

EFFECT OF ARM SWING EXERCISES ON CARDIOVASCULAR RESPONSE AND BALANCE OF OLDER WOMEN

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ABSTRACT: The purpose of this study was to assess the effect of arm swing exercises (ASE) on cardiovascular response and dynamic body balance of older women. 4 villages were randomly selected. The total population was 128 participants divided into 64 older women from two villages in the experimental group, another 64 older women from another two villages in the control group. The experimental group participated in the evening ASE program, five days a week, lasted for six months. The ASE program began with warming up for 5 minutes, swinging arms for 30 minutes, and gradually cooling down for another 5 minutes. Data collection consisted of pre and post-data collection before and after six months of the ASE program exercise. The collected data were validated by the experienced researcher. An independent t-test was used to compare the mean of both groups before participating in the ASE program. An intention-to-treat analysis was used for last observation carried forward missing data. Analysis of Covariance (ANCOVA) was used to compare the mean of both groups and Paired t-test within the group. After 6 months of exercising, the cardiovascular response and body balancing of both groups were measured. The results showed that the systolic blood pressure and diastolic blood pressure of participants in the experimental group were declined at 5.64 and 6.72 mmHg, respectively while there was only slightly changed in the control group of which statistically was not significant. In addition, the resting heart rates of the participants in the experimental group declined to 6.76 beats /minute and their body balancing has improved. Therefore, the ASE program can be effective to improve BP, HR, and body balancing of older women.

Keywords: Older, Arm-swing exercise, Blood pressure, Resting heart rate, Balance

1. INTRODUCTION

An increase of aging society has globally been an issue of discussion and challenges for many countries. More than a half of the aging population (414 million) is in Asia and Europe (161 million). China was reported to have the most older people (209.24 million), India was the second (116.55 million) and Japan had 41.85 million. Indonesia and Brazil had almost the same amount (21.19 and 24.39 million) [1].

Thailand is one of the countries where the aging population has increased to 10.73 million and has a tendency to increase each year [2]. Health problems also occur. These older people have to encounter not only their health problems but also the other aspects of their living like high blood pressure, chronic diseases, unexpected non-communicable diseases, more dangerously body balancing [3]. Physiological changes in the older people can be very dangerous, particularly cardiovascular system. For instance, the reduction of Cardiac function, the inflexibility of blood vessel [4]. These can cause hypertension and heart disease [5].

Regular exercises have a benefit towards cardiovascular health, increase cardiovascular endurance, decrease heart disease, or any factors associated with heart diseases [6].

In China, Arm-swing exercise (ASE) has been performed and very popular among older people for more than thousand years and has been proved very safe for them [7]. It is non-equipment involved. No cost is concerned. People can do everywhere and any circumstances. It is very easy to remember. The only condition is that it has to be done continuously for a certain period of time.

The study involving Arm-swing exercise (ASE) related to the effect of cardiovascular system and body balancing of older people has been limited. This study aims to assess the effect of Arm-swing exercise on cardiovascular response and balance of older women.

2. METHODS

2.1 Design and setting

This study employed a parallel two-arm cluster randomized control trial (CRT). A Block of 2 was

used for randomization. (4 villages were equally divided.) The size of each village was required to have similar geographically characteristics such as a similar number of older women, similar size of the community, and each village has to be a distance apart. The study was conducted at one of the districts in Khon Kaen province, from October 2014 to March 2015.

2.2 Participants

Four villages were randomly selected and divided into an experimental and a control group. 128 healthy older women, age more than 60 years old from the four villages were randomly recruited and grouped accordingly to the inclusive criteria (have been living in the village more than a year and have to live in the village more than a year) to participate in the study. The exclusive criteria included regular exercise, disability, and having dynamic body balance problems (Fig. 1).

