

Effect of Stretching and Strengthening Exercises on Mobility among the Elderly

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ABSTRACT

Aim: Ageing is associated with a decline in many body functions; it is accompanied by a physiological change in the muscles, bones and joints that affect mobility and which can ultimately affect the independence of older people mobility. The present study was conducted to evaluate the effect of stretching and strengthening exercises on mobility among the elderly.

Material and Method: A true experimental study included 140 elderly participants from the five different old age homes in Puducherry using a stratified random sampling technique and then randomized into the interventional group (N=70) and control group(N=70). The demographic and clinical variables were collected at the baseline and also the mobility level was assessed using the Timed Get Up and Go Test (TUG) and 6-minute walk test (6MWT). The interventional group participants have received the stretching and strengthening exercises for 3 months but the control group participants received the routine care. The posttest was conducted after 3 months of intervention. The collected data were compiled and analyzed using descriptive and inferential statistics.

Result: The pretest mean TUG score was 17.07sec and 16.53sec in the interventional and control groups, respectively. Regarding the mean 6MWT distance was 305.80m and 324m in the interventional and control group, respectively. After an intervention, the mean TUG score was 14.84sec in the interventional group and 17.06 sec in the control group which was statistically significant at $p < 0.05$ level. Besides, the mean 6MWT distance of the

interventional group was 419.03m but in the control group, it was 300.40m which was significant at $p < 0.001$ level.

Conclusion: The above findings indicated that stretching and strengthening exercises were very effective in decreasing the TUG score and increasing the 6MWT distance score among the interventional group participants when compared to the control group participants.

Keywords: Elderly, mobility, stretching exercise, strengthening exercise, timed up and go test, 6 minutes walk test.

INTRODUCTION

The world continues to experience an unprecedented and sustained change in the old age population, driven by increasing life expectancy and decreasing fertility. According to a United Nations report, 727 million persons were aged 65 years or over in 2020¹. Ageing is a natural process; the decline in organ function is unstoppable². This process results in increased chronic illness and disability which leads to a decline in the ability to perform day-to-day tasks necessary to live independently. Mobility is prime important for maintaining independence in old age but age-related changes, co-morbidity, individual vulnerabilities, and environmental barriers may increase the risk of mobility decline.

Mobility refers to one's ability to move himself or herself independently and safely from one place to another to meet one daily needs³. Mobility limitations can physically hinder elderly people from

spending their time doing activities of daily living and other social activities which lead to social isolation, depression and declining health. Ageing generally makes a person less physically active than younger adults. Poor health, pain, and injury were found to be the reasons for not practicing regular exercise.

Mobility limitations have been linked with increased risk of fall, disability, hospitalization, and mortality risk as well as decreased quality of life next to declining function. A low level of physical activity has been associated with sarcopenia⁴ and mobility limitations among older people^{5,6}. Research findings show that 10 weeks of lower limb stretching exercise was very effective in improving balance and decreasing falls among the elderly people⁷ and also another study recommends 150 minutes of physical activity per week especially walking and muscle strengthening exercises were found to be effective in improving the functional mobility of the older people⁸.

NEED FOR THE STUDY

India is ageing much faster than previously thought and may have nearly 20% population of 60 years and above by 2050⁹. Ageing produces many changes in the musculoskeletal system such as loss of muscle mass, strength, bone density, physical activity and also have muscle soreness, loss of tendons elasticity, and decreased range of motion in joints which affects its flexibility leading to joint stiffness. All these changes affect not only mobility but also compromise their activities of daily living.

Active lifestyle plays an important role in preventing mobility limitation. Use it or lose it is true for mobility in old age which means the elderly those who are practice regular physical activity have good mobility than those who haven't practice. Exercise is one of the best medicines to slow down or prevent many age-related health issues of muscles, joints, and bones. A stretching and strengthening exercise

training helps elderly people to maintain strength, balance, and flexibility which make the bones stay stronger and also promote muscle mass.

