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TO STUDY THE EFFECT OF LAND EXERCISES VS AQUATIC EXERCISES ON BALANCE IN THE ELDERLY

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Abstract: Ageing is a complex biological process that is progressive in nature. There is a decline observed in the muscle mass and the sensorimotor systems which may contribute to decreased balance and stability while walking.Balance is one of the most crucial intrinsic risk factor for the occurrence of falls. Falls are the leading cause of fatal and non fatal injuries among the elderly.Multiple studies indicate that a structured exercise program helps in improving balance and reducing risk of falls.Exercises can be performed on land as well as in water.Thereby the need of the study to evaluate the effect of land vs aquatic exercises on balance in the elderly.

Method :A Randomised Control Trial with 40 elderly's selected based on the inclusion criteria; randomly divided in 2 groups. Balance was assessed using Tinetti POMA scale. Exercises were done 3 times a week on alternate days. Below are the walking activities: Walking forward 11 feet. Marching forward 11 feet. Sidestepping without crossing legs 11 feet. Tandem walking 11 feet. Below are the exercise activities. Marching in place. Hip flexion/extension .Hip abduction/adduction. Toe raises/heel raises. Shallow knee bends. Sit to stand from chair in land group. Sit to stand from pool shelf in aquatic group.

Results :Wilcoxin pair signed rank test was used for within group pre and post analysis, for land exercise the two tailed p value <0.0001, which is extremely significant; for aquatic exercises the two tailed p values < 0.0001, which is extremely significant.For between group analysis Mann Whitney Test was used, the two tailed p value < 0.0001, which is extremely significant.

Conclusion:The results show that there is an improvement in balance post both land and aquatic exercises individually, but when compared between the two mediums aquatic exercises showed a better result.

Index terms : Land exercises, Aquatic exercises, Balance in elderly, reduce risk of fall

INTRODUCTION:

Ageing leads to diminished functioning of various physiological systems. Age related declines are seen in the muscle mass or sensorimotor systems which may contribute to decreased balance and stability while walking. Falls are the leading cause of fatal and non-fatal injuries, among the elderly. It is estimated that 30% of community-dwelling elders older than 65, 40% of those older than 80 years, and 66% of institutionalized elders fall each year. There is a greater-than-linear increase in the rate of falls between the ages of 60 to 65 and 80 to 85yrs [3]. Major morbidity from falls includes hip and other fractures that require immobilization or hospitalization. The majority of falls in the elderly, however could result in minor or no injury, but a single fall often results in a fear of falling [7]. This leads to a loss confidence in one's ability to perform routine tasks, restriction in activities, social isolation, and increased dependency on others [8]. This eventually leads to deconditioning, joint stiffness, and muscle weakness due to immobility which can further cause more falls and further mobility restriction [9,10]. Fear of falling can also affect those with impaired mobility who have not fallen, leading to similar sequelae of restricted activity, social isolation, and increasingly greater dependence [11].

Identification of significant risk factors is the most important step towards fall prevention. Risk factors associated with falls can be classified as either intrinsic or extrinsic [12]. Intrinsic factors include symptoms such as dizziness, weakness, difficulty walking, or joint stiffness ; environmental factors include conditions such slippery surface, loose rug, poor Lighting, and obstacles. Tinnetti and colleagues found that intrinsic factors such as sedative use, cognitive impairment, lower extremity disability, palmo-mental reflex, and foot problems increase the likelihood of falling in community-dwelling elders [13]Mac Rae and colleagues identified muscular weakness in the hip abductors, knee extensors, knee flexors and ankle dorsiflexors muscles as being related to an elder's risk of falls [1]. For most of the falls in the elderly, it is difficult to distinguish between those that are intrinsically and extrinsically precipitated. It is likely that most falls are a result of complex interaction between host and environmental factors.

The aging process affects all components of postural control, that is the sensory, effector, and central processing system. In the sensory system, visual acuity, contrast sensitivity, and depth perception worsen with age. Changes in the vestibular-ocular reflex are consistent with age-related peripheral anatomical changes in the vestibular system. In the effector system, joint stiffness and loss of range of motion occur as a result of age-related degenerative changes in the joints. Declines in muscle strength with age are associated with decrease in size and number of muscle fibre. Increased stiffness in connective tissues in general is likely to contribute to age related losses in joint range of motion and flexibility.