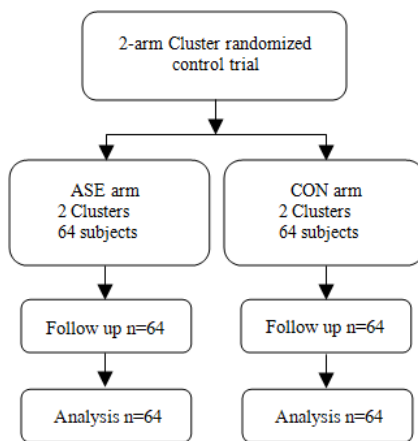


Fig. 1 Eligible clusters in the randomized control trial

2.3 Intervention

All 64 participants from the two selected villages in the experimental group followed the ASE program in the evening, five days a week lasted for six months. All participants from each village did the exercise together at the same time. The ASE program started by warming up for five minutes, after that they followed the steps of the ASE program by standing on feet as wide as their shoulder width, swinging both arms forwards at thirty degrees and backward at sixty degrees in a second. They had to repeatedly do this sixty times per minute, lasted for thirty minutes each day. Since the exercise had taken a bit of time, to avoid the boringness, local music was included throughout the exercise. All participants were allowed to walk or dance while swinging their arms. The exercise was gradually cooled down for five minutes (Fig. 2-3).

All participants were suggested not to perform any other exercises apart from the ASE program during the period of this study.

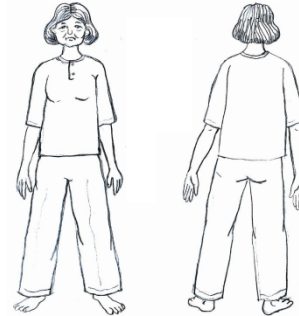


Fig. 2 Standing position

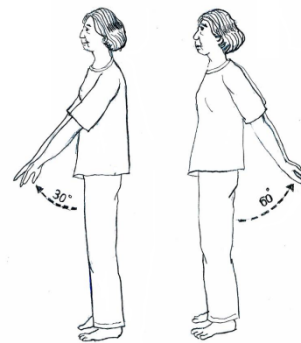


Fig. 3 Arm swinging

2.4 Procedure

Firstly, the research proposal was required to be approved by the Khon Kaen University Ethics Committee. Eventually, the research was registered for Human Research, coded HE571237. The objectives and the study design were described to all the participants for both the experimental and control groups. The consent form was read and signed at the Health Promoting Hospital. The appointment was arranged right after the consent form was acknowledged and signed for self-risk assessment. Those who were initially screened, the steps of the program were introduced. Every participant was provided with a recording-book to sign every time participated in the exercise. Normally, the exercise was performed in the village meeting point center nearby where was convenient and older people had fun.

Village health volunteers and Health Promoting Hospital officers followed up whether the ASE program had been regularly performed. All the participants were encouraged to regularly participate accordingly to the study design. The researcher and research assistants regularly visited and interviewed

the participants. After 6 months of the ASE program, another appointment was made at the Health Promoting Hospital in the morning to measure blood pressure (BP), resting heart rate (HR), and dynamic body balance.

2.5 Measurement equipment

Blood pressure (BP) and resting heart rate (HR) were measured by a digital sphygmomanometer (Omron® Japan) at the right arm. The participant rested for 10 minutes after the arrival at the Health Promoting Hospital. The measurement was repeated 3 times for each participant and recorded. If the results of the systolic or diastolic blood pressure varied more or less than 10% of the previous measurement, the participant was advised to sit down for a 10 minutes rest. All the three times measurement was averaged.

A timed up and go test (TUG) was used to measure the dynamic body balance purposely to assess the balance, walking ability, and fall risk in older women. Participants were suggested to wear their regular footwear. The procedure of TUG measurement began with the advice for the participants to sit on a chair, waiting for the signal from the researcher to get up and walk along the three meters line, then went back to their seat. The duration of this performance was timed and recorded.

2.6 Data collection

The data were collected on the morning of each day for each cluster. All participants in each cluster arrived at Primary Health Care center at 7.30 am. Physiological variables (Blood pressure, Resting heart rate), Balance (The timed up and go test) were evaluated for baseline and outcome measurement. All participants were advised avoid consuming any coffee or tea before coming to the center. The digital sphygmomanometer was calibrated for accuracy before baseline data collection and every 6 months. The assistant's researchers were registered nurses who were trained to interview and know how to use the digital sphygmomanometer to measure. The appointment for the next data collection and baseline measurement were made after 3 and 6 months respectively.