Stretching is another excellent way to maintain joint flexibility. Chronic stretching exercise increases the range of motion, flexibility, balance, gait, and mobility of older people (Gama H .S. 2018)¹⁰. Ishak, Zahari and Justine (2016) reported that the strengthening exercise was very beneficial for reducing pain intensity, disability, and improved functional performances for the elderly with low back pain¹¹. Many research evidence shows that exercise intervention, counseling, and education were effective in improving muscle strength thereby preventing mobility decline among old age. With this background, an attempt was made to evaluate the effectiveness of stretching and strengthening exercises on mobility among the elderly and also to associate the pretest level of mobility with selected demographical variables.

MATERIALS & METHODS

A true experimental study was carried out to evaluate the effectiveness of stretching and strengthening exercises on mobility among the elderly people residing at old age homes of Puducherry. A total of 140 elderly participants aged between 60 and 74 years were selected from the five different old age homes in Puducherry using a stratified random sampling technique and randomized into the interventional group (N=70) and control group(N=70). The investigator established rapport with study participants. Then, the researcher explained the purposes of the study and obtained informed written consent after gaining their confidence and cooperation. The demographic and clinical variables were collected at the baseline and also the mobility level was assessed using the Timed Get Up and Go Test (TUG) and 6-minute walk test (6MWT). The interventional group participants have received the stretching and strengthening exercises. The physiotherapist

and Investigator taught exercises to the participants for about 30 minutes which included 5 minutes of warm-up, 20 minutes of stretching and strengthening exercises and 5 minutes of cool down. The subjects were asked to practice the exercises under the supervision of the investigator. The subjects were asked to practice these exercises daily for 30 minutes x 5 days/week for 3 months, but the control group received the routine treatment. The posttest level of mobility was assessed after 3 months of intervention for both groups. The collected data were compiled and analyzed using descriptive and inferential statistics.

RESULT

Demographic Variables of the study participants

The present study revealed that 44.29% belonged to the age group of 66 to 70 years, 67.14% were female, 48.57% were married, and 81.43% were Hindus. As per literacy status, it was observed that 40% of the elderly had no formal education, 45.72% were residing in old age homes for 1–5 years, 92.86% were non-vegetarian, and 37.14% were engaged themselves in the household work in the interventional group. Whereas, the control group showed that 38.57% belonged to the age group of 66 to 70 years, 61.43% were female, 48.57% were married, and 71.43% were Hindus. As per literacy status, it was observed that 24.29% had no formal education, 52.86% were residing in old age homes for 1 – 5 years,

92.86% were non-vegetarian, and 30% were engaged themselves in the household work.

Clinical Variables of the study participants

Nearly half of the elderly (51.43%) had a normal body built, 70% had normal hearing, 29% had lost their weight, 21.43% had less than ≤ 5 numbers of teeth, 28.57% had loose teeth and 10% were used denture. About 24.29% were able to recall three objects in 5 minutes, 50 % had restricted range of motion, 42.86% of them found much difficulty in climbing 10 steps or walking one-quarter of a mile and 22.85 % were unable to walk one-quarter of a mile or climb 10- step. Also, 67.14% had co-morbidities and 48.57% had taken both Tab. Calcium and Multivitamin supplementation in the interventional group. Whereas in the control group 64.29% of them had a normal body built, 40% had hard of hearing, 27.14% had lost their weight, 32.86 % had ≤ 5 numbers of teeth, 34.29% had loose teeth and 4.29% were used denture. About 30% were able to recall three objects in 5 minutes, 42.86 % had restricted range of motion, 27.14% of them found much difficulty in climbing 10 steps or walking one-quarter of a mile, and 21.43% were unable to walk one-quarter of a mile or climb 10- step and also, 75.71% had co-morbidities and 51.43% had taken both Tab. Calcium and Multivitamin supplementation in the control group.

