

**Original Article****COMMUNITY BASED PHYSICAL EXERCISE PROGRAM FOR THE ELDERLY IN SOUTH INDIA**Lakshminarayanan Subitha<sup>1</sup>, Soudarssanane M Bala<sup>2</sup>, Murugesan Ramanujam<sup>3</sup>

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**ABSTRACT**

**Context:** Physical inactivity is an important risk factor for hypertension, osteoarthritis, diabetes and cardiovascular diseases among elderly.

**Aims:** This study was done to study the feasibility of implementing of a community based geriatric exercise program by providing Bicycle Ergometers and to assess the reduction in blood pressure.

**Settings and Design:** Community based intervention study

**Methods and Material:** This study was carried out in four phases, awareness campaign, recruitment and baseline assessment, intervention (10 weeks) and final assessment. Three bicycle ergometers were placed in the community hall and made accessible during fixed timings. Sixty subjects > 60 years were allotted to six groups based on their convenience of exercise timings. Members of self help groups, youth clubs and other volunteers were trained on assisting and supervising exercise sessions. Ten minutes per exercise session for three sessions a week included warm-up period, main period of cycling, and cool-down period.

**Statistical analysis used:** Analysis was done using paired 't' test.

**Results:** Mean age of participants (28 males, 32 females) was 64.6 years. Drop out rate was 37%; 22 subjects (37%) engaged in  $\geq 3$  sessions per week, while 26 % participated in 1-3 sessions during the intervention. Per protocol analysis on 38 participants who completed intervention, showed a significant reduction in mean BP by 4.18/ 2.02 mm Hg (p=0.000).

**Conclusions:** This study has proved the functional feasibility of enabling elderly people to undertake physical activity in a rural Indian community, and the effectiveness of physical activity in significantly reducing mean blood pressure levels.

**Keywords:** exercise program, geriatric, community based, physical activity

**INTRODUCTION**

The demographic transition, fall in fertility rates and increased life expectancy contribute to increased proportion of elderly persons in developing countries. Both the share and size of elderly population is increasing over time; from

5.6% in 1961 it is projected to rise to 12.4% of population by the year 2026.<sup>1</sup> Effective geriatric health care services need to stress a community approach to primary health care with special emphasis on health promotion<sup>2</sup>. Physiologic changes that occur with decreased activity have a profound impact on an individual's functional

ability and these changes are magnified for the elderly. The common morbidities among this age group are hypertension, osteoarthritis, diabetes and cardiovascular diseases. Mostly, the underlying risk factors in all these conditions are physical inactivity and obesity. Inactivity is perhaps the greatest health threat for older adults. Therefore, promoting physical activity among the elderly is beneficial in more ways than one. World Health Organisation recommends 30 minutes of physical activity to prevent cardiovascular diseases<sup>3</sup>.

With advancing age there is a social slackening at being physically active due to lack of interest, lack of initiative, and lack of facilities for exercise (lack of proper roads or walking tracks). Barriers to exercise in elderly are accessibility, timing, apprehension and assumption of limited energy<sup>4</sup>.

This study aims at providing the trigger point, in the form of a structured exercise program and the required facility, by way of providing Bicycle Ergometers. The present study is designed to test the feasibility of implementing of a community based geriatric exercise program by providing Bicycle Ergometers and to assess the reduction in blood pressure due to physical activity at the end of the physical exercise program

## **SUBJECTS AND METHODS**

### **Study setting**

Two villages of Periakattupalayam & Rangareddipalayam belong to Madalapattu Panchayat of Cuddalore district, Tamil Nadu. The total population of Periakattupalayam is 1020 and Rangareddipalayam is 360. A meeting with the village leaders was conducted to sensitize them on the extent of morbidity among elderly in rural areas and the various causes for rising trend of such diseases. Ill effects of high blood pressure and hypertension and the benefits of regular physical activity in reducing blood pressure were explained to the village leaders in simple terms. The possibility of physical activity in elderly through bicycle ergometers was put forth. They were briefed about the objectives and methodology of this study and the safety of the intervention for both hypertensives and elderly with normal blood pressure. They were convinced of the usefulness of the intervention and assured full cooperation on behalf of other villagers.

