

## Outcome of Chair-based Exercise on Physical Performance and Quality of Life of Older Women: A Preliminary Study in Kuala Lumpur, Malaysia

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### ABSTRAK

Senaman berasaskan kerusi (SBK) adalah senaman alternatif untuk golongan dewasa tua bagi memastikan keselamatan semasa bersenam. Namun, bukti keberkesanan latihan senaman ini terhad kepada populasi dewasa tua yang mempunyai kondisi kesihatan akut atau penyakit terminal. Jika tahap kesukaran senaman ditingkatkan, SBK boleh memberi manfaat kepada populasi dewasa tua lain. Kajian ini bertujuan menilai kesan SBK terhadap prestasi fizikal dan kualiti hidup wanita dewasa tua di komuniti Malaysia. Sejumlah 18 wanita dewasa tua berumur  $66.78 \pm 4.60$  tahun telah melengkapkan latihan SBK pada kekerapan dua kali seminggu selama lapan minggu. Kesan senaman diukur dari aspek ketahanan fizikal, kekuatan kaki dan kekuatan genggam tangan menggunakan ujian berjalan selama enam minit (6MWT), ujian berdiri dari posisi duduk sebanyak lima kali (FTSTS) dan dinamometer tangan. Skala Kualiti Hidup Pertubuhan Kesihatan Sedunia versi Melayu (WHOQOL-BREFMalay) telah digunakan untuk mengukur status kesihatan dan tahap kualiti hidup peserta kajian. Data dianalisis menggunakan statistik inferensi, tahap signifikan ditetapkan pada nilai  $p < 0.05$ . Min jarak berjalan dalam ujian 6MWT meningkat selepas SBK ( $20.11 \pm 24.50$ ;  $p < 0.001$ ) dan ini menunjukkan peningkatan ketahanan fizikal. Perubahan positif juga

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didapati dalam skor keseluruhan, dan dalam domain kesihatan umum, kesihatan fizikal, psikologi serta persekitaran skala WHOQOL-BREFMalay ( $p < 0.05$ ). Namun, tiada perubahan yang signifikan ditemui bagi skor FTSTS dan kekuatan genggaman tangan selepas senaman. SBK dapat meningkatkan ketahanan fizikal dan kualiti hidup dalam kalangan wanita dewasa tua sihat di komuniti terpilih dan ia boleh menjadi pilihan senaman bagi golongan ini.

*Kata kunci:* kebolehan fizikal, kualiti hidup, senaman berasaskan kerusi, warga emas wanita

## ABSTRACT

Chair based exercise (CBE) is an exercise alternative for older adults in ensuring safety during exercise. Its evidence of effectiveness is currently limited to frail older adults or those with acute medical conditions or terminal illnesses. Given higher exercise difficulty level, CBE could benefit healthier older adults and can be an exercise option for this population. This study was designed to evaluate the outcome of a CBE on physical performance and quality of life in community-dwelling older women in Malaysia. A total of 18 older women (mean age  $66.78 \pm 4.60$  years) completed CBE at twice-per-week for eight weeks. Exercise outcomes were measured using six minutes' walk test (6MWT), five times sit to stand test (FTSTS) and hand-held dynamometer for physical endurance, functional lower limb strength and grip strength, respectively. A Malay version of the World Health Organization quality of life scale (WHOQOL-BREFMalay) was used to measure the health status and QOL of the participants. All data were analysed with the use of inferential statistics, with significance level set at  $p < 0.05$ . The mean distance walked in 6MWT improved after CBE ( $p < 0.001$ ), indicating greater physical endurance. Significant improvements were also found in the overall QOL, and in the general health, physical health, psychological and environment domains of the WHOQOL-BREFMalay ( $p < 0.05$ ). However, no significant changes were demonstrated in the FTSTS and grip strength following the exercise. CBE enhances physical endurance and quality of life among older women in the selected community and can be an exercise option for this population.

**Keywords:** chair based exercise, older women, physical abilities, quality of life

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## INTRODUCTION

Population aging, which refers to an increase in the number of older person in a community is one of the most important demographic events which

occur in the 21<sup>st</sup> century (Wan-Ibrahim & Zainab 2014). Similar to other countries around the world, Malaysia is experiencing a rapid growth of the older population aged 60 years and above. This population group made

up 2.8 million or 9% of the country's population of 31 million in 2015 and Malaysia is expected to become an ageing population country by the year 2030 (Zawawi 2013).

