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Effectiveness of Otago Exercises in Elderly Type 2 Diabetes Mellitus Patients to Improve Balance and Prevent Falls - An Experimental Study

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ABSTRACT

Introduction: In elderly people the key to perform the ADLs independently is balance and less concern of falling. In patients of type 2 diabetic patients there is increased risk of falls due to its complications. The recent articles have shown that Otago exercises have an effect on improving balance and prevent falls in individuals. Thus, this study aims to find effectiveness of Otago exercise Program in elderly type 2 diabetes mellitus patients.
Method: 40 subjects were selected according to inclusion and exclusion criteria and were assessed by Falls Efficacy Scale and Timed Up and Go for concern of fall and balance.
Results: Paired t-test is used to analyse the difference between pre and post-intervention score. Both the tests showed significant results with $P<0.05$.
Conclusion: This study confirms that Otago exercises are effective to prevent fall and improve balance in elderly type 2 diabetic patients.

Keywords: Balance Exercises, Falls prevention, Otago exercise Program, Diabetes mellitus.

INTRODUCTION

More than 33% of people of 65 years of age or older fall each year and in 50% of such cases, falls are recurrent.[1]Approximately 10 % falls are the cause of serious injury such as fractures; subdural head injury and other soft tissue injury.[1]Falls account for approximately 10% of visits to the emergency departments and 6% of urgent hospitalizations among elderly people. Independently of other health conditions, falls are associated with restricted mobility; a decline in the ability to carry out activities such as dressing, bathing, shopping, or housekeeping; and an increased risk of placement in a nursing home.[1] Diabetes mellitus is a chronic progressive metabolic disorder caused due to increase in blood sugar level. The prevalence of type 2 diabetes is also rising in India. According to a WHO report about 77 million individuals have diabetes in India.[2]Diabetes mellitus can cause complications such as diabetic retinopathy and peripheral neuropathy, which are contribute to gait instability and falls. A less known complication of diabetes mellitus is its effect on the vestibular system. The vestibular system contributes to balance in static and dynamic conditions by providing spatially orienting information. It is noted that diabetes mellitus affects vestibular function in both animal and clinical studies. Diabetes mellitus causes pathophysiological changes in central and peripheral vestibular structures. Vestibular dysfunction causes impaired balance and a

higher risk of falls. As the prevalence of diabetes increases, so does the potential for falls due to diabetic complications.[3] Severity of vestibular dysfunction is more in older adults of type 2 diabetes mellitus than type 1 diabetes mellitus.[4]

Diabetes mellitus causes complications like vestibular dysfunction. Vestibular dysfunction leads to impaired balance and higher risk of falls[3]. Otago Exercise Program is found to be effective in improving balance and fall prevention in healthy older adults[5].Therefore this study is intended to understand the effectiveness of Otago Exercises in elderly type 2 Diabetes mellitus patients to prevent falls.

The Otago Exercise Program (OEP) is a home exercise program which includes both balance and strength retraining of lower limbs. OEP was proven to be effective for preventing falls among adults 65 years of age and older in four randomized controlled trials in New Zealand. OEP has been shown to reduce falls by 35 percent among high-risk individuals. OEP improves both strength and balance—two of the most readily modifiable risk factors for falls.[5] Studies showed that combined effect of balance and resistance training exercises improve physical (i.e., balance and strength), mental (i.e., quality of life and fear of falling), and functional performance (i.e., ADL).[5]

MATERIALS & METHODS

The study was conducted by visiting the diabetic patients in and around Pune. The study was approved by ethical committee. The subjects were selected on the basis of the inclusion and exclusion criteria.

The assessment was done prior to the treatment.

The subjects were explained about the study. Consent was taken from the patient who wished to participate in the study and who were fitting in the inclusion criteria.

Subjects were assured that the collected information will not be misused in any form.

Exercise protocol was explained to the subjects.

Pre-intervention and post-intervention tests were done (falls efficacy scale -International and Timed Up and Go).

For falls efficacy scale subjects were given a 16-item questionnaire which states the concern of subjects about falling.

For timed Up and Go test measures in seconds the time it takes a subject to rise from a chair, walk a distance of 3 meters, turn, walk back to the chair and sit down.

The exercise protocol was carried out for 5 days /week for 6 weeks5

The exercises consisted of the following strengthening exercises: knee extensors, knee flexors, hip abductors, ankle plantar flexors, and ankle dorsiflexors.[6] The balance retraining exercises consisted of the following: knee bends, backwards walking, walking and turning around, sideways walking, tandem stance, tandem walk, one-leg stand, heel walking, toe walking, heel toe walking backwards, and sit to stand[6].