A Pilot study was done with the objective of testing methodology, studying participant behaviour and the motivation involved. Two Self Help Groups (SHG) were contacted to enlist cooperation in the study. Five participants aged 60 to 70 were enrolled for a week. Their identification data, socio-demographic details, anthropometry and baseline BP were recorded. Health benefits of regular physical activity were explained. After initial training, they participated in the exercise program for two weeks. A log of their exercise frequency and repeat measurements of blood pressure were collected after 2 weeks.

The study protocol was approved by the JIPMER Institute Ethics Committee. Official permission was obtained from the Deputy Director of Health and from the village Panchayat. Village leaders, self help groups and youth club members were involved as resource people for motivation of the elderly. Periodic health education sessions were conducted in order to sustain the motivation. Medical Officer and Health workers of the local Primary Health Centre were involved in continued motivation. This study was carried out in four main phases, starting with an Awareness campaign, followed by Recruitment and Baseline assessment of participants, the Intervention phase (10 weeks) and Final assessment.

### **Awareness Campaign**

Health awareness campaign on physical activity was done using banners, pamphlets, sessions through group meetings and one-to-one counselling. Three Health education sessions were conducted in the monthly meetings of the SHGs, to inform elderly women about the risk factors of high blood pressure and Hypertension, and benefits of regular physical activity. Another meeting was organized for elderly men to create awareness about Hypertension, its risk factors and benefits of physical activity.

### **Recruitment and Baseline Assessment of Participants**

Following the awareness campaign, subjects were recruited by house to house visits. Subjects aged above 60 years were included in the study. Subjects with ischemic heart disease, chronic illness like asthma and severe arthritis and other conditions that limited physical activity like deformities were excluded from the study.

Following Informed Consent, identification details were collected from the study participants and baseline assessment was done. Socio demographic details were recorded using a proforma. Height was measured to the nearest millimeter by using Microtoise tape. Weight, to the nearest 100 grams was measured by UNICEF Electronic Scale 890-SECA. BMI was calculated using the formula  $\text{Weight}/\text{Height}^2$  and expressed as  $\text{kg}/\text{m}^2$ . Blood pressure was recorded using a digital BP monitor (OMRONSEM-1, Japan) as recommended by NCD Surveillance of IDSP. After 5 minutes rest, 2 readings were recorded 3 to 5 min apart. If SBP was  $\geq 140$  mm Hg or DBP  $\geq 90$  mm Hg, a third reading was taken after 30 min rest. Average of either 2 or 3 readings was taken for recording final BP.

### Intervention

Three bicycle ergometers were placed in the community hall and made accessible during fixed timings in the mornings and evenings. The elderly subjects were allotted to six small groups of ten members based on their convenience of exercise timings. Members of SHGs and Youth Clubs and other volunteers were the group leaders who were also trained on assisting and supervising exercise sessions in elderly. Every trainer was in charge of five study subjects. The exercise intensity was monitored by heart rate measures and reporting of any chest discomfort. The investigator or the physical instructor was present during most of the exercise sessions. The ergometers are relatively safer when compared to treadmills: however, in case of any person developing chest pain or any chest symptoms, it was agreed that he/she would be taken to the nearby hospital immediately, by the Investigator or Trainer. The SHG members and volunteers were also trained in first aid and appropriate initial management.

Training session for the elderly on how to use the bicycle was conducted by the investigator with the help of the Physical instructor. The Physical Instructor briefed the participants during the baseline assessment and other group meetings. Training program characteristics like length, frequency, intensity, total minutes, duration of intervention and compliance were explained to the participants to result in health benefits. The training routine included a warm-up period with gentle exercises, a main period of cycling, and a cool-down and relaxation period. Gradual stepping up of the exercise

session was done for each of the participants as per fitness and ability, to reach around ten minutes per exercise session. The subjects were instructed to participate in minimum three sessions per week for health benefits.