Aging is defined as deterioration of functional properties (Faber et al. 2006), with a significant impact on one's physical and cognitive functions (Ferrucci et al. 2004). Physical activity plays a role in ensuring healthy ageing. Participation in exercise, which is a form of physical activity induces positive effects on the aging process and assists in preventing, delaying or reversing age-related functional decline (Bean et al. 2004; Chou et al. 2012; Faber et al. 2006; Fahlman et al. 2007; Singh 2002). Engagement in regular exercise has also been shown to reduce falls rate and improve the ability to perform activities of daily living, and consequently enhance quality of life among the older adults (Chou et al. 2012; Munro et al. 2004; Sherrington et al. 2011).

Nonetheless, despite increasing documentation on the benefits of exercises for older adults, a large percentage of this group, especially women still lead a sedentary lifestyle (Muntner et al. 2005, Moschny et al. 2011). Multiple barriers to exercise participation have been reported, which consist of psychosocial factors such as fear of falls during exercise (Bruce et al. 2002; Murphy et al. 2002), low motivation, lack of interest as well as lack of time (Aily et al. 2017; Wilcox et al. 2003) and environmental factors such as poor access to exercise facilities (Aily et al. 2017; Chen 2010). All these barriers are reported more

frequently among women than men (Moschny et al. 2011). Incidence of falls during exercise is also documented as a reason for low exercise participation among older adults. This is because normally, exercise is performed in standing position, which places a demand on one's body physically and psychologically. Modification of exercise is therefore required for older population to ensure safe exercise practice. Prescription of exercise should also take into consideration the individual fitness level of the older adults (Nelson et al. 2007).

Chair based exercise (CBE), an alternative mode of exercise which predominantly use chair during exercise (Headley et al. 2004) has been introduced to increase safety during exercise. Other than offering a more stable position due to a larger base of support as compared to standing alone, CBE can be progressed to increase aerobic demand, balance and strength during exercise (Razaob & Doherty 2012). Similar to conventional exercise, CBE can be tailored to meet the individual needs of older adults and is seen as an increasingly popular exercise choice among older people (Anthony et al. 2013).

More and more studies have been conducted to evaluate the benefit of CBE among older populations. Reported positive outcomes following CBE include enhancement of functional capacity (Witham et al. 2005) and enhancement of quality of life (Headley et al. 2004). A systematic review in this topic area concluded that CBE is also feasible for frail older adults (Anthony et al. 2013). However,

previous studies mostly targeted older adults with acute or critical medical illnesses such as heart failure (Witham et al. 2005), breast cancer (Headley et al. 2004) and hip fracture (Hruda et al. 2003). CBE could benefit healthier older adults if suitable exercise difficulty levels are used, and can be an exercise option for this population. Therefore, this study was conducted to evaluate the outcome of CBE training program on functional performance and quality of life among older women without acute or terminal illnesses in the community. This population was chosen due to the lower exercise participation than men.

## MATERIALS AND METHODS

### STUDY DESIGN, LOCATION AND TIME SCALE

This was a preliminary single cohort experimental study conducted among senior citizens' attending a recreational club in Kuala Lumpur from January until May 2016. The study was approved by the Universiti Kebangsaan Malaysia Research Ethics Committee with a code project assigned; NN-153-2014.

### STUDY PARTICIPANTS

Eligible participants were screened among older adults who are registered members of the club. The inclusion criteria were 1) women age 60 years and above, 2) able to walk for at least six minutes with or without walking aids, 3) no cognitive impairment (scored 5 or more on Elderly Cognitive

Assessment Questionnaire) and 4) no acute or terminal medical illness. Older women who have difficulty in understanding Malay and English language were excluded.

The number of participants required for the study was calculated with the use of G power. Data of effect size of key variables from previous studies were used, namely six minute walk test (6MWT) and sit to stand test (Benavent-Caballer et al. 2016) and QoL (Headley et al. 2004). Setting the probability level at 0.05, power of 0.80 and effect size between 0.32 and 1.06, a sample size of 81 is yielded from the calculation. Considering up to 30% drop-outs, a total sample size of 105 would be required for the study. As regarding a preliminary study, a sample size of 10 to 15% of the projected number for actual study (Connelly 2008) is required. Based on this recommendation, the targeted number of participants for this preliminary study was 16 which was 15% of 105.

