Original Article

Effectiveness of a multimodal intervention in promoting physical activity among sedentary elderly population in socially and economically constrained settings - A quasi-experimental study

Jyothi Vasudevan[1], Lalithambigai Chellamuthu[1], Swarnalatha RS[1], Meena Ramanathan[2]

[1]Department of Community Medicine, Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth, Puducherry, India, [2]Departement of Yoga Therapy, Institute of Salutogenesis and Complementary Medicine, Sri Balaji Vidyapeeth, Puducherry, India

Abstract

Introduction: Aging is becoming a major challenge for policymakers. Regular exercise helps keep elderly people mobile, enhances physical and mental abilities, and to some extent delays the effects of chronic illnesses. **Objectives:** To evaluate the effectiveness of a multimodal intervention to increase physical activity levels among sedentary elderly living in socially and economically constrained settings. **Materials and Methods:** A quasi-experimental study was conducted in selected old age homes in Puducherry, South India in 2022 for 3 months. Individuals aged ≥60 years, both genders residing in selected old-age homes were included through convenience sampling. The sample size was 36 subjects per arm [three arms namely E1, E2 (intervention arms), and C (control arm)]. Baseline data collection on physical activity was collected using a semi-structured questionnaire in all three arms. The intervention arms (E1 and E2) received a multimodal intervention to promote physical activity. In addition, E1 arms were instructed to perform exercises with an "exercise partner" and to maintain a daily log. At the end of 8 weeks, follow-up data collection was done using the same questionnaire in all three arms. Data entry was done by MS Excel 2010 and analysis using SPSS version 21. **Results:** The mean (SD) of the days of physical activity per week and time of physical activity per day before and after the intervention among E1 and E2 were compared using paired t-tests. The difference between pre- and post-intervention was found to be statistically significant, that is, *P* value <0.05 in both the groups, thereby proving the effectiveness of the intervention. The difference between the three groups was found to be statistically significant, that is, *P* value <0.05. **Conclusion:** This multimodal intervention is found to be effective in increasing the physical activity of the participants in the interventional arms. Furthermore, having an exercise partner was found to be beneficial in ensuring motivation and compliance to carry out physical activity among the elderly living in socially and economically constrained settings.

Keywords: Elderly population, multimodal intervention, physical activity, quasi-experimental study, sedentary

Address for correspondence: Dr. Lalithambigai Chellamuthu, Department of Community Medicine, Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth, Puducherry - 607 402, India.
E-mail: lalli.muthu@gmail.com

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Introduction

The world is undergoing a longevity revolution with an increase in the number of elderly population that has been estimated

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to become twice, reaching around 1.5 billion in 2050.[1] India is home to 1.38 billion older persons and is projected to increase by nearly 20% in 2050 from the current level.[2] Population ageing is becoming a major challenge for policymakers globally, and the central concern is whether the added time comprises healthy and a good quality of life. Regular exercise helps keep elderly people mobile, enhances physical and mental abilities, and to some extent delays the effects of chronic illnesses.[3] Older adults have frequent contact with the primary healthcare system to treat their existing chronic conditions and prevent emergence of new ones. The elderly individuals aged 65 to 74 years and ≥75 years on an average make 6.5 and 7.7 physician consultations per year, respectively. Around 45% of these visits were to primary healthcare physicians who provides them an opportunity to encourage adoption and maintenance of a healthy diet and physical activity.[3] Despite the advice given by primary care physicians to all older adults during each consultation regarding the potential benefits of engaging in physical activities and a healthy diet, physical inactivity remains pervasive among elderly, especially those residing in less affluent neighborhoods and in old-age homes.[4] It is the duty of local health authorities and primary care providers to encourage physical activity amongst the older people in socially and economically constrained settings like old-age homes, and to frequently monitor and motivate them for sustained adherence, but accomplishing this in a resource-poor country like India is a formidable task.[5-7]

In India, the Government has taken the right steps in promoting physical activity and yoga by establishing health and wellness centers at a primary healthcare level for a holistic approach to promote health.[8] Another commendable step by the Indian government toward promoting physical activity is the "Fit India movement" to promote physical activity among citizens. Physical activity guidelines are also prescribed for all ages from 5 years to >65 years which also advocate yoga practice for a healthy living.[9] On the other hand, frequent monitoring and motivation of individuals to follow the prescribed regimens is a paramount challenge due to lack of resources and adequate peripheral health workers in a country like ours.