The intervention was planned for 10 weeks since earlier studies showed that approximately 75% of the BP lowering effect found after 20 weeks of physical activity, occurred in the first 10 weeks.<sup>6</sup> The intervention was limited to 10 weeks due to time and resource constraints, and the fact that this study was done by a single investigator. Long term compliance of the participants to exercise program was also stressed so that they benefit with a healthier lifestyle. The sessions were monitored by the group leaders from the village and the investigators. An attendance record of the number of exercise sessions for the participants was maintained for each group.

### Final Assessment

At the end of 10 weeks intervention, the participants were contacted again and their BP was recorded. Assessment was done even for dropouts as a requirement for 'Intention to Treat' analysis. The number of exercise sessions per person was collected from the attendance records maintained by the group leaders. Subjects were classified into 3 levels of compliance based on the total number of exercise sessions attended - less than 10 sessions (<1 session per week, dropouts), 10 - 29 sessions (1-2 sessions per week on an average) and 30 or more exercise sessions ( $\geq 3$  sessions per week)

### Analysis

Data was analyzed using SPSS Version 13. Statistical significance was set at  $p < 0.05$ . Data are reported as mean  $\pm$ SD and proportions. Paired t test was used to test the difference between pre and post intervention effects. ANOVA was used to compare the difference between subgroups.

### RESULTS

Of the 60 subjects, 30 subjects (50%) were aged 60-64 years, 25 (41.7%) aged 65-69 years and 5 (8.3%) aged 70 years or more. Of the 28 males, 60.7 % were aged 60-64 years, 32% aged 65-69 years, and 7% were aged more than 70. Of the 32 females, 40.6 % were aged 60-64 years, 50% were aged 65-69 years, and 9.4 % were aged more than 70. Mean age of the participants was 64.6 years. Mean height observed was 157.9 cm. Mean weight was 57.7 kg and the mean BMI

was 23.0 kg/m<sup>2</sup>. Mean SBP of the participants at baseline was 127.7 mm Hg and mean DBP was 78.21 mm Hg. (Table 1)

**Table 1: Baseline characteristics of the study population**

Characteristics	Male(n= 28)	Female(n= 32)	Overall(n=60)
Age (years)	64.29 ± 2.17	65 ± 2.10	64.6 ± 2.15
Height (cm)	164.75 ± 6.35	151.9 ± 5.2	157.9 ± 8.64
Weight (kg)	64.03 ± 10.24	52.2 ± 11.0	57.7 ± 12.13
BMI (kg/sq m)	23.58 ± 3.49	22.52 ± 3.95	23.0 ± 3.75
SBP (mm Hg)	129.8 ± 16.8	125.0 ± 20.87	127.27 ± 19.1
DBP (mm Hg)	82.26 ± 8.5	74.7 ± 10.24	78.21 ± 10.2

Values are expressed as Mean ± SD

### Compliance of the participants

Drop out rate was 37% (22 subjects) and was greatest during the first two weeks. Of the 60 subjects, 22 subjects (37%) engaged in three or more sessions of exercise program, while 16 subjects (26 %) participated in one to three exercise sessions during the intervention period. Thus 38 subjects (63 %) engaged in moderate intensity physical activity during the intervention period. (Table 2)

### Changes in Blood Pressure following 10 weeks intervention

Per protocol analysis was done on 38 participants who engaged in physical activity

**Table 3: Changes in Blood pressure after 10 weeks of Intervention among the study participants**

Characteristic	Baseline	Week 10	Difference (95% CI)	p value
<b>Per Protocol Analysis (n=38)</b>				
Mean ± SD SBP (mmHg)	126.89 ± 16.9	122.71 ± 14.4	4.18 ± 4.4 (2.73 to 5.63)	<0.01
Mean ± SD DBP (mm Hg)	77.84 ± 10.5	75.82 ± 9.46	2.02 ± 2.5 (1.20 to 2.84)	<0.01
<b>Intention To Treat Analysis (n=60)</b>				
Mean ± SD SBP (mm Hg)	127.27 ± 19.1	124.08 ± 16.6	3.18 ± 4.3 (2.06 to 4.3)	<0.01
Mean ± SD DBP (mm Hg)	78.21 ± 10.1	76.7 ± 9.2	1.46 ± 2.41 (0.84 to 2.08)	<0.01