In the central processing component, general slowing of sensory information processing coupled with slowing of nerve conduction velocity may contribute to the observed 20 to 30 msec delay in onset of automatic postural responses. Other manifestations of age-related changes in central processing include increased incidence of proximal-to-distal sequencing, increased incidence of co-contraction of antagonist muscle groups, increased static sway, and increases in the number of steps required to recover balance after perturbation. In the aging adult, it is difficult to distinguish pure age effects from effects of the subtle

subclinical diseases and life-style changes that accompany the aging process. Nevertheless, it is important to understand that subtle changes in any single component of the postural control system are not likely to be sufficient to cause postural instability. Redundancy in the system can guard against subtle losses in any single component. Accumulation of mild deficits across multiple components of postural control, however, may diminish the compensatory capacity of the system, leading to a lowered threshold for instability. Balance, strength and proprioception may be addressed in an aquatic environment. According to Campbell et al, activities in water are appropriate for geriatric population. Ruoti and associates described the support offered by water as allowing more independent upright postures. They posited that in water there may be an increase in afferent stimulation from greater cutaneous in puts, that muscles may be more freely firing, patients are less fearful of movements and that activity in water may facilitate vestibular inputs. Exercising in water may be more appropriate than on land for those with musculoskeletal impairments as joint loading diminishes relative to depth of immersion. Exercise in water can slow the speed of falling, secondary to the properties of viscosity and density, allowing an individual with impaired balance more time to detect postural errors that might lead to a fall [10]. Water's natural buoyancy helps to do resistance exercises. On land, resistance exercises would be done by lifting or pushing weights, according to the National Institutes of Aging. Water provides resistance without the possibility of falling.

METHODOLOGY :

A Randomised Control Trial with 40 elderly's selected based on the inclusion criteria; randomly divided in 2 groups. Balance was assessed using Tinetti POMA scale. The Elderly between the age of 60 - 75yrs were with a low and medium risk of fall on Tinnetti POMA scale were included in the study. The elderly with neurological disorders, respiratory conditions, total hip or total knee joint replacement, hospital admission in past 6 months and those whose score indicates high risk of fall on Tinetti POMA scale were excluded.

PROCEDURE:

The study was approved by the Institutional Ethical Committee, the subjects were recruited based on the inclusion and exclusion criteria. Informed consent was taken. The subjects were randomly divided in two groups. . Exercises were done 3 times a week on alternate days.

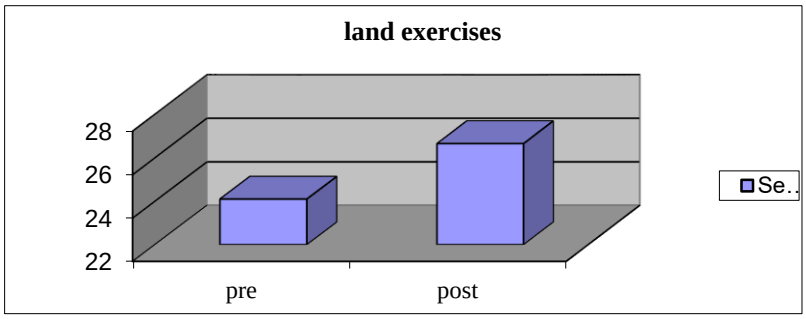
1. Below are the walking activities :Walking forward 11 feet. Marching forward 11 feet. Sidestepping without crossing legs 11 feet. Tandem walking 11 feet.
2. Below are the exercise activities : Marching in place. Hip flexion/extension . Hip abduction/adduction. Toe raises/heel raises. Shallow knee bends. Sit to stand from chair in land group. Sit to stand from pool shelf in aquatic group.

Each session lasted for 20-30 minutes. Subjects exercised to their tolerance level and were allowed to rest periods as needed. Subjects were instructed to report any discomfort immediately. Land exercises were conducted indoors in an assisted living recreation area. The subjects exercised in a water level based on their height; the water level was between their waist and nipple line. After 6 weeks balance scores of the subject's were assessed using Tinetti POMA scale.

OBSERVATIONS AND RESULTS:

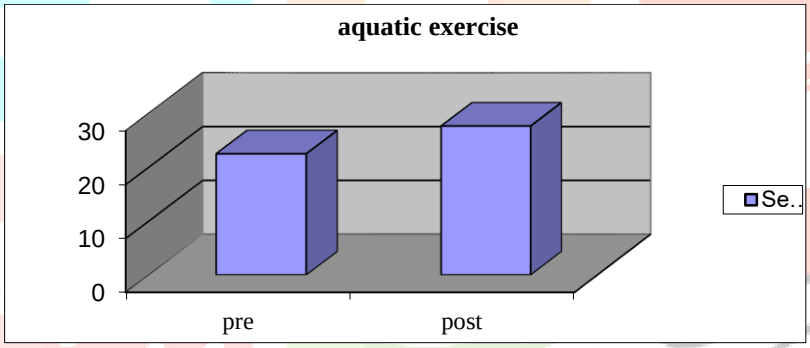
Data was collected and analyzed using the SPSS 12 software with the level of significance set at 0.001

1. The balance scores obtained before and after in each group were statistically analysed using Wilcoxon matched pair signed rank test.



