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**EFFICACY OF CORE – STABILITY, DUAL TASKING AND SENSORY
STRATEGIES (CODUSE) EXERCISE VS OTAGO EXERCISE ON BALANCE
AND RISK OF FALL IN COMMUNITY – DWELLING ELDERLY
POPULATION – A COMPERATIVE STUDY**

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ABSTRACT

Introduction: Ageing is associated with a progressive decline in balance, coordination, muscle strength, and postural control, which markedly increases the risk of falls among elderly individuals aged 60–70 years. Falls represent a major public health concern, often resulting in serious injuries, reduced mobility, loss of independence, and diminished quality of life. Exercise-based interventions targeting balance and strength have shown potential in mitigating fall risk.

Purpose of Study: To compare the effectiveness of the CoDuSe exercise program versus the Otago exercise program on balance and risk of falls in elderly individuals aged 60–70 years.

Materials and Methodology: The study included 30 community-dwelling older adults aged 60-70 years with reduced balance and history of falls. Group A received the CoDuSe exercise program and Group B received the Otago exercise program. Both interventions were given 3 days per week for 8 weeks. Outcome measures were the Timed Up and Go (TUG) test and Tinetti Balance and Gait Assessment. Pre- and post-intervention assessments were performed.

Result: Data was analyzed using appropriate statistical tests. Both groups showed significant improvement in balance and fall risk after 8 weeks ($p < 0.001$). However, the CoDuSe group demonstrated greater improvement in TUG and Tinetti scores compared to the Otago group.

Conclusion: The CoDuSe exercise program was more effective than the Otago exercise program in improving balance and reducing fall risk among elderly individuals aged 60–70 years.

Keywords: CoDuSe exercise program, Otago exercise program, fall risk

INTRODUCTION

Ageing is associated with a progressive decline in physiological functions, including muscle strength, joint flexibility, proprioception, and postural control. These changes impair balance and increase susceptibility to falls among older adults. Falls are a major cause of injury, disability, and mortality in the elderly population. Globally, the prevalence of falls among older adults is estimated at 26.5%, with rates ranging from 28–35% in individuals aged 65 years and above, increasing to 32–42% in those over 70 years.[1] In India, the prevalence of falls among community-dwelling older adults ranges from 26% to 53%, contributing significantly to healthcare burden, loss of independence, and reduced quality of life [2, 3].

Falls often result in fractures, head injuries, fear of falling, and social isolation. Even non-injurious falls can lead to activity restriction and further decline in physical function. The risk is particularly high among elderly individuals aged 60–70 years with reduced balance and a history of falls. Therefore, effective fall prevention strategies are essential to promote healthy

ageing and reduce the socio-economic burden [4].

Exercise-based interventions are considered the most effective non-pharmacological approach for improving balance and reducing fall risk. The Otago Exercise Program (OEP) is a widely recognized evidence-based intervention focusing on lower limb strengthening, balance training, and walking exercises. Studies have shown that OEP improves gait, muscle strength, and balance, thereby reducing fall incidence in both healthy and frail elderly populations [5, 6].

However, traditional programs such as OEP primarily target strength and basic balance and may have limited impact on complex aspects of postural control, including core stability, dual-task performance, and sensory integration. In daily life, older adults often perform multiple tasks simultaneously, requiring adequate cognitive and sensory processing. Impairments in these domains are strongly associated with increased fall risk [7].

The CoDuSe Exercise Program (Core stability, Dual-task, and Sensory strategies)

addresses these multidimensional components of balance. It incorporates core muscle activation, dual-task training, and sensory reweighting to improve neuromuscular coordination, dynamic balance, and functional mobility. Evidence suggests that such multicomponent interventions produce superior improvements compared to single-component programs [8].

Despite the growing use of both CoDuSe and Otago programs, limited comparative evidence exists, particularly among the Indian elderly population aged 60–70 years. Few studies have directly compared these interventions using objective measures such as the Timed Up and Go (TUG) test and the Tinetti Balance and Gait Assessment [9].

OBJECTIVES

- To assess the impact of CoDuSe exercise on balance and risk of fall in community dwelling older adults using TUG and TINNETI Test
- To assess the impact of OTAGO exercise on balance and risk of fall in community dwelling older adults using TUG test and TINNETI test
- To compare the efficacy of CoDuSe and OTAGO exercise on balance and risk of fall in community dwelling older adults.

METHODS

- Study of design: Randomized

controlled comparative study.

- Study type: Comparative study
- Sample size: 30 community -dwelling older adults
- Study population: Male and Female of 60 to 70 years

• Inclusion criteria

1. Subjects of age 60-74 years.
2. Gender – male and female.
3. Independent walking.
4. Patient willing to perform the exercise.
5. Mini-mental scale examination score at least 24.
6. History of fall within last 3-4 months.

• Exclusion criteria

1. Subjects with history of impairment of hip, and knees, recent fracture or any injury to the lower limb.
2. Inflammatory condition of the lower limb, Previous surgery to the spine or the lower limb.
3. Subjects with cardio-respiratory disorder.
4. Subjects with any other neurological disorders.
5. Any other musculoskeletal problem interfering with the capacity to maintain an upright stance or to stand up from and sit down onto the chair.

