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Original Research Article

EFFECTS OF YOGASANA ON BALANCE IN GERIATRIC POPULATION

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ABSTRACT

Background: Geriatric population is defined as population aged 60 years and above. Currently, India has the second largest aged population in the world. Due to aging processes, diseases and inactivity, balance often is impaired among older people. The impairment can lead to dramatic consequences such as dependency in ADL, administration to nursing homes, falls and fractures. Complementary and alternative therapies, such as yoga, are theorized to be more therapeutic than traditional exercise because of the mind-body component. Yoga requires the stretching of major muscle groups to improve physical strength and flexibility. Yoga, with its gentle movements, can address known fall risk factors like poor balance, impaired mobility, reduced strength and flexibility and focus on increased awareness and proprioception, resulting in improved balance in older adult.

Objective: The objective of the study was to see the effects of yoga on balance in geriatric population.

Materials and Methodology: 60 healthy elderly volunteers aged 60 years and above both male and female were selected from different old age homes of ahmedabad city and randomly divided in to 2 groups. Group A: experimental and group B: control. General characteristics (age, gender) were collected. Experimental group performed yoga for 6 weeks, six days in a week for 45 to 50 minutes; including 5-10 minutes of warm up focused on slow dynamic muscle movements with shoulder/arm circling, neck rolling. This was followed by 25-30 minutes of asanas consisting of following poses: pavanmuktasana, sputa matsyendrasana, setu bandha sarvangasana, bhujangasana, ardh-paschimottasana, paschimottasana, parvatasana, marjarasana, trikonasana, virbhadrasana, uttkatasana, and vrikshasana. Session was ended with 5-10 min of relaxation with savasana. Subjects of control group were asked to report after six weeks. BBS and TUG scores were taken as pre and post data.

Result: The result shows that there is statistically significant improvement in balance after 6 week of yoga practice in elderly individuals compared to a control group at 5% significance level.

Conclusion: Yogasana is effective in improving balance in elderly individuals compared to control group. It can be applied clinically for improving balance in geriatric population.

KEY WORDS: Geriatric, Elderly, Balance, Yogasana, BBS, TUG Test.

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INTRODUCTION

The geriatric population is defined as population aged 60 years and above [1]. There is no United Nations (UN) standard numerical criterion, but the UN agreed cut off is 60+ years to refer to the older population [2].

It is estimated that presently in 2011, there were around 600 million persons who were aged 60 years and above over all over the world. According to Indian Scenario of geriatric

population 2011, 99 million out of 1.21 billion are over the age of 60, which was 77 million in 2001. According to an estimate, by 2021, India's elderly population will cross 137 million. Currently, India has the second largest aged population in the world [3,4].

Life expectancy for the elderly in developed and developing countries has increased as a result of improvement in public health and medical advances [5]. Due to the increased longevity and life expectancy, the quality of life (QOL) has been considered as an important issue for aging individuals [6].

The performance of all activities of daily living requires good balance control while at rest or when moving from one position to another [7,8]. Maintenance of the balance function is essential to stay physically active in life [9].

During quite stance balance is defined as the ability to maintain centre of mass (COM) within base of support (BOS) [10]. Achieving effective balance is a multi-system and multi-dimensional task [8]. Coordination of sensory, neural and musculoskeletal system is needed to maintain balance [7,8]. Many of these systems undergo deterioration as people age [11,12]. This can affect balance, restrict safe mobility and increase the fall and adversely affect quality of life [11,13].

Balance problems in elderly are most commonly due to multi factorial condition which may include age related or disease-related declines in the balance system. Causes of reduced balance in elderly could be weakness in the core stabilizing muscles, altered muscle activation patterns, loss of proprioception, and an inability to control normal postural sway. Balance problems and falls are leading cause of institutionalization in this group [14,15] which may cause major consequences like dependency in activities of daily living (ADL) [16].

The postural and equilibrium components of balance control ensure stability of the body during different activities. The exact demand of the balance control system is determined by both the task and the environment in which it is performed [8].