Pre	Post
24.1	26.65

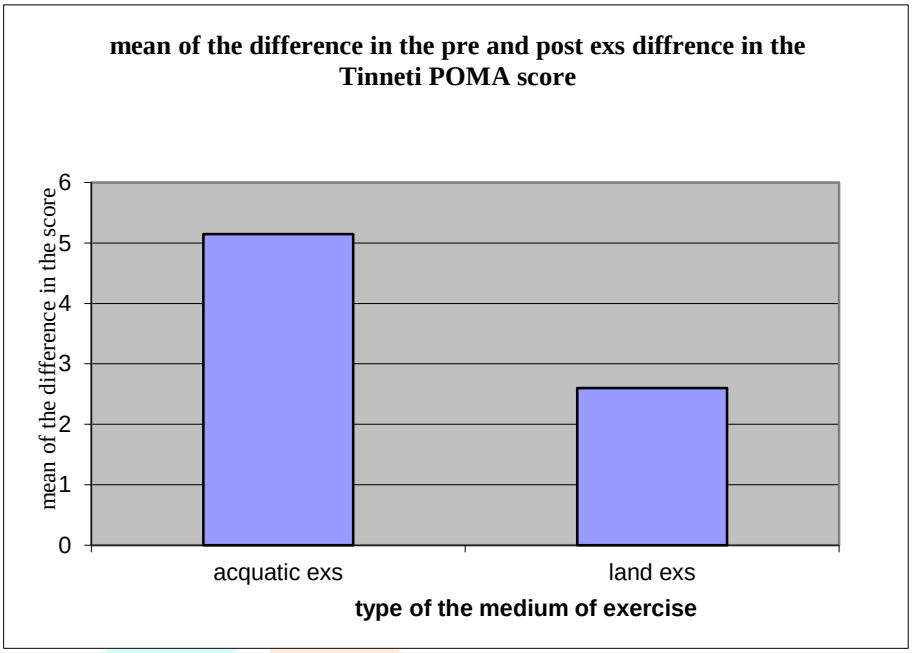
The two-tailed p value <0.0001, considered extremely significant.



Pre	post
22.5	27.65

The two tailed p-value is<0.0001, considered extremely significant.

2. The comparison between the data of land exercises and aquatic exercises was analysed using Mann Whitney Test.



Aquatic exercise	Land exercise
5.15	2.6

The two tailed p-value is<0.0001, considered to be extremely significant.

DISCUSSION :

This study was designed to compare the effectiveness of similar balance retraining interventions performed in a land versus aquatic environment. The results of this study demonstrated that regardless of the exercise medium, significant improvements in balance were achieved, although more improvement was seen in aquatic group. Subjects exercising in water were more comfortable as they weren't worried about falling during the exercise. Also buoyancy of water helps to increase the muscle strength without putting much load on joints. Exercising in water may be more appropriate than on land for those with musculoskeletal impairments. Joint loading diminishes relative to the depth of immersion [5]. Thein and Brody-Thein found that being submerged to the level of the anterior superior iliac spine allows for a 54% reduction in weight bearing, thus reducing lower extremity stress [6]. Ruoti and associates described the support offered by water as allowing more independent upright postures. They posited that in water there may be an increase in afferent stimulation from greater cutaneous inputs, that muscles may be more freely firing, as patients are less fearful of movement, and that activity in water may facilitate vestibular inputs [4].

This study also denotes that lower body activity as described in either medium is effective in increasing balance outcomes as determined using the Tinneti POMA scale. Considering individual components of Tinneti POMA scale, a major improvement was seen in arising from chair, subjects could arise easily without use of arm rest post intervention, regardless of medium. Also improvement was seen in standing balance, subjects could stand steadily with narrow stance.

Post intervention, subjects in aquatic group could stay steady even if their sternum was pushed(nudged).(6th component). However no difference was seen in land group. This may be due to exercising in water maintains an erect posture. However no difference was seen in subjects of both groups for taking 360 degree turn, this may be addressed with a longer duration of intervention.

Therefore, with the use of the Tinneti POMA scale noted as a significant predictor for falls status, we can say that balance improvements by both groups of subjects were correlated directly with a decreased falls in the future.

CONCLUSION:

1. The results of this study demonstrated that regardless of the exercise medium, significant improvements in balance were achieved, although more improvement was seen in aquatic group.
2. This indicates that use of aquatic exercises are more beneficial than land exercises to improve balance scores in elderly.

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