Table 1. Distribution of level of TUG & 6MWT (Mobility) scores of the participants in both the interventional group and control group before intervention, N=140

| Mobility assessment | Score | Groups | | | | χ^2 | P value |
|---------------------|------------------------------|-----------------------|-------|----------------|-------|----------|-----------|
| | | Interventional (N=70) | | Control (N=70) | | | |
| | | n | % | n | % | | |
| TUG | Normal mobility (<10 Sec) | 26 | 37.14 | 30 | 42.86 | 0.58 | 0.75 (NS) |
| | Better mobility (<20 Sec) | 26 | 37.14 | 25 | 35.71 | | |
| | Mobility problem (20-30 Sec) | 18 | 25.72 | 15 | 21.43 | | |
| | Total | 70 | 100 | 70 | 100 | | |
| 6MWT | Walked 6 Minutes | 37 | 52.86 | 40 | 57.14 | 0.91 | 0.64 (NS) |
| | Walked 3–5 Minutes | 23 | 32.86 | 18 | 25.72 | | |
| | Walked 1–2 Minutes | 10 | 14.28 | 12 | 17.14 | | |
| | Total | 70 | 100 | 70 | 100 | | |

NS -Non Significant

Table 1 illustrates that 37.14% of the subjects had normal TUG score, 37.14% of them had better mobility and they could go

out alone without gait aids, and 25.72% of them had mobility problem and they were unable to go outside alone, they required

gait aids for their mobility in the interventional group. Whereas in the control group, 42.86% had normal mobility, 35.71% had better mobility, and 21.43% had mobility problems. A score of > 14 indicated a high risk of falls in the subjects. Similarly, 6MWT score, 52.86% of them had completed the 6MWT, 32.86% were able to walk for 3-5 minutes and 14.28% had walking difficulty and they were unable to walk for more than 1-2 minutes.

Whereas, in the control group 57.14%, 25.72%, and 17.14% were able to walk 6 minutes, 3–5 Minutes, and 1–2 Minutes respectively. The Chi-square analysis revealed that there was no significant difference between the interventional group and control group during the pretest. Therefore both the groups were identical and comparable in terms of TUG and 6MWT during the pretest.

Table 2. Distribution of level of TUG & 6MWT (Mobility) scores of the participants in both the interventional and control groups after the intervention, N=140

| Mobility assessment | Score | Groups | | | | χ^2 | p value |
|---------------------|-----------------------------|-----------------------|-------|----------------|-------|----------|----------------------|
| | | Interventional (N=70) | | Control (N=70) | | | |
| | | N | % | N | % | | |
| TUG | Normal mobility (<10 Sec) | 36 | 51.43 | 25 | 35.71 | 6.17 | 0.05* (s) |
| | Better mobility (<20 Sec) | 27 | 38.57 | 28 | 40.00 | | |
| | Mobility Problem (20-30Sec) | 7 | 10.00 | 17 | 24.29 | | |
| | Total | 70 | 100 | 70 | 100 | | |
| 6MWT | Walked 6 Minutes | 48 | 68.57 | 34 | 44.29 | 9.77 | 0.01** (s) |
| | Walked 3–5 Minutes | 17 | 24.29 | 18 | 25.71 | | |
| | Walked 1–2 Minutes | 5 | 7.14 | 18 | 24.29 | | |
| | Total | 70 | 100 | 70 | 100 | | |

** S- Significant at p< 0.01 level * S- Significant at p< 0.05 level NS -Non Significant

Table 2 shows 51.43% of the participants had normal TUG score and 38.57% had better mobility in meeting their daily routine and 10% had mobility problems in the interventional group (p <0.05). Whereas in the control group 35.71% had a normal TUG score, 40% had better mobility and 24.29% had mobility problems doesn't show any significant difference. Similarly, 68.57% had completed 6MWT, 27.14% were walked for 3-5 minutes and 7.14% had walking difficulty and they were unable to walk for

more than 1-2 minutes in the interventional group (p<0.01). Whereas, in the control group 44.29%, 25.71%, and 24.29% were able to walk for about 6 minutes, 3–5 Minutes, and 1–2 Minutes, respectively. The results inferred that there was a significant reduction in the posttest TUG score and improvement in 6MWT distance in the interventional group which indicated that Stretching and Strengthening exercises were effective in improving the mobility level of the participants.