Balance assessment tools in older people most commonly uses simple clinical measures. Different measures have been designed to assess different aspects of balance or a person's balance ability under different conditions. These included measures of static and dynamic standing balance, utilizing tasks, such as stepping, reaching or leaning, and turning [17]. The Berg Balance Scale (BBS) was developed by Berg et.al (1989) which is widely used as clinical assessment tool for measurement of functional balance in elderly [18,19]. Timed Up & Go test (TUG) is also commonly used to examine functional mobility, risk of falling, balance and general locomotion in community-dwelling, frail older adults [20,21].

Yoga as a complementary therapy is thought to be more therapeutic than traditional exercise because it involves active engagement between mind and body [22]. According to Feuerstein yoga therapy aims to promote health and self awareness for the purpose of enlightment [23]. Yoga is an alternative approach to conventional exercise training and it also can be adapted to meet the needs of people with physical limitations [24]. Yoga is a gentle form of exercise that has positive impact on physical, mental and emotional well being in older adults [25].

Yoga is a commonly practiced, mind-body approach which has major components like meditation, breathing, and activity or postures [22]. Increased muscular strength, flexibility, range of motion, energy, relaxation, and sense of well-being, decreased pain, improved sleep quality, reduction of stress, and control over physiological parameters are the presumed benefits of yoga therapy [26-30]. Yoga can address known fall risk factors (poor balance, impaired mobility, reduced strength and flexibility) and improved balance in older adults [25].

Although yoga is historical a spiritual discipline, it has been used clinically for therapeutic intervention. Since past 3 decades, the number of publications for clinical applications of yoga has greatly increased [31]. In literature there are many articles of use of yoga in variety of condition such as multiple sclerosis, rheumatoid arthritis, breast cancer, low back pain, migraine, epilepsy [26,32,33-35]. There are many reviews on the effects of hath yoga in rehabilitation after myocardial infarction, menopausal symptoms,

diabetes, and hypertension [36-40].

Yoga and Balance: Yogasanas ranges from simple to complex body postures, along with controlled breathing. These asanas stretches major muscle groups and uses isometric contraction and relaxation of various group of muscles to assume static posture [22].

Its practice has been associated with increased muscle strength, endurance, flexibility, range of motion and cardiopulmonary endurance. It mainly works on increasing body awareness and proprioception, which will lead to improvement of balance in older adults [28,41].

There are very few studies establishing the effect of yoga on balance in elderly individuals. However, there is a lack of sufficient evidence that is dedicated to Indian geriatric population. Hence the need of the present study is to determine, whether yoga practice for duration of 6 weeks would lead to change in balance in geriatric population.

Aim: To evaluate the effects of yoga on balance in geriatric population

MATERIALS AND METHODS

Consent form, Assessment form, BBS, Pen, pencil, Paper pad, Scale, Ruler, Measure tape, Stop watch, Steps, Chairs.

The ethical clearance was obtained from institutional ethics committee of government physiotherapy college, Ahmadabad. This was an experimental study and method of sampling was convenient sampling. 60 healthy elderly volunteers residing at old age homes of Ahmadabad city, aged 60 years and above, both male and female were taken for the study. Sixty elderly were included in study depending on inclusion/exclusion criteria. Inclusion criteria for study were Age 60 years and above, both male and female, Subjects who were willing to participate in the study, Subjects who were ready to sign written informed consent form, and Subjects who were functionally independent that is, score of 100 point on barthel index. Exclusion criteria for the study were History of any recent musculoskeletal problems, serious cardiac and pulmonary condition which may required hospitalization, neurological conditions, psychiatric illness, serious visual impairments (i.e. cataracts), Self-report of uncontrollable diabetes & hypertension, vertigo, Who were already in another active research study.

Subjects were conveniently divided into two groups, 30 into yoga therapy group (study group) or group A and 30 into control group or group B. On the first visit a complete assessment was done including history taking. All subjects were explained about the aim and nature of the study and those willing to participate were requested to sign written consent form. Pre participation evaluation form consisted of general assessment including and outcome measures that include Berg Balance Scale (BBS), Timed Up and GO test (TUG) [42,43]. The outcome measures were taken before and after six weeks in both the groups.

Subjects in group A received yoga therapy six days in a week for six weeks. Subjects in group B were asked to report at the end of six weeks duration.