**Table 4: Dose-response Relationship between physical activity and blood pressure reduction among the study participants**

Sessions of physical activity	n	Diff. in SBP mmHg (95%CI)	Diff. in DBP mmHg (95%CI)
<10 sessions per week	22	-1.45 (-3.08 to 0.18)	-0.50 (-1.36 to 0.36)
10 to 29 sessions per week	16	-4.0 (-7.15 to -0.84)	-0.93 (-2.19 to 0.31)
≥ 30 sessions per week	22	-4.31 (-5.6 to -2.96)	-2.82 (-3.85 to -1.77)
Total	60	-3.18 (-4.3 to -2.06)	-1.46 (-2.08 to -0.84)

The blood pressure reduction increased with increasing frequency of exercise sessions. In the group with 10-29 sessions, there was a reduction in BP by 4/0.9 mm Hg (95% CI 7.15 to 0.84 mm Hg SBP; 2.19 to -0.31 mm Hg DBP); the BP lowering effect of physical activity was more pronounced in the 37 subjects who performed 30

and completed the intervention. Mean SBP reduced from 126 mm Hg at baseline to 122 mm at the end of 10 weeks intervention, resulting in a significant reduction of 4.18 mm Hg (95% CI 2.73 to 5.63 mm Hg) (p=0.000). Mean DBP reduced from 77 mm Hg at baseline to 75 mm Hg, resulting in a significant reduction of 2.02 mm Hg (95% CI 1.20 to 2.84 mm Hg) (p=0.000).

**Table 2: Participation of the study subjects in the exercise program**

Exercise sessions	Men	Women	Total (%)
<10 sessions /week	10	12	22 (36.7)
10 to 29 sessions/week	7	9	16 (26.7)
≥ 30 sessions /week	11	11	22 (36.7)
Total	28 (46.7)	32 (53.3)	60 (100)

Intention to Treat analysis was done on all 60 participants who were recruited for the intervention. The mean Systolic Blood Pressure reduced from 127 mm Hg at baseline to 124 mm Hg at 10 weeks. A significant reduction of 3.18 mm Hg (95% CI 2.06 to 4.3 mm Hg) was observed (p=0.000). The mean Diastolic Blood Pressure reduced from 78 mm Hg at baseline to 76 mm Hg at 10 weeks. A significant reduction of 1.46 mm Hg (95% CI 0.84 to 2.09 mm Hg) was observed (p=0.000). (Table 3)

or more sessions, where significant reductions of 4.3/2.8 mm Hg was seen (95% CI 5.6 to 2.96 mm Hg SBP; 3.85 to 1.77 mm Hg DBP). It is to be noted that in the 38 subjects who dropped out, the decrease in BP was by 1.45/0.5 mm Hg (95% CI 3.08 to -0.18 mm Hg SBP; 1.36 to -0.36 mm Hg DBP) (Table 4).

## DISCUSSION

The overall results of this study suggest that it is feasible to implement exercise programs for elderly in the community. It also demonstrates that a 10-week controlled aerobic exercise program can influence blood pressure in the individuals aged 60 years and older.

As such community based interventions of physical activity are very few in India much of the literature support for this discussion includes Western studies. The magnitude of BP response across studies varied based on the type of study (original study or meta-analysis), study methods (community or clinic based), participants (free volunteering or paid volunteers), duration of the study (<10 weeks, 10-24 weeks or longer), sample size (small or large), methods of physical activity promotion (individual or group based activity or use of media), type of physical activity (walking, cycling or a combination of cycling, swimming and aerobics), intensities of exercise programs (3, 4 or 5 days per week). Given the wide heterogeneity in study methodologies, it is difficult to compare the effect of the present study with other studies. But, the public health implications of the significant BP reduction observed in this study can be illustrated as follows. The study found that a 10 week program of moderate intensity physical activity resulted in significant blood pressure reduction of approximately 4.18/2.02 mm Hg on per protocol analysis and 3.18/1.46 mm Hg on intention to treat analysis. It has been estimated that a 2 mm Hg downward shift in the entire distribution of SBP is likely to reduce the annual mortality from stroke by 6%, CHD by 4% and all causes by 3%. Studies have observed that the greatest absolute number of strokes occurred in individuals with DBP between 80 and 89 mm Hg.<sup>7</sup> Furthermore, it has been reported that risk of stroke and CHD is directly related to the level of BP throughout the normotensive and hypertensive range.<sup>8</sup> Therefore, the significant reductions in resting SBP and DBP observed in this study have public health importance in prevention of Hypertension and Cardiovascular Diseases among elderly.

