moves and routines, individuals can challenge their bodies in different ways and work towards increasing their VO^2 max. Overall, both groups show increasing significance on VO^2 max through regular exercise can have a positive impact on heart function and blood pressure (Myers & Kaminsky, 2017), as it can lead to a more efficient heart, lower resting and exercise heart rates, and improved cardiovascular fitness (Ghosh & Banerjee, 2023; Kelley et al., 2017). Moreover, the participants were advised on how to breathe and manage fatigue whilst exercising. This is consistent with the recommendations of Emiliano et al. (2005) which described that the benefits of breathing exercises while exercising can affect the efficiency of the breathing and the myocardium that help with compression. This is related to the function of controlling the baroreceptor system. Exercise will stimulate the vagal tone, resulting in slower heart rate. Lower peripheral vascular resistance helps promote the function of the artery wall, which is an important reason for the decrease in blood pressure values (Marsh & Coombes, 2005; Carnelissen & Fagard, 2005).

Thai rhythm calisthenics movement is a new alternative exercise that can be added for physical fitness for the elderly. The basic parameters of the structure of the body that promotes good physical performance are 2 components, which are the strength and endurance of the muscles which have positive effect on the structure of the body. In this study, the researcher realized the training posture with the basic movement skills in daily life of the elderly. From the 30-second chair stand test, it was found that both experimental groups had an increased average when compared with before the exercise, with statistical significance at the level of 0.05. In addition, the average after 12 weeks of exercise mean shows improvement that lower body function ability in experimental groups. This is due to the use of Thai rhythm calisthenics movement gestures, using gestures that use the power of the muscles of various parts of the body in rhythm, with the use of muscles in relation to the rhythm of the music that controls the movement. This helps control the muscles in various movements, postures and concentrate during practice. It is consistent with the study of Jeon et al. (2005) using ancient Korean traditional dance movement training on lower body function in the elderly that after practicing Korean traditional dance movement, there was a positive effect on the leg strength (kg) and muscle endurance of the muscles in sit to standing posture for 30 seconds, which is a fundamental factor that is related to the ability to maintain a balanced body while in motion and to move effectively.

This study focused on the study of variables related to balance in the elderly by the Functional reach test, which found that the sample has the ability to test the functional reach test in increasing range after exercise with statistical significance at the level of.001. However, it was found that Thai rhythm calisthenics movement group may lead to better body adjustment mechanisms to maintain balance when movements were performed in dual-task conditions. They were able to stand and touch the front further compared to the exercise group by walking. There is also a test of agility and dynamic balance with timed up and go test, which are related to basic skills in daily physical movements. From the test results, it was found that both groups were able to improve their balance while moving the body according to the conditions of the test with shorter duration. Although this study does not examine mechanisms that increase the ability to functional balance performance tests directly, but it can discuss the strengths from the designed posture training of Thai rhythm calisthenics movement. This pattern requires the principle of transferring weight during movement in rhythm with various gestures together with weighting on the heel and toes which will stimulate the senses and maintain a more balanced

weight on the feet (Nicole & Michael, 2014), that individuals who practiced Thai dance spent more time turning the step inside and outside continually by focusing on components of dancing technique, including elements of meditation, body maintenance in extended periods of movement, weight transfer and base narrowing, coordination and control posture, which improved balance (Noopud et al., 2018). Thai rhythm calisthenics movement pattern was applied by the researcher using rhythm to control body movement together with contracting the abdominal muscles to help increase the stability of the core muscle while moving rhythmically at all times while performing the strength of the core muscles that are responsible for controlling body movement. This causes the motion recognition mechanism to work harmoniously (coordination movement) both the arms and legs, resulting in the control of the coordination of muscles (neuromuscular control) awareness of joints (proprioceptive sense) according to the rhythm repeatedly throughout the training period (Nicole & Michael, 2014; Komagata & Newton, 2003). That is to say, exercise in a muscle group that is primarily responsible for controlling the movement of the arms, legs, or core muscle groups, including abdominal muscles, back, pelvic floor and oblique, resulting better balance of the participants (Kwon, 2015). In this research, work out with four regions of Thai rhythm calisthenics were performed and repeatedly practiced with simple rhythm. Therefore, according to the above principles, it can be explained that the form of exercise by paying respect to Thai rhythm calisthenics movement is to promote the mechanism of the relationship in the movement and develop the ability to maintain the balance of the body while in static (static balance) and the movement of the body (dynamic balance) which is consistent with this study, the subjects were able to walk statistically significantly longer distances in the 6-minute walk test. This observation agrees with Taylor et al. (2012). whose study indicated an increase in the walking speed and stride length in individuals who practiced Tai Chi Chuan using the clinical walking test. Faster walking speed may have resulted from walking to the music and responding to changes in the ten music rhythm patterns (Low et al., 2017). These tasks involved a range of movements that challenge the balance control system by requiring multidirectional movements when dancing, as well as practice learning and remembering the postures of the dance. It also has a positive effect on various aspects of physiology. The results of this experiment suggested that in the case of the elderly who are unable to comply, basic movements should be used by starting from the easy posture to the difficult posture or begin by using a slow tempo and increasing the tempo faster. When the participants are ready to follow, they may choose to use local, or regional music for familiarity and rhythm. Then they have confidence in the rhythm of movement, fun, enjoyment, or use rhythmic instruments instead of music, with rhythms that can be easily remembered. Overall, these findings suggest that sAA can be a useful biomarker for assessing health performance in the elderly population, particularly with respect to physical functioning. However, more research is needed to fully understand the relationship between sAA levels of cognitive outcomes, sleep quality and inflammation in this population, as well as to identify potential interventions that may help to optimize sAA levels and improve health outcomes in older adults. This study was limited to monitoring food intake, mood, and sleep habits each day, which may have influenced changes in sAA values throughout the study.

CONCLUSIONS

Dance provides various beneficial effects because it combines complex movements with rhythmic changes, weight transfers, agility maintenance, and proprioceptive changes. Thai rhythm calisthenics movement is an alternative aerobic exercise with slow rhyming movement, which can reduce physical impact well. This exercise is appropriate to be applied for group exercise activity in the school for the old people in order to promote health-related physical fitness and give the elderly a chance to meet other people as well as reduce emotional stress and have good mental health. The research results revealed that Thai rhythm calisthenics movement with four regions shows positively resulted in strength and endurance of lower body and improve core stability which are main factors for balance and effectiveness of responsive muscular structures. Controlling body movement is a basic skill for doing daily life among the older people with confidence. It can help reduce accidents from falls and indicates a good quality of life of older people in the future.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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