6. Subjects not willing to give the consent for exercise.

All participants provided informed consent and underwent pre- and post-assessment using the Berg Balance Scale and Tinetti test. Thirty elderly participants were randomly allocated into two groups:

CoDuSe and Otago, receiving intervention 3 days/week for 8 weeks with maintained confidentiality.

INTERVENTION PROTOCOL:

CoDuSe EXERCISE PROGRAM [10]:

Table 1: CoDuSe exercise program

Component	Position	Exercise	Dosage
Core Stability	Supine	Heel slides	10–12 reps
		Single leg lift	10–12 reps
		Double leg lift	10–12 reps
		Bridging	10–12 reps
	Side-lying	Bent leg lift	2–3 sets
		Straight leg raise	10–12 reps
		Weight shifting	10–12 reps
		Hand walking	10–12 reps
		Leg sliding	10–12 reps
		Leg lift	10–12 reps
		Diagonal arm-leg lift	10–12 reps
	Standing	Forward bending	10–12 reps
Dual Tasking	Functional	Ball juggling	10–12 reps
		Tray holding	10–12 reps
		Carrying bags	10–12 reps
		Walking with cognitive task	10–12 reps
Sensory Strategy	Standing	Single-leg stance	15 sec × 10–12
		Tandem standing	15 sec × 10–12
	Walking	Knee lift walking	10–12 reps
		Walking on cushions	10–12 reps
		Simon's task	10–12 reps

OTAGO EXERCISE PROGRAM [11]:

Table 2: OTAGO exercise program

Component	Exercise	Dosage
Warm-up	Marching in place	5–10 min
Strengthening	Knee extension (seated)	10 reps × 2 sets
Strengthening	Knee flexion (standing)	10 reps × 2 sets
Strengthening	Hip abduction	10 reps × 2 sets
Strengthening	Hip extension	10 reps × 2 sets
Strengthening	Ankle plantarflexion	10 reps × 2 sets
Strengthening	Ankle dorsiflexion	10 reps × 2 sets
Balance	Tandem stance	10–30 sec × 3
Balance	Single-leg stance	10–30 sec × 3
Balance	Heel-toe walking	10 steps × 3
Balance	Backward walking	10 steps × 3
Balance	Sit to stand	10 reps
Walking	Walking program	10–30 min

Both interventions were given 3 days per week for 8 weeks.

RESULTS

Table 1: Mean Age Distribution

GROUPS	n	MEAN AGE	SD	P-VALUE
CoDuSe	15	64.40	2.64	
OTAGO	15	64.53	2.75	0.89

There was no statistically significant difference in age between the groups ($p > 0.05$) indicating both groups were comparable at baseline

Table 2: Pre TUG and Post TUG of Group A and B

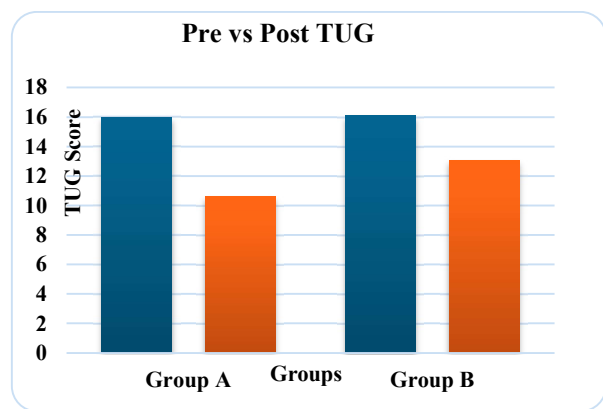
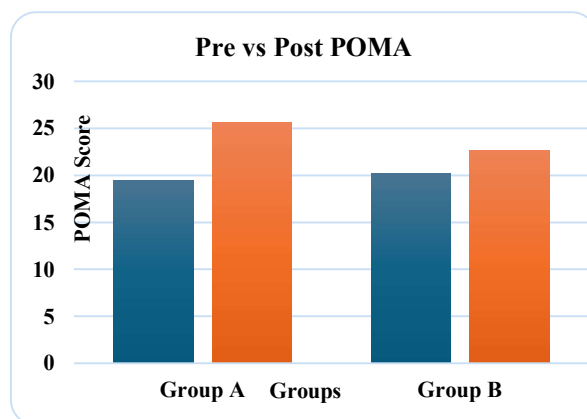
GROUPS	VARIABLE	MEAN	SD	P VALUE
GROUP A	PRE TUG	15.94	0.95	
	POST TUG	10.63	0.73	< 0.001
GROUP B	PRE TUG	16.08	0.91	
	POST TUG	13.05	0.84	<0.001

There was a statistically significant improvement in TUG score in Group A and ($p < 0.001$).