Keeping in mind the current scenario of increasing age of the population and the need to promote physical activity and monitor the compliance in the background of inadequate resources, we have designed this quasi-experimental study to assess the effectiveness of a multimodal intervention and the effect of peer support through "exercise partner" in ensuring compliance to physical activity interventions among sedentary elderly in resource poor settings. Thus, this study is of special relevance due to the current lacunae of knowledge on effective interventional methods to promote physical activity at the population level among elderly individuals living in constrained settings. In addition, the primary healthcare physicians can adopt and implement this multimodal intervention in future to motivate their elderly patients for being more physically active.

Materials and Methods

A three-arm quasi-experimental study was conducted over a period of 3 months from January 20th to March 20th 2022 in Puducherry, South India among selected old-age homes after obtaining prior permission from the administrative authorities. Sedentary elderly individuals (aged ≥60 years, both genders) residing in selected old-age homes in Puducherry for at least a year, willing to participate in the study and were eligible after assessment with the long form of the International Physical Activity Questionnaire (IPAQ) and the Physical Activity Readiness Questionnaire (PARQ) were included in the current research. Elderly individuals with psychiatric illness, pre-existing physical conditions which prevent mobility, cognition problems, Alzheimer's disease, or any other condition preventing their effective participation in the study were excluded. Assuming the baseline prevalence of adequate physical activity as 10% and aiming for a 30% improvement after the intervention, the sample size was calculated using the formula for experimental studies[10] $n = \frac{2(Z_{\frac{(1-\alpha)}{2}} + Z_{(1-\beta)})^2 \times p \times q}{(p_1 - p_2)^2}$ [considering prevalence before intervention as 10%, prevalence after intervention as 40% and 10% attrition rate], the minimum required sample size was computed to be 36 per arm.

Convenience sampling was employed to select the old-age homes in the study setting. The elderly individuals from the selected old-age homes were first screened with International Physical Activity Questionnaire (IPAQ) to assess their activity level.[11,12] Only those who met the criteria for sedentary/low physical activities were chosen and were administered with Physical Activity Readiness Questionnaire (PARQ) to assess their capability to do physical activities.[13] Only those who cleared the PARQ were considered for the study. The participants were then assigned to three arms namely E1, E2 (intervention arms), and C (control arm)].

Baseline data collection on physical activity was collected using a semi-structured questionnaire in all three arms. The intervention arms (E1 and E2) received a multimodal intervention which comprised of an interactive health education session to create awareness regarding the benefits of physical activity and advice to walk at a pace which is comfortable for the elderly individual, for at least 30 minutes a day, in a single stretch or in two sessions of 15 minutes each; demonstration of simple exercises including breathing exercises or pranayama (designed to improve balance and posture for elderly to be done for 10 minutes every day for at least 5 days in a week) by the primary investigator under the guidance of a certified yoga therapist; distribution of pamphlets detailing the exercises to be done in a pictorial manner for easy understanding by the elderly. In addition, interventional arm E1 was instructed to do the exercises with an "exercise partner" who would be a resident of the same old age home where the selected eligible person resides. Meanwhile, the interventional arm E2 was instructed to practice the exercises individually by themselves (without an "exercise partner") whereas the control arm C had no intervention. E1 and E2 arms were requested to maintain a daily diary to document

the adherence to exercise regimens as prescribed. The diary was provided to the participants along with stickers to document the completion of the prescribed physical activity on a daily basis. At the end of 8 weeks, follow-up data were collected using the same semi-structured questionnaire in all three arms.

The data entry was performed using MS Excel 2010 and analysis was done by SPSS version 21. Descriptive data was represented as mean ± SD or median (IQR) for numerical variables. Percentages and proportions were used for categorical variables. Paired t- test was applied to find difference between pre- and post-intervention in E1 and E2 arms. The mean (SD) of the days and time duration of physical activity per week and per day, respectively, collected during the follow-up data collection was compared between the three arms using a one-way ANOVA test followed by post-hoc analysis (Fischer's Least Significant Difference – LSD).