Some important guidelines and precautions for practice of asanas were explained such as:

· Take light snacks 1 hour before yoga class.
· Evacuate bowel and bladder.
· Dress should be loose and comfortable.
· Avoid jerky movements while doing asanas.
· Breathe normally while maintaining the pose.
· Do not force your body to achieve final pose.

Each therapy session starts with pranayama in form of anulom-vilom and 5-10 minutes of warm up focused on slow dynamic muscle movements with shoulder/arm circling, wrist circling and neck rolling. This was followed by 25 – 30 minutes of asanas consisting of following poses [44-47]: pavanmuktasana (The Wind free Pose), sputa matsyendrasana (Supine Lord of the Fishes Pose), setu bandha sarvangasana (Bridge Pose), bhujangasana (The Cobra Pose), ardhpaschi-mottasana (Semi Posterior stretch pose), paschimottasana (Posterior stretch pose), parvatasana (Sitting mountain pose), marjarasana (Sitting mountain pose), trikonasana (Triangle pose), virbhadrasana (Warrior pose), uttkatasana (Powerful pose), and tadasana (Tree pose). All the asanas were progressed gradually starting from supine to sitting to standing position. Each asana was performed for three to five rounds according to participants' capacity. Each therapy session ends

with savasana and pranayama. Entire session of yoga was under supervision. Heart rate, Respiratory rate and Blood pressure were measured at each session.

RESULTS

Before applying statistical tests, data was screened for normal distribution and outcome measures were analyzed by using appropriate statistical test using Graph pad Prism-5. Confidence interval was set at 95% & $p<0.05$ was considered as significant. Changes in outcome measures were analyzed within group as well as between groups.

Out of 60 total six subjects were drop out from the study, four from group A and two from group B. In group A two found six weeks a long duration, one had some personal issue and one could not completed because of lack of time. In group B two subjects were lost to follow up. Total 54 subjects completed the study, 26 (15 male & 11 female) in group A and 28 (13 male & 15 female) in group B.

The mean age of patients in study group A was 67.6 years and in control group B, it was 68.63 years.

In this study to analyze the difference in BBS score before and after intervention within group A and B "Wilcoxon matched pairs signed rank test" was used. P value <0.05 was considered significant. Here within group A, $p<0.0001$ shows statistically significant difference while within group B, $p=0.23$ was not significant.

Table 1: Mean difference in BBS score within group A and B.

Group	Pre treatment (BBS score)		Post treatment (BBS score)		w value	p value
	Mean	±SD	Mean	±SD		
Group A	44.08	3.773	48.62	4.867	-325	< 0.0001
Group B	45.79	5.006	45.96	5.364	-35	0.2388

Table 2: Mean difference in BBS score between group A and B.

Group	Mean BBS score	±SD	U value	p value
Group A	4.538	1.726	22.5	< 0.0001
Group B	0.5357	0.5762		

For comparing the post-intervention mean difference in BBS score between groups A & B, Mann-Whitney U test was performed. Mann-Whitney U=22.5 at $p<0.0001$ was found to be statistically significant as shown in Table 2.

To analyze the difference of TUG score before and after intervention within group A and B "paired t test" was used. Degree of freedom was kept at df=25 and t=3.34 at p=0.0026 was found to be statistically significant within group A. Degree of freedom was kept at df=27 and t=1.651 at p=0.11 was not statistically significant within group B.

Table 3: Mean difference in TUG score within group A and B.

Group	Pre treatment TUG (sec)		Post treatment TUG (sec)		t value	p value
	Mean	±SD	Mean	±SD		
Group A	12.23	2.673	11.5	2.717	3.34	0.0026
Group B	12.86	2.851	12.64	3.082	1.651	0.11

For comparing the post-intervention mean difference in TUG score between Groups A & B, "Unpaired t test" was used. In Unpaired t test, degree of freedom kept at df=52 and t=2.878 at p=0.0058 was found to be statistically significant between group A and B as shown in table 4.

Table 4: Mean difference in TUG score between group A and B.

Group	Mean TUG score (sec)	±SD	t value	p value
Group A	0.9231	0.6884	2.878	0.0058
Group B	0.4286	0.5727		

From the above findings, null hypothesis was rejected. And above findings conclude that;

Statistically significant difference was found in BBS score with in group A compared to group B.

Statistically significant difference was found in TUG score with in group A compared to control group B.