Table 3: Pre And Post Tinetti of Group A and Group B

GROUPS	VARIABLE	MEAN	SD	P VALUE
GROUP A	PRE POMA	19.42	1.31	
	POST POMA	25.67	1.23	<0.001
GROUP B	PRE POMA	20.18	1.16	
	POST POMA	22.67	1.23	<0.001

There was a statistically significant improvement in TINNETI score in Group A and ($p < 0.001$)

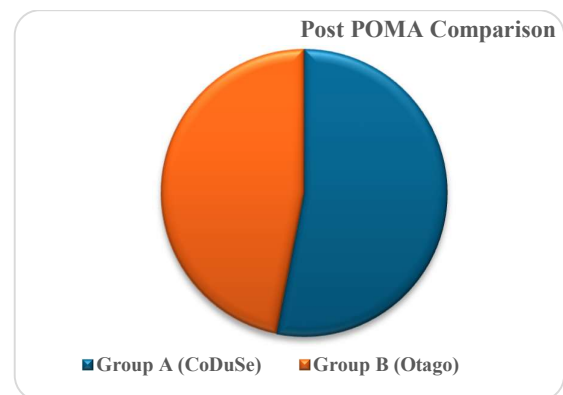
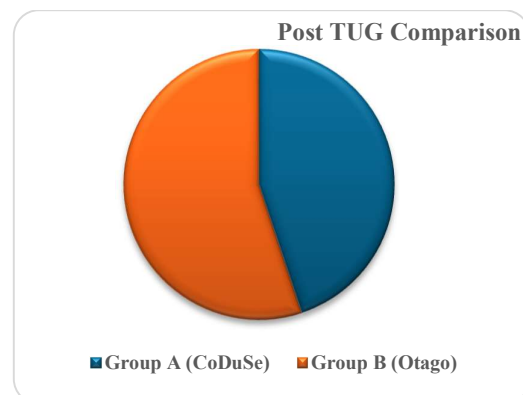


Graph 1 and 2: Pre Vs Post Tug and Tinetti of Both the Groups

Table 4: Between Group Comparison Post Intervention: Unpaired t Test

Outcome Measure	Group A Mean $\pm$ SD	Group B Mean $\pm$ SD	p-value	t-Value
Post TUG (sec)	10.63 $\pm$ 0.73	13.05 $\pm$ 0.84	-8.34	<0.001
Post POMA	25.67 $\pm$ 1.23	22.67 $\pm$ 1.23	6.70	<0.001

Between-group analysis using unpaired t-test showed statistically significant improvement in the CoDuSe group compared to the Otago group for both TUG and Tinetti scores ($p < 0.001$)



Graph 2: Between Group Comparison Post Intervention: Unpaired T Test

DISCUSSION

The present study demonstrated that both the CoDuSe and Otago exercise programs significantly improved balance and reduced fall risk in community-dwelling elderly individuals aged 60–70 years after 8 weeks of intervention (3 sessions/week), as evidenced by improvements in the Timed Up and Go (TUG) test and Tinetti Balance and Gait Assessment scores ($p < 0.001$). However, the CoDuSe group showed significantly greater improvement compared to the Otago group.

These findings are consistent with the multifactorial nature of balance decline in ageing, involving impairments in proprioception, core stability, sensory integration, and dual-task performance [12]. The CoDuSe program integrates core stability, dual-tasking, and sensory strategies, which enhance postural control under functional and cognitively demanding conditions. This comprehensive approach likely contributed to the superior improvements observed in TUG and Tinetti scores. Previous studies have demonstrated that CoDuSe-based interventions significantly improve balance and reduce fall risk through enhanced neuromuscular coordination and sensory processing [13, 14].

In contrast, the Otago Exercise Program (OEP) primarily focuses on lower-limb strengthening, balance training, and

walking. It is a well-established intervention shown to reduce falls and improve functional mobility in older adults [15, 16]. However, its emphasis on physical components alone may limit its effectiveness in addressing cognitive-motor interference and sensory deficits, which are critical determinants of fall risk in elderly individuals [17]. This may explain the comparatively smaller improvements observed in the Otago group.

The findings are further supported by systematic reviews indicating that multicomponent and dual-task training programs are more effective than single-component interventions in improving balance and reducing fall risk [18, 19]. The 8-week intervention produced significant improvements. However, the small sample size and lack of long-term follow-up are limitations. Future studies should include larger samples and long-term assessment. Clinically, CoDuSe appears to be a more effective approach for improving balance and reducing fall risk.

CONCLUSION

The present study concludes that both the CoDuSe and Otago exercise programs are effective in improving balance and reducing fall risk among community-dwelling elderly individuals aged 60–70 years. Significant improvements were observed in both groups following the 8-week intervention. However, the CoDuSe exercise program

demonstrated superior effectiveness compared to the Otago program, as evidenced by greater improvements in TUG and Tinetti scores. This may be attributed to its comprehensive approach incorporating core stability, dual-task training, and sensory integration, which better addresses the multifactorial components of balance control. Therefore, CoDuSe can be recommended as a more effective intervention for enhancing functional balance, reducing fall risk, and promoting independence in the elderly population.

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