Written informed consent was sought from all participants. All the participants were informed about the need and purpose of the study and their cooperation was sought. Ethical clearance for the study was obtained from the Institutional Ethical Committee (Ref. no. MGMCRI/IRC/03/2020/81/IHEC/219).

Results

The mean age of the study participants was 73.16 (5.32) years and the mean duration of stay in an old-age home was found to be 3.37 (1.73) years. The socio-demographic profile of the subjects in the three arms (intervention arm with exercise partners, intervention arm without exercise partners, and control arm) has been illustrated in Table 1.

Figure 1 shows that about 16 (42.1%), 19 (44%), and 19 (44%) of the participants in the interventional group with an exercise partner, without an exercise partner and the control group had no comorbidities, respectively. Diabetes mellitus was witnessed to be the most common comorbidity among the participants in all three arms.

Figure 2 illustrates that about 24 (63.2%), 24 (55%) and 20 (46.5%) participants had normal BMI in the interventional group with an exercise partner, the interventional group without an exercise partner and the control group, respectively, whereas, 7 (18.4%), 5 (13.2%) and 9 (20.9%) were underweight in the interventional group with an exercise partner, the interventional group without an exercise partner and the control group, respectively.

On an average, the participants in the intervention arm with "exercise partners" were engaged in physical activity for 2.26 (1.13) days in a week with 14.61 (4.70) minutes per day before intervention which improved to 3.55 (1.17) days in a week with 18.16 (5.74) minutes per day after intervention.

Amongst the intervention arm without exercise partners, the subjects were engaged in physical activity for 2.26 (1.13) days in a week with 13.95 (4.01) minutes per day before intervention which improved to 3.05 (1.32) days in a week with 17.36 (5.38) minutes per day after intervention.

In the control arm, the individuals were engaged in physical activity for 2.26 (1.13) days in a week with 13.95 (4.01) minutes per day during baseline data collection while the follow-up data

Table 1: Socio-demographic profile of the participants

Socio-demographic profile of the participants in each group	Intervention arm with partners *n*=38 (%)	Intervention arm without partners *n*=43 (%)	Control arm *n*=43 (%)
Age group (in years)			
60–70	15 (39.5)	17 (39.5)	13 (30.2)
71–80	18 (47.4)	21 (49)	25 (58.1)
81–90	5 (13.2)	5 (11.5)	5 (11.6)
Gender			
Female	18 (47.4)	22 (51.2)	23 (53.5)
Male	20 (52.6)	21 (48.8)	20 (46.5)
Education			
Illiterate	11 (29)	15 (34.9)	15 (34.9)
Literate (Primary school level)	27 (71)	28 (65.1)	28 (65.1)
Occupation (in the past)			
Coolie	3 (7.9)	4 (9.3)	4 (9.3)
Factory worker	4 (10.5)	3 (7.0)	3 (7.0)
Farmer	9 (23.7)	9 (20.9)	6 (14.0)
Housewife	15 (39.5)	17 (39.5)	17 (39.5)
Laborer	6 (15.8)	8 (18.6)	11 (25.6)
Mason	1 (2.6)	2 (4.7)	2 (4.7)
Duration of stay in old age home (in years)			
1–2	21 (55.27)	19 (44.2)	19 (44.2)
3–4	10 (26.31)	13 (30.2)	13 (30.2)
5–6	7 (18.42)	9 (21)	9 (21)
7–8	0 (0)	2 (4.6)	2 (4.6)

showed that the mean days of physical activity in a week to be 2.3 (1.03) with 14.19 (4.2) minutes per day.

The mean (SD) of the days of physical activity per week and time of physical activity per day before and after the multimodal intervention in E1 and E2 arms were compared using paired t-tests. The difference between pre- and post-intervention was found to be statistically significant, that is, *P* value <0.05 [Table 2].

The mean (SD) of the days and time duration of physical activity per week and per day respectively collected during the follow-up data collection was compared between the three arms using the one-way ANOVA test. The difference between the three arms was found to be statistically significant, that is, *P* value <0.05 [Table 3].

The *post hoc* analysis (Fischer's Least Significant Difference – LSD) was performed after running the one-way ANOVA test and it was noted that the intervention arm "with exercise partner" (E1) showed a significant difference in the number of days and time duration of physical activity per week and per day, respectively, among all three arms [Table 4].