There is a statistically significant difference in BBS and TUG score between group A and group B

DISCUSSION

The aim of the present study was to analyze the effects of 6 week yoga therapy program on

balance in geriatric population with mean age of 67.6±6 years in group A (yoga therapy group) and 68.63±6.2 years in group B (control group). The outcome measures analyzed were berg balance scale and timed up and go test.

Group A subjects were asked to perform yoga therapy in form of different asanas for 45 to 50 minute a day, 6 days in a week for 6 weeks. Subjects in group B were asked to inform at the end of 6 weeks. BBS and TUG were taken at the beginning and at the end of six weeks in both the groups.

Statistically significant improvement was seen in balance measured by BBS ($P< 0.0001$, w=-435.0) and TUG test ($P=0.001$, $t =3.673$) in subjects who have performed yoga compared to those who have not.

The result of the present study is supported by Kathleen K. Zettergren et al [50] who found statistically significant improvement in BBS score but improvement in TUG score was not statistically significant and this may attribute to small sample size (n=16) they took.

Mary L et al. [51] have evaluated the effects of modified chair-yoga in 16 elderly where they found improvement in functional mobility by reduction in TUG score.

In a preliminary trial with stroke survivors, Julie V et al. [52] found that subjects who adhered to the yoga program experienced the most benefits in terms of mobility and balance.

The improvements in physical measures like balance, directly related to the yoga intervention are not surprising [48,49]. Yoga poses are very similar to conventional balancing exercises given in routine clinical practice. Asanas or poses in the present study are given in different position like supine, sitting, quadruped and standing in a sequential order and progression was done according to improvment in balance. It ranges from low COM and wide BOS in supine position to high COM and narrow BOS in standing position.

Mark D et al [28] concluded that muscular strength, muscular endurance, flexibility, and cardio respiratory endurance can be improved after yoga therapy. They also reported that ankle flexibility, shoulder elevation, trunk extension, and trunk flexion was improved significantly after hatha yoga practice. Improvement in range of motion can be due to the static stretching nature of the asanas as stretching is most commonly advisable to improve flexibility. He also reported that increase in isometric and isokinetic muscular strength. The increases in isometric muscular strength in the above mentioned study most likely to derive from holding static postures in the asanas. Because staic or isometric contractions do not reliably lead to increases in isokinetic strength measurements, the controlled movement from one asana to the next should also be considered for increase in isokinetic muscular strength.

Mandanmohan et al. [54] demonstrated significant improvements in muscular strength in children resulting from yoga practice.

Arlene et al, who found improvement, fear of fall (FOF), balance and lower body flexibility in the population of older adults living and working in a retirement community. Out of all outcome measure, only static balance was found statistically significant. And they revealed that, the improvements in balance scores may be resulted of improvement in flexibility [25].

Flexibility decreases significantly per decade in both male and female after 20 years of age [55]. Especially hamstring and lower back flexibility in sit and reach test reduces about 2.5 centimetres per decade in both genders [56].

In a recent study involving young adults, 9.8% increase in LB flexibility was reported after 2 months (3 times a week) of yoga therapy [57]. On the other hand 6 to 10-week of stretching exercises in the elderly resulted in 25% increase in LB flexibility [58].

Greendale et al [59], reported a case study of a woman with hyperkyphosis who participated in a yoga intervention twice a week for 12 weeks improved significantly in the ability to stand quickly, move faster and reach longer, as well as reported increased physical self-awareness and well being.

According to Jayasinghe S R, Hatha yoga practice will lead to improvement in flexibility, balance, strength and overall fitness. Pranayam component of yoga (slow breathing) is able to improve heart rate variability by improving cardiovascular rhythms [36].

The increase in muscular strength, ROM and flexibility in addition to yoga poses may contribute to improvement in balance and postural control in the present study.

CONCLUSION

The present study concludes that yogasanas are effective in improving balance in elderly individuals at the end of six weeks compared to control group. Thus it can be used clinically to improve balance in geriatric population.

ABBREVIATIONS

BBS - Berg balance sale
TUG test - Timed UP & Go test
SD - Standard Deviation
COM – Center of Mass
BOS – Base of Support
FOF – Fear of fall

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Conflicts of interest: None

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