### CHAIR BASED EXERCISE INTERVENTION

A Malay version of CBE was used in this study. The CBE was adopted with permission from the original English version which developed in United Kingdom (Razaob & Doherty 2012). The CBE has seven levels of exercise difficulty; each level consists of warm up, main and cool down exercises except for level one which does not contain main exercises. Exercises are initially started in sitting positions, following which exercises in standing are included in level three to seven

while sit to stand exercise is added in level five onwards. Chair was used to provide hand support and increase balance during standing exercises. The intensity and duration of CBE were increased proportionally with the level of difficulty. The intensities were varied throughout the seven levels of exercise with increasing duration for each level, which ranged from 30 to 45 minutes. The CBE does not include resistance training and the use of exercise equipment other than chairs.

The demonstration of CBE to the study participants was performed by playing a digital video disc (DVD) with voice over, with explanation about each exercise tasks provided in a form of text which appeared on a television screen. A research assistant was present during the demonstration and all exercise sessions, to monitor the participants' exercise performance. A chair with arm rest and height of 45cm was used through the CBE training.

The CBE was developed using 'frequency, intensity, types of training and time' (FITT) principle. Literature has shown that the total frequencies of exercise training varied across studies, range between two and seven days per week and similar achievement in QoL could be obtained either following a twice per week or five days per week session (Nieuwland et al. 2000). Therefore, CBE intervention used in this current study was an eight-week intervention program conducted twice per week. All CBE were performed at appropriate intensity for example main exercise has higher number of repetition than warm up and cool down exercises, and the intensity

was progressively increased with the increased in the level of CBE. The duration of CBE was longer as the exercise level increased. CBE activities consists of arm movement alone, hand movement alone, alternate arm and leg movement, rotation of trunk, and combination of two standing activities such as heel digs and slide which require greater coordination.

All participants attended exercise familiarization session prior to the 8 week CBE intervention, to ensure that they fully understand each exercise task including the instruction given in the DVD. The initial level of CBE for each participant was determined based on the participant's functional performance and was progressively increased to the next level when the participant demonstrated good exercise performance. During CBE implementation, the exercise video was played through each exercise session.

## MEASUREMENT OF OUTCOME

Outcome of the exercise training was measured by comparing functional performance and quality of life score at baseline and week 8 of training. Functional performance measures include physical endurance, functional lower limb strength and grip strength, while quality of life scores include physical health and mental health. All measurements were conducted by an independent researcher.

## PHYSICAL ENDURANCE

Physical endurance was measured

with the use of six-minute walking test (6MWT), a valid and reliable tool which is easily administered and well tolerated by older adults (Enright et al. 2003; Razaob et al. 2016; Steffen et al. 2002). Participants were required to walk along a flat and straight walkway at their normal pace as far as they possibly could in six minutes. Normal walking aids were allowed during the test. Standardised instructions and encouragements were given to all participants (Laboratories 2002). The total distance walked was then recorded. For safety purpose, participants' blood pressure, heart rate, oxygen saturation and exertion level using Borg Scale were measured at baseline and at one minute and two minutes post-test (Laboratories 2002).

### **FUNCTIONAL LOWER LIMB STRENGTH**

Functional lower limb strength was measured using five times sit to stand (FTSTS) test. With arms folded over chest, participants completed a five-repetition standing up and sitting down task at their best speed and time to complete the task was recorded. A standard, stationary and armless chair with the height of 43.0cm from the ground was used. FTSTS is a reliable and valid test to measure the strength of lower limb in older adults (Bohannon, 2006; Schaubert & Bohannon 2005).

### **GRIP STRENGTH**

Grip strength is a valid predictor of generalized upper extremity strength among older adults (Reis & Arantes

2011; Schaubert & Bohannon 2005). The grip strength of both dominant and non-dominant hand was assessed using a digital hand dynamometer (Saehan®, Model DHD-1). In sitting position with their wrist in neutral position and elbow flexed 90°, participants were asked to squeeze the dynamometer to their best level. Three trials were allowed for both hands and the best score was taken.

### **HEALTH-RELATED QUALITY OF LIFE**

WHO quality of life scale abbreviated in Malay Language (WHOQOL-BREF<sub>Malay</sub>) was used to assess health-related quality of life among the participants. The WHOQOL-BREF<sub>Malay</sub>, with Interclass Correlation (ICC) ranged from 0.49 to 0.88, enables measurement of four domains of quality of life which are physical, psychological, social relations and environment (Hasanah et al. 2003)

### **STATISTICAL ANALYSIS**

All data were analysed using Statistical Package for Social Sciences (SPSS) version 23.0. Paired t-test was used to compare the pre and post scores for 6MWT, grip strength, five times sit to stand and WHOQOL-BREF<sub>Malay</sub> respectively.