Discussion

In the present research, the mean age was 73.16 (5.32) years and an equal proportion (50%) of both genders were included. Diabetes mellitus was witnessed to be the most common comorbidity among the participants in all three arms. Around half of the subjects had a normal body mass index. A cluster randomized controlled trial from Taiwan cited that the mean

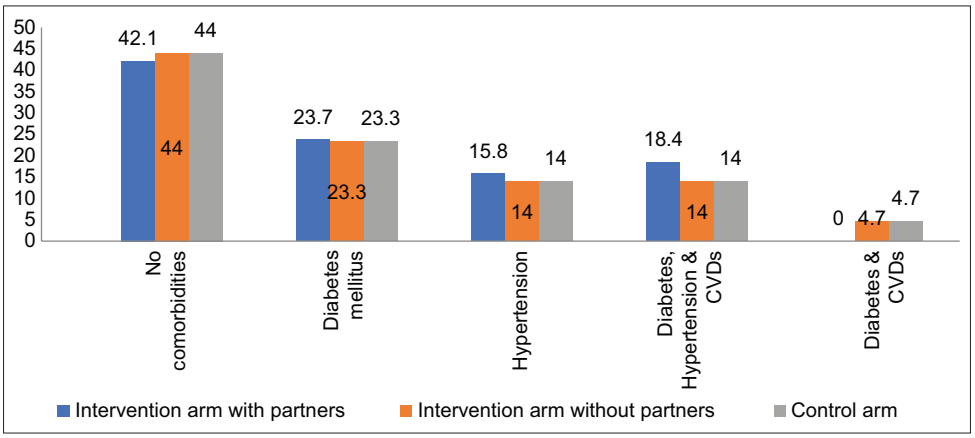

Figure 1: Distribution of participants based on their comorbidities

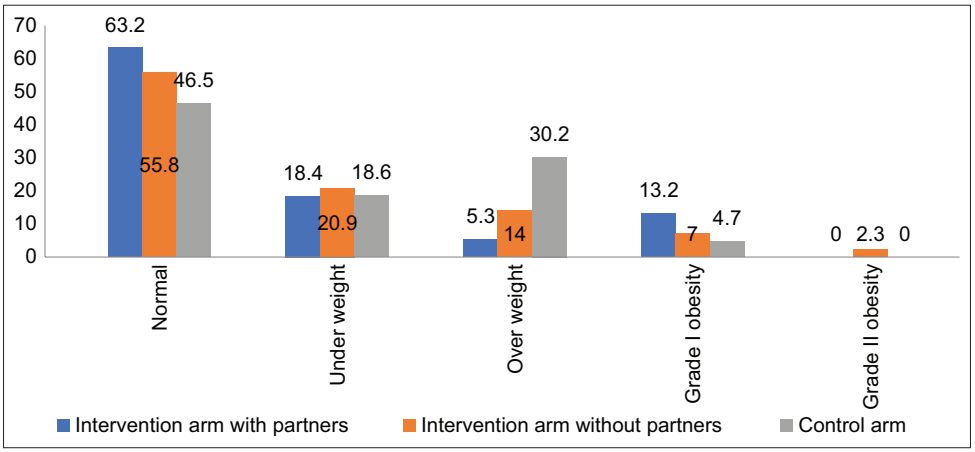

Figure 2: Distribution of participants based on their body mass index

Table 2: Paired *t*-test result for intervention arms

Parameters	Before intervention (Mean±SD)	After intervention (Mean±SD)	Mean difference	*P* (Paired *t*-test)
Days of physical activity per week among intervention arm with exercise partner	2.26±1.13	3.55±1.17	−1.289	0.001*
Time duration of physical activity per day among intervention arm with exercise partner	14.61±4.70	18.1 6±5.74	−3.553	0.001*
Days of physical activity per week among intervention arm without exercise partner	2.26±1.13	3.05±1.32	−0.791	0.001*
Time duration of physical activity per day among intervention arm without exercise partner	13.95±4.01	17.56±5.38	−3.605	0.001*

*$P<0.05$ is considered to be statistically significant

Table 3: One-way ANOVA results for days and time duration of physical activity among three arms

Parameters	Intervention arm with an exercise partner (Mean±SD)	Intervention arm without an exercise partner (Mean±SD)	Control arm (Mean±SD)	*P* (One-way ANOVA)
Days of physical activity per week	3.55±1.17	3.04±1.32	2.30±1.03	0.001*
Time duration of physical activity per day	18.15±5.74	17.55±5.38	14.18±4.21	0.001*

*P<0.05 is considered to be statistically significant

Table 4: Post-hoc analysis for days and time duration of physical activity among three arms.