A randomized controlled trial in Japan done on 62 men and women aged 60 to 81 years (mean age 67.1 years), living in communities, randomly allocated into an exercise group (n = 32) or a control group (n = 33). The exercise regimen consisted of endurance training and resistance

exercises in a two-hour class conducted at least twice a week for 25 weeks. Physical activity, expressed as total daily energy expenditure, was calculated. This randomized controlled trial indicated that exercise training for elderly was effective in increasing physical activity in daily life.<sup>9</sup> A multi-centric controlled trial (n=268) done to test the feasibility and effectiveness of a nurse-led community exercise program for elderly showed improved physical function, emotional status and broad acceptance.<sup>10</sup>

A community based study done in Philadelphia (n=247) demonstrates that a large-scale training program using cycle ergometers is feasible for elderly adults and that physiologic response can be measured at the end of 16 weeks.<sup>11</sup> The Sendai Silver Center Trial was a randomized trial designed to test the effect of endurance training (using bicycle ergometer) on healthy elderly (aged 60-81). The results show that the participants become younger in aerobic capacity by 5 years after 6 months of exercise training.<sup>12</sup>

Sheldahl et al conclude that the older age group show greater interest in continued participation in a supervised exercise program (with treadmills and cycle ergometers) compared to middle-aged men.<sup>13</sup> Kelley et al used a meta-analytic approach to examine the effects of aerobic exercise for reducing resting SBP and DBP in older adults. Decreases of approximately 2-3 mm Hg in SBP from seven studies (statistically significant, 95% confidence interval [CI] - 4 to -1 mm Hg;) while DBP changes were of -1 to -2 mm Hg (95% CI: -2 to 0 mm Hg).<sup>14</sup>

A significant dose response relationship on change in BP was seen in this study. Similarly, Huang et al conducted a study to determine the efficacy of a 10-week controlled aerobic exercise program on BP in sedentary elderly individuals. Previously sedentary participants aged 75 years and older were randomized to either a control or one of two exercise groups (n=52). Subjects in exercise groups performed aerobic exercise at moderate or high intensity, 3 days per week for 40 minutes per session. The high-intensity exercise group showed a significant reduction in resting systolic BP (-7.8 mmHg) and diastolic BP (-9.6 mmHg). Significant BP decreases for the moderate-intensity exercise group were only observed on diastolic BP (-8.4 mmHg) but not systolic BP (-5.2 mmHg, *P* = 0.25). The data suggest that the lowering effect of a 10-week aerobic exercise program on resting systolic BP may be closely related to the training intensity.<sup>15</sup>

These results imply that the effect of short-term aerobic exercise on lowering SBP among the elderly individuals appears to be related to the training "dose." For a relatively short-term training program, exercise intensity plays an important role and must reach a certain level or threshold so as to elicit a substantial BP reduction for older adults.

Systolic BP has stronger association with risk of cardiovascular and renal disease. The greatest number of strokes occurred in those subjects with a DBP in the upper range of normal (80-89 mmHg). The magnitude of decrease in resting blood pressure in this study is clinically important, contributing to cardiovascular risk factor reduction for older adults and may provide a cost-saving benefit to the community.

Adding life to years, not years to life, is the current agenda for productive and successful aging. Policies and programs on aging need to focus on identifying ways to improve quality of life and health status rather than just extending life span. Although links between diet and exercise and chronic disease risks have been well documented, more needs to be known about motivations for behavioral change and actual benefits in the community setting. Additionally, such interventions have resulted in improvement in quality-of-life measures.

Main strength of this study was the extent of community participation. Such studies on physical activity and health are paramount in addressing the health problems of older adults, and may be helpful in informing government decision making. 'Intention to Treat' analysis employed facilitates an understanding of effectiveness of the intervention. As it was not possible to include a control population, a pre-post intervention design was adopted within available resources. Longer periods of study would be necessary to observe attrition patterns in participation behaviour.