## **RESULTS**

### **PARTICIPANTS' DEMOGRAPHY, ATTENDANCE AND ATTRITION**

Table 1: Demographic of the study participants

Variable	Participants
Mean Age (SD), years	66.78 (4.60)
	n
<b>Marital Status</b>	
Single	0
Married	12
Widow/ Divorced	6
<b>Educational Level</b>	
None	0
Primary School	13
Secondary School	4
Tertiary School	1
<b>Medical Illness*</b>	
No Medical Illness	2
One Disease	4
Two Diseases	9
Three Diseases	3
>Three Diseases	0
<b>Past Exercise Practice#</b>	
None	8
1-2 days/ week	6
3-4 days/ week	3
7 days/ week	1

Note: n=18

\*Medical Illness included hypertension, diabetes, high cholesterol, osteoarthritis and low back pain

#Past Exercise Practice included light exercise in the morning and Tai Chi

Of 30 participants who were enrolled into the study, 12 participants withdrew after a few training sessions. Reasons for withdrawal include busy working (n= 3), had a fall at home (n= 1), and hospitalized for a surgery (n= 1). For 7 other participants who withdrew, the reasons for withdrawal could not be identified due to the participants been non-contactable. A total of 18 participants completed at least 75% of the CBE training sessions, whose data could be analyzed following the intervention.

The characteristics of the 18 participants are shown in Table 1.

Their mean age (SD) was 66.78 (4.60) (range 60-80) years. In the beginning of this program, the distribution of CBE training levels among the 18 participants were 56% in level three, 16% in level four, 16% in level five, and 6% in level six and seven. By the end of the CBE intervention, the distribution of the exercise levels was 11%, 28% and 61% in level five, six, and seven, respectively.

## PHYSICAL PERFORMANCE

Table 2 presents the mean score of 6MWT, grip strength and five times

Table 2: The mean score of six minute walk test, five times sit to stand and grip strength among the study participants at pre and post-CBE

	Pre-CBE	Post-CBE	Pre-Post CBE Differences	95% Confidence Interval of the Differences		<i>p-value</i>
	Mean ± SD	Mean ± SD	Mean ± SD	Lower	Upper	
6MWT (m)	316.75 ± 60.41	336.86 ± 61.18	20.11 ± 24.50	7.93	32.29	<0.001
Grip Strength						
Dominant Hand (kg)	16.07 ± 5.04	17.39 ± 3.74	1.32 ± 3.62	-0.48	3.12	.090
Non-dominant Hand (kg)	14.16 ± 4.12	14.46 ± 3.43	0.29 ± 3.47	-3.13	-1.16	.098
FTSTS (s)	13.41 ± 3.73	12.29 ± 2.72	-1.11 ± 1.074	-3.13	-0.91	.311

Note: n=18. Significant at p<0.001.

sit to stand (FTSTS) of the participants at pre and post-CBE. Significant difference is observed in the score of 6MWT (p<0.001). While in other outcomes, the differences in score are not significant.

### HEALTH- RELATED QUALITY OF LIFE

Table 3 shows the results of each domain in the WHOQOL-BREFMalay. The Overall Quality of Life (QOL) and General Health, Physical Health, Psychological and Environment domains improved significantly following the CBE program (all p<0.05). Social Relationship domain was not assessed as six participants are widow and other participants were reluctant to answer some questions in this domain.

### DISCUSSION

The current study examined the benefits of a CBE on functional performance, which focused on physical endurance, functional lower limb strength and

grip strength, and quality of life among older women without acute or terminal illness in a community. As other CBE reported in some literature, the CBE used in this study is easy to perform, with no exercise equipments required. This provides opportunity for the study participants to continue the exercise program on their own post-intervention. Although safety concerns related to the use of CBE have been expressed (Babakus & Thompson 2012), no adverse events were reported among the study participants throughout the training. This demonstrates that CBE training is safe for older adults in the community.

The study findings showed that the CBE has positive impact on functionality of older women without acute or terminal illness, although this CBE program was originally designed for heart failure patients (Razaob & Doherty 2012). The positive change could have resulted from the nature and content of the CBE which comprise seven exercise levels, with moderate and high exercise levels seem to suit a ‘healthier’ population.