BALANCE RETRAING EXERCISES				
	LEVEL 1	**LEVEL 2**	**LEVEL C**	**LEVEL D**
Knee bends	10 repetitions Hold support	1)10 repetitions, no support or 2)10 repetitions, Hold support, repeat	10 repetitions, no support, repeat	3*10 repetitions No support
Tandem stance (heel toe stand)	10 sec, hold support	10 second, no support		
Sit to stand	5 stands, 2 hands	1)5 stands, one hand support or 2) 10 stands 2 hands for support	1)10 stands, no support, or 2)10 stands 2 hands for support, repeat	10 stands no support, repeat
Backwards walking		10 steps 4 times Hold support		10 steps,4 times No support

Walking and Turning around		Walk and turn around (make figure of 8) twice	Walk and turn around (4 times)	
Sideways walking		10 steps 4 times with support	10 steps 4 times, no support	
One leg stand		10 sec, hold support	10 sec no hold	30 sec no hold
Tandem Walk (heel toe walk)			Walk 10 steps, hold support, repeat	Walk 10 steps, no support, repeat
Heel walking			10 steps 4 times, hold support	10 steps 4 times, no support
Toe Walking			10 steps 4 times, hold support	10 steps 4 times, no support
Heel toe Walking Backwards				Walk 10 steps No support, repeat

STATISTICAL ANALYSIS AND RESULTS

The study was aimed at finding effect of Otago Exercises on balance and fall prevention in type 2 diabetes mellitus patients. The study included 40 type 2 diabetic patients both males (25) and females (15) of age more than 65 years that were selected according to inclusion and exclusion criteria.

Data was analysed using graph pad instat. Paired t-test is used to analyse the difference between pre and post treatment score.

The various statistical measures such as mean, standard deviation (SD) and test of significance were utilized to analyse the data. Both the tests showed significant results with $P<0.05$.

There was pre-intervention value (29.6±3.86) and post-intervention value (26±3.76) for Falls Efficacy Scale, and Pre-intervention value (19.33±2.84) and post-intervention value (16.58±2.91) for Timed Up and Go test.

Hence the results showed that Otago exercise Program was effective in improving balance and preventing fall in elderly type 2 diabetes mellitus patients after 6 weeks.