3. STATISTICAL ANALYSES

Shapiro-Wilk test was used to verify the normal distribution of continuous variables. Data were analyzed by using SPSS Version 19 (IBM Corp. Released 2010. IBM SPSS Statistics for Windows,

Version 19.0. Armonk, NY: IBM Corp.) Under licensed by Khon Kaen University. An intention-to-treat analysis was also used for last observation carried forward missing data. The Independent t-test was used to compare the averaged results from blood pressure, resting heart rate and dynamic body balance of both groups before participating in the ASE program. The intention-to-treat analysis for last observation carried forward missing data was also used. Subsequently, an analysis of covariance (ANCOVA) was employed to compare the averaged results from blood pressure, resting heart rate, and dynamic body balance of both groups after the ASE program, followed by a paired t-test to compare the mean within the experimental and control group. A difference at the level of $p < 0.05$ was considered statistically significant.

4. RESULTS

Most of the participants of ASE and CON group, 87.50% and 81.24%, were married. Their educational background was only primary school level. Their income was between 500-1500 Baht and most of them work at home (As shown in Table 1)

Table 1 The characteristic of ASE and CON group

Characteristics	ASE n(%)	CON n(%)
Status		
Marriage	56(87.50)	52(81.24)
Separated	3(4.69)	6(9.38)
Widow	5(7.81)	6(9.38)
Education		
Non study	5(7.81)	7(10.94)
Primary school	59(92.19)	57(89.06)
Income (Baht)		
500-1000	29(45.31)	31(48.43)
1001-1500	28(43.75)	22(34.38)
Over 1500	7(10.94)	11(17.19)
Occupation		
Farmer	12(18.75)	17(26.56)
Homework	52(81.25)	47(73.44)

Before participating in the ASE program, all participants' age, systolic blood pressure (SBP), diastolic blood pressure (DBP), resting heart rate, (HR), and dynamic body balance were compared to investigate any obvious differences. There was no statistical difference except the diastolic blood pressure from the experimental group was higher than the control group. This was statistically significant. (As shown in Table 2)

Table 2 Baseline demographic data before the experiment

Variables	ASE	CON	p-value
Age	67.32±5.95	67.94±6.58	0.58
SBP	124.23±12.82	125.19±14.15	0.81
DBP	75.76±10.05	70.98±8.94	0.01
HR	79.10±10.59	77.22±8.11	0.26
Balance	9.60±3.34	10.45±3.11	0.14

Note: Mean±SD., Independence t-test

After 6 months of the ASE program, the results of systolic blood pressure (SBP), diastolic blood pressure (DBP), resting heart rate (HR), and dynamic body balance of the experimental group were improved more than the control group. (As shown in Table 3)

Table 3 Comparison between ASE and CON group

Variables	ASE	CON	p-value
SBP	118.60	123.12	0.005
DBP	67.71	71.87	0.003
HR	71.75	75.86	0.005
Balance	8.78	10.62	<0.001

Note: ANCOVA adjusted mean using baseline as a covariate

A comparison within the experimental group after 6 months of the ASE program, the results of systolic blood pressure and (SBP) diastolic blood pressure (DBP), and resting heart rate (HR) were reduced, while the dynamic body balance was significantly improved. (As shown in Table 4)

Table 4 Comparison of ASE group

Variables	Before	After	p-value
SBP	124.23±12.82	118.59±12.47	0.001
DBP	75.18±10.05	68.46±6.41	<0.001
HR	79.10±10.59	72.34±7.70	<0.001
Balance	9.60±3.34	8.75±2.40	0.028

Note: Mean±SD., paired t-test

A comparison within the control group after 6 months of the ASE program, the results of systolic blood pressure and (SBP) and resting heart rate (HR) were reduced, but statistically no difference, while there were no significant changes in dynamic body balance and diastolic blood pressure (DBP) (As shown in Table 5)

Table 5 Comparison of CON group

Variables	Before	After	p-value
SBP	125.19±14.15	123.83±11.54	0.436
DBP	70.98±8.94	71.02±9.62	0.974
HR	77.22±8.11	75.33±9.04	0.070
Balance	10.45±3.11	10.72±3.32	0.179

Note: Mean±SD., paired t-test

A Comparison between ASE and CON group after 3 months and 6 months demonstrated that

systolic blood pressure (SBP) trend in ASE group was significantly reduced after 3 and 6 months whereas no significant change in CON group (Fig.4).