Table 3. Comparison of the mean mobility scores (TUG & 6MWT) among the participants in both the groups before and after the intervention, N=140

| Mobility | Assessment | Groups | | | | MD | Student independent t-test | p value |
|----------|------------|-----------------------|--------|----------------|--------|--------|----------------------------|---------------------|
| | | Interventional (N=70) | | Control (N=70) | | | | |
| | | Mean | SD | Mean | SD | | | |
| TUG | Pretest | 17.07 | 7.07 | 16.53 | 6.85 | 0.54 | 0.46 | 0.65(NS) |
| | Posttest | 14.84 | 4.44 | 17.06 | 6.44 | 2.02 | 2.36 | 0.05*(S) |
| 6MWT | Pretest | 305.80 | 121.43 | 324.24 | 126.46 | 18.44 | 0.88 | 0.38(NS) |
| | Posttest | 419.03 | 72.87 | 300.40 | 115.87 | 118.63 | 7.25 | 0.001****(S) |

***S- Highly Significant at p< 0.001 level & p< 0.05 level NS -Non Significant

Table 3 shows the comparison of the mean Mobility (TUG & 6MWT) scores among the participants in both the interventional and control groups before and after the intervention. In the pretest, the mean TUG score of the interventional group was 17.07sec, and the control group was

16.53sec. After stretching and strengthening exercises the mean TUG score decreased to 14.84sec in the interventional group but in the control group, it was increased to 17.06 sec. The Independent student t-test revealed that there was a significant difference between interventional and control groups

on the TUG score at $p < 0.05$ level. Regarding the 6MWT, the mean score of the interventional group was 305.80 meters and in the control group, it was 324m. After the exercise session, the mean 6MWT distance score increased to 419.03m but in the control group, it was found to be decreased to 300.40 m which was statistically significant at $p < 0.001$ level. Therefore it was evident that stretching and strengthening exercises were very effective in decreasing the TUG score and increasing the 6MWT distance score among the interventional group participants when compared to the control group participants.

Association between pretest TUG score and demographic and clinical variables

The demographical variables such as age and duration of stay at old age home had shown a statistically significant association with the pretest TUG score in the interventional group but no significant association was found in the control group. Besides, the clinical variables like ROM and self-reported walking difficulties in both the groups and hearing in the control group had shown a significant association with the TUG score.

Association between pretest 6MWT score and demographic and clinical variables

The demographical variables such as age and duration of stay at old age home had shown statistically significant associations with the 6MWT score in the interventional group whereas, in the control group, age and leisure activities had shown a significant association with 6MWT. Related to clinical variables, self-reported walking difficulties in both the groups and hearing and range of motion in the control group were shown a statistically significant association with 6MWT distance.

DISCUSSION

The present study revealed that 37.14% of the elderly had normal TUG scores, 37.14% had better mobility and 25.72% had mobility problems in the

interventional group. Whereas in the control group, 42.86% had normal, 35.71% better mobility and 21.43% had mobility problems. In relation to 6MWT, 52.86% had completed the 6MWT, 32.86% were able to walk for 3-5 minutes and 14.28% had walking difficulty and they were unable to walk for more than 1-2 minutes. Similarly, in the control group 57.14%, 25.72%, and 17.14% were able to walk 6 minutes, 3–5 Minutes, and 1–2 Minutes, respectively in the pretest. The study findings were supported by Singh, et al., (2017)¹² that women had more difficulty in walking short and long distances compared to men of Telangana state and also found poor mobility in both genders. Whereas, Yeom, et al. (2015)¹³ reported that 90% of the study participants had impaired mobility, and also the mean 6MWT distance was 212.68 meters. Low incomes, sedentary lifestyles of elderly subjects were found to be high-risk for mobility limitation.