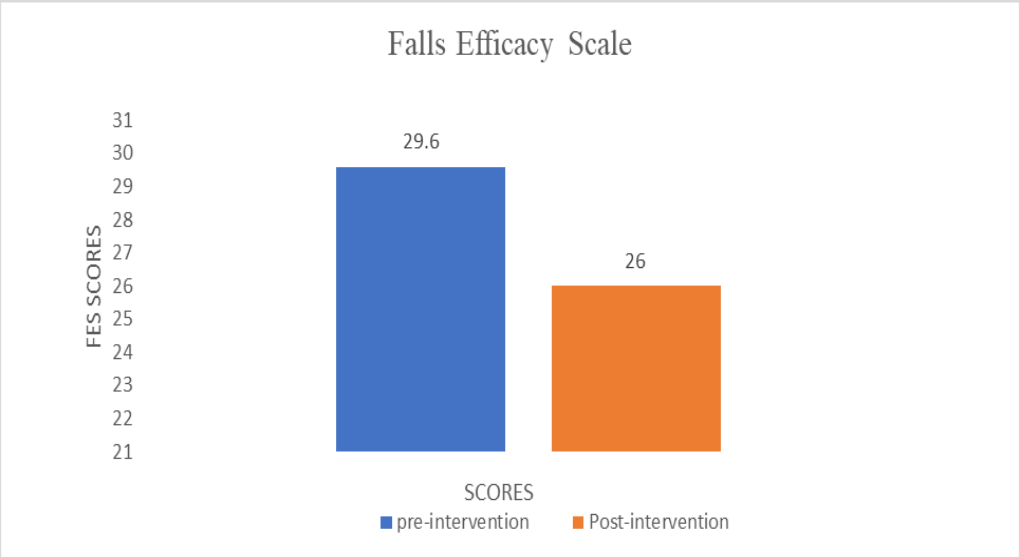

Figure no. 1: Comparison Of Pre and Post values of Falls Efficacy Scales

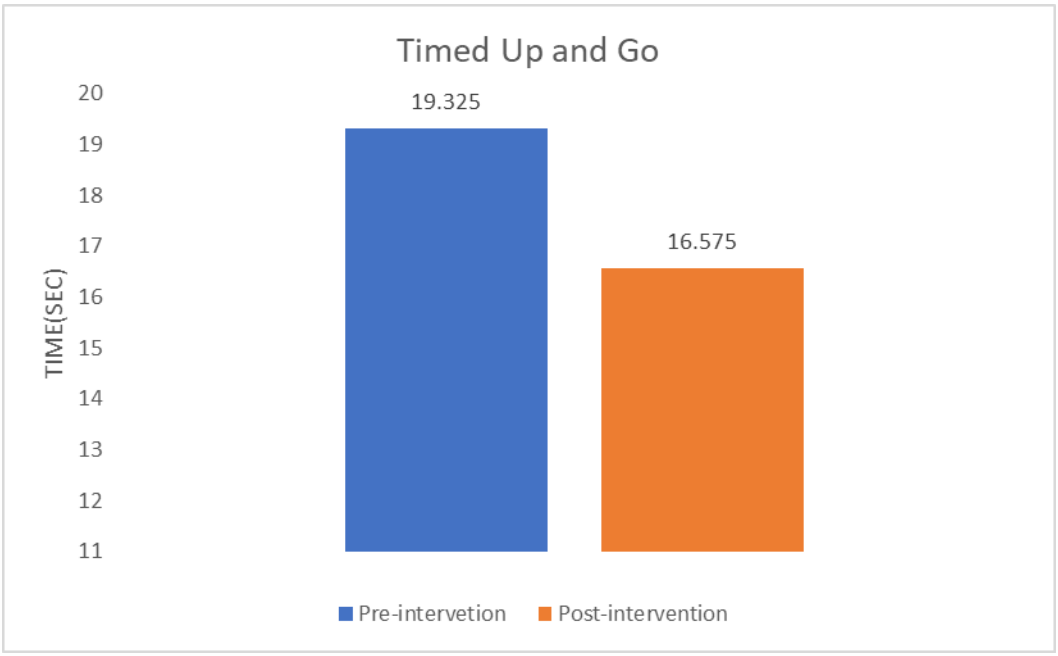

Figure No.2: Comparison Of Pre and Post intervention values of Timed Up and Go test

DISCUSSION

The present study assessed the effectiveness of Otago exercise program in elderly type 2 diabetes patients to prevent falls and improve balance by using Falls Efficacy Scale-International and Timed Up and Go. In this study total 40 subjects were included which were trained for 6 weeks. The statistical data analysis showed that there is significant effect of Otago Exercise Program on fall and balance using Falls Efficacy Scale-International and Timed Up and Go. The previous studies have shown that there is a vestibular dysfunction is seen in elderly type 2 diabetic patients as one of its complications. Therefore as the prevalence of diabetes increases so does the vestibular dysfunction[3]. Vestibular system contributes to balance in static and dynamic conditions[3]. Thus as the prevalence of diabetes increases the prevalence of fall increases[3].

Otago exercise program is a home exercise program which includes both lower limb strengthening and balance retraining exercises. Falls Efficacy Scale-International showed a significant decrease in the score after the Otago Exercise Program

intervention. The possible reason might be that the balance exercises challenge the sensory, cognitive, and musculoskeletal systems while addressing balance constraints such as orientation in space, changes in direction, and the speed or height of the centre of mass during static and dynamic situations resembling ADL[7]. Balance exercises cause structural and functional changes in brain. It has been hypothesized that due to vestibular input during self-motion, exercise induced neuroplasticity is seen. The vestibular system asseses self-motion to quickly adjust eyes and other body parts for balance control. Balance control requires the integration of visual, proprioceptive, as well as motor related multisensory cues, which takes place as early as in the first stage of central vestibular processing, that is, in the vestibular nuclei of the brain stem.[9] Pathways that connects vestibular nuclei and the hippocampus, prefrontal and parietal areas provide information relevant for memory and spatial functions[9] .

The balance training exercises cover a broad spectrum of postural control demands which involve the integration of vestibular, visual and proprioceptive information[9]. It is observed that there are some changes in cortical thickness and grey matter volume in brain structures of the sensory-motor and vestibular system, including the hippocampus and the basal ganglia. Since the implemented balance exercise tasks required planar motion detection to maintain an upright posture, the thickness increase in the visual area is likely related to visual-vestibular motion processing during the balance training[9].

Among type 2 diabetic older adults, this program has been found to improve static and dynamic stability while performing ADLs and because of the improved stability the older adults were less concerned about falling or losing balance.

There is increased lower limb strength and balance the confidence in the subjects to perform the daily living activities. Therefore it took the subjects less time to perform Timed Up and Go test and it showed a significant decrease after 6 weeks which indicates improved balance in the subjects[8].

The reason for that is strengthening exercises and balance exercises reduce intracortical inhibitory networks within the primary motor cortex (M1) and corticospinal pathway and increases the propagation velocity of action potentials along the muscle fibers, which could in turn influence automatic and voluntary muscle actions for maintaining balance[8].

The limitation of this study was that it was done on smaller group. The study can be done on larger scale to get a generalised result.

The future scope for this study id larger sample size can be taken, study can be done separately on male and female participants and the study can be done for a longer duration in the same population.

CONCLUSION

This study concludes that Otago exercises are effective to prevent fall and improve balance in elderly type 2 diabetic patients.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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