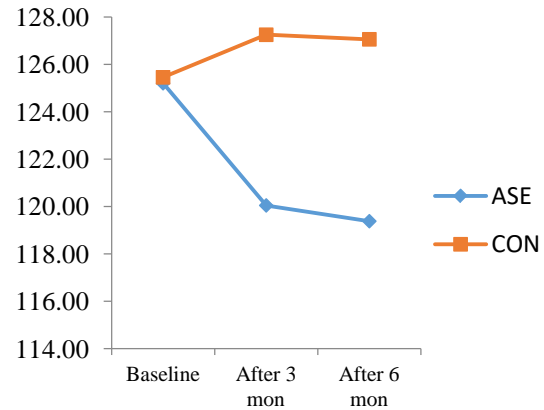


Fig. 4 A Changes in systolic blood pressure in ASE and CON groups after 3 and 6 months

A Comparison of diastolic blood pressure between ASE and CON group before the experiment was not statistically significant, but after 3 and 6 months the results of diastolic blood pressure in ASE group, there were significant changes (Fig.5).

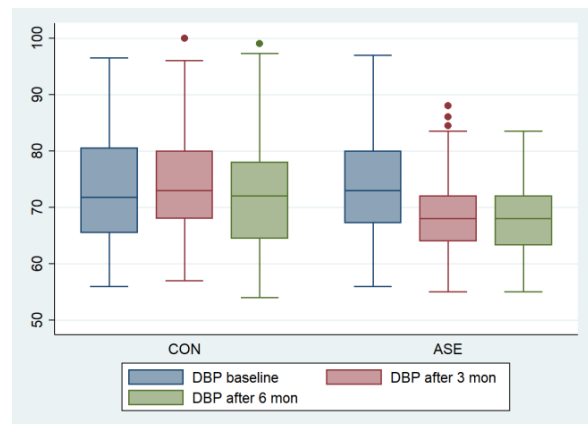


Fig. 5 A Comparison of diastolic blood pressure between ASE and CON group after 3 months and 6 months

5. DISCUSSION

The results of the ASE program for older women in the villages could help reduce blood pressure and resting heart rate, similarly to several studies. Vitro reported that 12 weeks of low-intensity exercise in older men and women found affected the reduction of resting heart rate [8]. Similarly to the study of healthy older men and women, after 6 months of low and high-intensity exercise, it was found that the low-intensity

exercise group developed lower blood pressure comparing to the high-intensity exercise group [9]. Another study of borderline diabetic mellitus older people, after 12 weeks of low-intensity exercise training, their blood pressure was also reduced [10].

The potential based on the mechanism of reducing the blood pressure can be explained by the effect of sympathetic nerve activity. During the exercise recovery period, the sympathetic nerve activity is decreased. This also happens to the signal transduction from sympathetic nerve activation into vasoconstriction. The local vasodilator mechanisms decrease the arterial blood pressure, apparently found after the exercise [11].

As far as the dynamic body balance is concerned, the results of the ASE program affected similarly to several studies. A home exercise program for 78 years old people, the results showed that their dynamic body balance has improved [12]. Similarly to another study done on three-month exercise program for older men and women and followed up after 12 months, the finding demonstrated that the exercise program significantly improved their dynamic body balance measurement of which the same type of tool used for this study (timed up and go test) [13]. Consequently, the potential based on mechanism increased the dynamic body balance due to the peripheral sensation improved by the ASE program.

There were three limitations in the study. Firstly the researcher did not collect the data on the participant's daily basis activities such as physical activity level, food consumption, alcohol drinking, or medication taking. Secondly, the intervention and activities in ASE and CON group were not blinded. There might be some information bias concerning questions and answers due to lacking prevention the participants to share what they had answered during the interview and participating in ASE activity. The research assistant was not reiterated how to prevent the participants to reveal what they had said in the interview. Finally, the data were collected between the end of a year and early in the New Year. This seasonal timing had obviously affected the study.

6. CONCLUSION

Regular exercising of older women in the villages by Arm-swing, 5 times a week lasted for 6 months, may reduce blood pressure, resting heart rate and improve the dynamic body balance. This kind of activity can contribute a lot to the communities where there are a lot of older people in terms of health promotion, opportunities for social gathering, having fun as well as no-money costing. Any older people with any social status can perform this

exercise program. More importantly, older people could use their leisure time worthwhile for their lives. This activity can certainly economically reduce the medication cost of the country.

7. ACKNOWLEDGMENTS

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