Parameters	Intervention arm with an exercise partner Vs Intervention arm without a partner		Intervention arm with an exercise partner Vs Control arm		Intervention arm without a partner Vs Control arm	
	Mean difference	*P*	Mean difference	*P*	Mean difference	*P*
Days of physical activity per week	0.50	0.058	1.25*	0.001	0.74*	0.004
Time duration of physical activity per day	0.59	0.601	3.97*	0.001	3.37*	0.003

*The mean difference is significant at *P*<0.05

age of the study participants was 67.55 (7.86) years, 70.1% were females, and 37.7% had hypertension.[14]

The results of this study showed that there was an improvement in performing physical activity by participants in all three arms with respect to the number of days per week and time duration per day in the follow-up data collection. Further, the difference between pre- and post-intervention based on the mean (SD) of the days of physical activity per week, and time duration of physical activity per day in E1 and E2 arms was found to be statistically significant. These findings were consistent with a systematic review of initiatives to encourage physical activity in older people among community dwellers. In the review, it was found that interventions were generally effective but it was unclear which aspects of the intervention would be most helpful. There were indications that older persons may benefit more from motivators that are more personal to them, such as peer and environmental support and enjoyment from physical activity, rather than solely cognitive techniques and behavior and communication therapy. According to the article's findings, a whole system-oriented strategy is necessary that is tailored to older individuals' requirements and in line with social, individual, and environmental aspects.[15]

In the current research, the post-intervention data illustrated that the difference in mean (SD) of the days and time duration of physical activity per week and per day, respectively, between the three arms was found to be statistically significant. Moreover, it was noted that the intervention arm "with exercise partner" (E1) showed a significant difference in the number of days and time duration of physical activity per week and per day, respectively, among all three arms. These findings were parallel to findings from Oliveria JS *et al.,* suggesting that health coaching had a small but statistically significant improvement in the physical activity patterns of the elderly study subjects.[16] Similar findings were also observed in other studies.[6,7]

The strength of the study could be that it was an interventional study carried out in the elderly and compared between three groups to know the effectiveness of a multimodal intervention to increase physical activity levels among sedentary elderly which is especially relevant in the current scenario of increasing the lifespan of the world's population. In addition, the study was held among elderly living in socially and economically constrained settings and hence will be useful to adopt these strategies in other developing countries to promote physical activity even in the general population.

The limitation of the study could be a short follow-up period (8 weeks after intervention). Hence, the long-term effectiveness of the multimodal intervention could not be assessed as the data collection and follow-up period in the study was conceivably affected by the COVID-19 pandemic.

Conclusion

To our knowledge, this is one of the very few interventional studies in India conducted at the community level among sedentary elderly to employ peer support as a component to improve adherence to a prescribed physical activity regimen. The multimodal intervention used in this study included an interactive health education session; demonstration of simple exercises including breathing exercises or pranayama; and distribution of pictorial pamphlets detailing the exercises. This multimodal intervention has been found to be effective in increasing the physical activity of the participants in the interventional arms. Furthermore, having an exercise partner was found to be beneficial in ensuring motivation and compliance to carry out physical activity among the elderly living in socially and economically constrained settings.

This study can be replicated at the community level to know the usefulness among all age groups so that it can be a strategy for improving physical activity levels in similar settings. Primary healthcare physicians can adopt and implement this multimodal intervention in future to motivate their elderly patients for being more physically active. Further, in future the study could be organized to include a larger number of samples and a longer follow-up period of at least 6 months to assess the physiological benefits of the multimodal intervention and also to know the

effectiveness of having an exercise partner to ensure long-term compliance.

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Conflicts of interest

There are no conflicts of interest.

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