The present study observed that after 3 months of stretching and strengthening exercises 51.43% of the elderly participants had normal TUG score and 38.57% had good mobility in meeting their daily routine and 10% had mobility problems in the interventional group ($p < 0.05$). Whereas in the control group 35.71% had a normal TUG score, 40% had good mobility and 24.29% had mobility problems doesn't show any significant difference. Similarly, after 3 months of stretching and strengthening exercises, 68.57% had completed the 6MWT, 27.14% were able to walk for about 3-5 minutes and 7.14% had walking difficulty and they were unable to walk for more than 1-2 minutes in the interventional group ($p < 0.01$). Whereas, in the control group 44.29%, 25.71%, and 24.29% were able to walk 6 minutes, 3–5 Minutes, and 1–2 Minutes, respectively.

The present study revealed the pretest mean comparison of TUG score was 17.07sec and 16.53sec in the interventional and control groups, respectively. According to Sivakumar. VPR. et al (2018) found the mean TUG scores of 19.7 sec among the

elderly between 60- 69 years¹⁴. After the intervention, the mean TUG score was decreased to 14.84sec in the interventional group and it was increased to 17.06 sec in the control group which was statistically significant at $p < 0.05$ level. Whereas Bohannon R W, Schaubert k (2005) revealed that the mean TUG times decreased over the first (10.1 sec), second (9.1 sec), and third (8.9 sec) tests among the older people¹⁵.

Besides, the mean pretest 6MWT distance was 305.80m and 324m in the interventional and control group, respectively. In the posttest, the mean 6MWT distance of the interventional group was increased to 419.03m but in the control group, it was decreased to 300.40m which was significant at $p < 0.001$ level. Therefore it was evident that stretching and strengthening exercises were very effective in decreasing the TUG score and increasing the 6MWT distance score among the interventional group participants when compared to the control group participants. The present findings were similar to the findings of Locks, et al., (2012) reported that the resistive or stretching training was effective in improving the 6MWT distance among the older adults after the intervention¹⁶.

The study results revealed that age in the year and duration of stay at old age home had shown a statistically significant association with the pretest level of TUG in the interventional group. The findings of the present study were similar to the findings of Lin, et al., (2017)¹⁷ stated that age was significantly associated with the TUG of older adults with impaired mobility living in Taiwan. The study findings are further supported by the Torres-de Araujo, et al., (2018)¹⁸ and Mahmud, et al., (2018) had reported that age was found to have a significant association with mobility limitations of old age people¹⁹.

The present study findings indicated that there was a significant association between the pretest level of 6MWT score and the demographic variables like age in

the year and duration of stay at old age home in the interventional group. Whereas, in the control group, age and leisure activities had shown significant association. The above findings are consistent with the findings of Benjamin, et al., (2014) had reported a significant association between age and walking difficulty of the elderly study participants²⁰. Casanova, et al., (2011) revealed that the mean 6-minute walk distance was significantly associated with the age of the participants²¹.

There was a significant association found between clinical variables like age of motion and self-reported walking difficulties in both groups and hearing in the control group had shown a significant association with the TUG score. But self-reported walking difficulties in both the groups and hearing and range of motion in the control group showed a significant association with 6MWT distance. There are no similar study results between 6MWT and clinical variables.

CONCLUSION

As the age increases the health problems also increase. Mobility limitations have been linked with increased risk of fall, disability, hospitalization, and mortality risk as well as decreased quality of life next to declining function. The study concluded that stretching and strengthening exercises were very effective to improve mobility thus improve the quality of life and promote successful ageing.

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