## CONCLUSION

This study has proved the functional feasibility of enabling elderly people to undertake physical activity in a rural Indian community, and the effectiveness of physical activity to significantly reduce mean BP levels in them.

## REFERENCES

1. Central Statistics Office Ministry of Statistics & Programme Implementation Government of India.

1. Situation Analysis of the Elderly in India. June 2011. Available at [http://mospi.nic.in/mospi\\_new/upload/elderly\\_in\\_india.pdf](http://mospi.nic.in/mospi_new/upload/elderly_in_india.pdf). Accessed on 14.08.2012
2. Kumar V, Acanfora M, Hennessy CH, Kalache A. Health status of the rural elderly. *J Rural Hlth*, 2001;17(4):328-31.
3. WHO: Diet, Nutrition and the Prevention of chronic diseases. Report of a Joint FAO/WHO Expert Consultation; World Health Organisation: Geneva 2003.(Technical Report Series No. 916)
4. Newson RS, Kemps EB. Factors that promote and prevent exercise engagement in older adults. *J Aging Health*. 2007;19(3):470-81
5. Cooper AR, Moore LAR, McKenna J, Riddoch CJ. What is the magnitude of blood pressure response to a programme of moderate intensity exercise? Randomised controlled trial among sedentary adults with unmedicated hypertension. *Br J Gen Pract*. 2000; 50:958-962.
6. Kiyonaga A, Arakawa A, Tanaka H, Shindo M. Blood pressure and hormonal responses to aerobic exercise. *Hypertension*. 1985; 7: 125-131.
7. MacMahon S, Rodgers A. Blood pressure, antihypertensive treatment and stroke risk. *J Hypertens*. 1994; 12:S5-S14.
8. MacMahon S, Peto R, Cutler J et al. Blood pressure, stroke, and coronary heart disease. Part 1: Prolonged differences in blood pressure: Prospective observational studies corrected for the regression dilution bias. *Lancet*. 1990; 335:765-774.
9. Fujita K, Nagatomi R, Hozawa A, Ohkubo T, Sato K, Anzai Y, Sauvaget C, Watanabe Y, Tamagawa A, Tsuji I. Effects of exercise training on physical activity in older people: a randomized controlled trial. *J Epidemiol*. 2003;13(2):120-6
10. Inokuchi S, Matsusaka N, Hayashi T, Shindo H. Feasibility and effectiveness of a nurse-led community exercise programme for prevention of falls among frail elderly people: a multi-centre controlled trial. *J Rehabil Med*. 2007;39(6):479-85
11. Posner JD, Gorman KM, Windsor-Landsberg L, Larsen J, Bleiman M, Shaw C, Rosenberg B, Knebl J. Low to moderate intensity endurance training in healthy older adults: physiological responses after four months. *J Am Geriatr Soc*. 1992;40(1):1-7
12. Tsuji I, Tamagawa A, Nagatomi R, Irie N, Ohkubo T, Saito M, Fujita K, Ogawa K, Sauvaget C, Anzai Y, Hozawa A, Watanabe Y, Sato A, Ohmori H, Hisamichi S. Randomized controlled trial of exercise training for older people (Sendai Silver Center Trial; SSCT): study design and primary outcome. *J Epidemiol*. 2000;10(1):55-64
13. Sheldahl LM, Tristani FE, Hastings JE, Wenzler RB, Levandoski SG. Comparison of adaptations and compliance to exercise training between middle-aged and older men. *J Am Geriatr Soc*. 1993; 41(8):795-801
14. Kelley GA, Kelley KS. Aerobic Exercise and Resting Blood Pressure in Older Adults: A Meta-analytic Review of Randomized Controlled Trials. *J Gerontology*. 2001; 56A(5): M298-M303
15. Huang G, Thompson CJ, Osness WH. Influence of a 10-Week Controlled Exercise Program on Resting Blood Pressure in Sedentary Older Adults. *J Applied Res*. 2006; 6(3):188-195.