Table 3: Results of overall and each domain of WHOQOL-BREFMalay

	Pre-CBE	Post-CBE	Pre-Post CBE Differences	95% Confidence Interval of the Differences		<i>p-value</i>
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Lower	Upper	
Overall QOL	3.50 $\pm$ 0.51	4.22 $\pm$ 0.65	0.72 $\pm$ 0.67	0.39	1.06	<0.001
General Health	3.89 $\pm$ 0.83	4.28 $\pm$ 0.58	0.83 $\pm$ 0.79	0.44	1.22	<0.001
Physical Health	71.03 $\pm$ 15.87	81.94 $\pm$ 10.85	10.91 $\pm$ 12.15	4.89	15.96	<0.01
Psychological	79.87 $\pm$ 10.33	81.01 $\pm$ 9.05	5.56 $\pm$ 9.80	0.68	10.43	0.028
Environment	68.75 $\pm$ 9.82	81.25 $\pm$ 11.83	12.50 $\pm$ 10.56	7.25	5.04	<0.001

Note: n=18. Significant at  $p < 0.05$

Walking and physical endurance are important pre-requisites to activity of daily living. In this study, majority of the participants shown improvement in walking, with a mean increase in walking distance recorded as 20 meters following the CBE. This finding is consistent with the result of a previous study by Benavent-Caballer and colleagues (2016) which used video-supported exercise interventions among community dwelling adults. In the study, the participants achieved a mean improvement of 21 meters post-intervention. The improvement in walking distance when measured using 6MWT indicates greater physical endurance among the participants and is most likely resulted from an increase in cardiopulmonary capacity due to having to perform exercises in various intensity levels and duration as part of the CBE.

Previous studies on CBE reported up to 22% significant improvement in functional lower limb strength, measured using FTSTS following the CBE (Hruda et al. 2003; Seynnes et al. 2004). In this current study, although most participants improved in FTSTS

test performance, the magnitude of change is not large enough to reach statistical significance. This could be explained by the nature of exercise tasks used, in which strength training was not carried out using equipment such as resistance band but by using body weight alone and increasing the exercise repetition and duration. Past studies included usage of resistance band and longer intervention duration, which enable greater gain in lower limb strength (Hruda et al. 2003; Seynnes et al. 2004).

CBE used in this study includes several upper limb exercises prior to lower limb activities. Therefore, grip strength was tested as a secondary outcome. However, no significant change in grip strength was found in the study participants after eight weeks of CBE. This could be due to the inadequacy of upper limb activities among the participants in the study through the intervention. In the CBE used in this study, exercises in the higher levels focused more on lower limb activities than upper limb tasks (Razaob & Doherty 2012); more than 60% of the participants reached

higher level of CBE midway during the intervention. This finding does not support the claim that increased physical activity levels correlates significantly with grip strength improvement in older women (Bruce et al. 2002; Pijnappels et al. 2008) and sufficient upper limb exercises are needed in an exercise program if gain in hand grip strength is intended.

Past studies on CBE showed no change or a reduction of quality of life among older adults following CBE (Headley et al. 2004; Witham et al. 2005). In the current study, the overall WHOQOL-BREFMalay score and the score of general health, physical health, psychological and environmental domains of the QOL improved significantly among the participants following the CBE. Being physically more active has been associated with greater health state among population of various ages (Kusumaratna 2016; Pernambuco et al. 2012). This could be a reason for quality of life enhancement in the current study participants. This contradictory finding when compared to the result of past studies is probably due to the difference in the tool used to measure quality of life.

This study is subjected to one main limitation. Been a preliminary study and only involved older women from a recreational club in Kuala Lumpur, the study findings could not be generalized to a wider population of older women in Malaysia. Further study with larger sample size, and include more cities from Peninsular Malaysia is required to ensure external validity.

## CONCLUSION

In conclusion, this study found that given appropriate level of exercise difficulties, chair based exercise can enhance physical endurance and quality of life of older women without acute or terminal illnesses in the selected community. CBE may be one of exercise options for the women. Larger study is warranted to establish the positive outcome of CBE on this population.

## ACKNOWLEDGEMENT

The authors thank the members of Kelab Warga Emas Sri Perlis 2, Kuala Lumpur for participation in this study. This study was funded by Universiti Kebangsaan Malaysia via the Young Researcher Grant Scheme 2013 (GGPM-2013-101). The Chair Based Exercise DVD is based on the work of Professor Patrick Doherty and was used in this study with permission.

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Received: 12 Mar 2018

Accepted: 17 Jul 2018