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For healthy older adults, does participation in a water-based balance training exercise program, when compared to a land-based balance training exercise program, improve balance performance?

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AOTA Critically Appraised Papers Series

Evidence Exchange

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CRITICALLY APPRAISED PAPER (CAP)

Walia, S. R. (2012). A comparison between land-based and water-based balance training exercise program in improvement of balance in community dwelling elderly population. Indian Journal of Physiotherapy and Occupational Therapy – An International Journal, 6(3), 221–227.

CLINICAL BOTTOM LINE:

Occupational therapy plays a significant role in wellness promotion for older adults. Critical to maintaining health and wellness in older adults is prevention of falls and fall-related injuries. One in three community-dwelling older adults reports a fall every year, and the incidence of falls increases exponentially from ages 60 to 65 and 80 to 85. Falls are associated with increased morbidity and mortality from fractures and secondary complications. Leading causes of falls in older adults include decreased balance and an abnormal gait pattern. Balance training programs can help improve balance, decrease the risk of falling, and promote functional independence. However, land-based exercises may pose safety risks or be intimidating to older adults with a fear of falling. The buoyant and viscous properties of water as well as proven clinical evidence of the benefits of aquatic therapy suggest that water-based balance training may be a safe and effective alternative to land-based training to improve balance performance for older adults.

In this study, 60 active and healthy community-dwelling older adults were randomly assigned to one of the two exercise groups: a land-based or water-based balance training group. In both groups, participants attended 5 1-hour sessions per week for 2 weeks of either land- or water-based balance exercise training programs. The results from this study indicated that there was no statistical difference in balance performance following land-based or water-based exercise programs. Although there was no difference between posttest balance performances between the two exercise mediums, both groups showed significant improvement in balance performance following the 2-week intervention.

This study supports existing evidence that balance performance of older adults can be improved with both land-based and water-based exercise programs. Clinical implications of the this study indicate that even within time constraints, land- or water-based balance training programs may provide intervention options to improve balance in older adults. Furthermore, water-based training provides an alternative to land-based training for older adults with risk or fear of falling, as well as opportunity for client preference in activity. This study was limited in size, duration, and representation of the wider older adult population. Future studies

looking into land- and water-based training with more frail and compromised older adult populations would widen the scope of evidence-based approaches for fall prevention. Lastly, although balance performance was assessed, the study did not provide longitudinal data on participants and their future fall history. Thus, no conclusive assumptions can be made that either exercise interventions lessened the participants' long-term fall risk.

RESEARCH OBJECTIVE(S)

List study objectives.

Determine whether water-based balance training exercise is a better medium for improving balance performance than land-based balance training exercise in community-dwelling older adults with active lifestyles.

DESIGN TYPE AND LEVEL OF EVIDENCE:

Level I: Randomized pretest–posttest experimental design

SAMPLE SELECTION

How were subjects recruited and selected to participate? Please describe.

The participants of the study were recruited through a geriatric camp at the Indian Spinal Injuries Center, Vasant Kunj, in New Delhi, India. Residents of Vasant Kunj and family members of inpatients of Indian Spinal Injury Center volunteered. Participants who met the inclusion criteria were randomly assigned to either the land or water exercise intervention groups.

Inclusion Criteria

The older adults included in the study were over the age of 60; healthy; independent in ambulation and activities of daily living; and scored a 24 or higher on the Mini-Mental Status Examination.

Exclusion Criteria

Older adults excluded from the study were receiving physical therapy or another form of formal exercise program at the time of this study; had uncorrected hearing and/or visual impairments; or had Meniere's disease, benign paroxysmal positional vertigo, any neurological or musculoskeletal impairments, any medical illness that might interfere with completion of the exercise program, or any contraindications (e.g., infections, incontinence, fever, wounds) to water therapy.

SAMPLE CHARACTERISTICS

N= (Number of participants taking part in the study)	**60**		
#/ (%) Male	22 (37%)	#/ (%) Female	38 (63%)
Ethnicity	NR		

Disease/disability diagnosis	Participants were healthy community-dwelling older adults

INTERVENTION(S) AND CONTROL GROUPS

Add groups if necessary

Group 1

Brief description of the intervention	In groups of 6 to 8 participants with one instructor, the land-based group received balance exercises on land. Each balance exercise session included a 10-minute warm-up of major muscle group stretching and 40 minutes of conditioning balance activities. These balance activities included weight transferring, reaching exercises, fast walking, side-stepping, walking backwards, hopping and jumping in a circle, team games such as ball relays, and upper and lower extremity range of motion exercises. Following the 40 minutes of balance exercises, there was a 10-minute cool-down period. The cool-down period focused on stretching and deep breathing exercises lying in supine.
How many participants in the group?	30
Where did the intervention take place?	The land-based exercise group took place in the Rehabilitation department of the Indian Spinal Injuries Center.
Who Delivered?	Therapist
How often?	5 60-minute sessions per week
For how long?	2 weeks

Group 2

Brief description of the intervention	In groups of 6 to 8 participants with one instructor, the water-based group received the same warm-up, balance exercises, and cool down period as the land-based group, but received these exercises in water. The water level was between the waist and nipple line and had a temperature of 35° C. Participants were familiarized with the aquatic center 1 day prior to the first exercise session.
How many participants in the group?	30
Where did the intervention take place?	The water-based group took place in the indoor aquatic therapy pool at the Indian Spinal Injuries Center.
Who Delivered?	Therapist

How often?	5 60-minute sessions per week
For how long?	2 weeks

Intervention Biases: *Check yes, no, or NR and explain, if needed.*

Contamination:

YES ☐ NO ☒ NR ☐	*Comment:*

Co-intervention:

YES ☐ NO ☒ NR ☐	*Comment:*

Timing:

YES ☐ NO ☒ NR ☐	*Comment:* Because the intervention was only for 2-week period, there may not been sufficient time to notice a difference between the two mediums that the intervention took place in.

Site:

YES ☐ NO ☒ NR ☐	*Comment:*

Use of different therapists to provide intervention:

YES ☐ NO ☐ NR ☒	*Comment:*

MEASURES AND OUTCOMES

Complete for each measure relevant to occupational therapy:

Measure 1:

Name/type of measure used:	Berg Balance Scale (BBS)		
What outcome was measured?	The BBS was used to test static and dynamic balance abilities in all participants. Using the BBS prior to and after the intervention allowed the researcher to see if there were any changes in balance for all participants during the course of the intervention.		
Is the measure reliable?	YES ☐	NO ☐	NR ☒
Is the measure	YES ☐	NO ☐	NR ☒

valid?	
When is the measure used?	The BBS was used pre- and post-intervention.

Measure 2:

Name/type of measure used:	Timed Up and Go Test (TUGT)
What outcome was measured?	The TUGT was used to measure participants' mobility and static and dynamic balance. Using the TUGT prior to and after the intervention allowed the researcher to see if there were any changes in mobility or balance for all participants during the course of the intervention
Is the measure reliable?	YES ☐ NO ☐ NR ☒
Is the measure valid?	YES ☐ NO ☐ NR ☒
When is the measure used?	The TUGT was used before and intervention.

Measurement Biases

Were the evaluators blind to treatment status? *Check yes, no, or NR, and if **no**, explain*.

YES ☐ NO ☐ NR ☒	*Comment:*

Recall or memory bias. *Check yes, no, or NR, and if **yes,** explain*.

YES ☐ NO ☒ NR ☐	*Comment:*

Others (list and explain):

RESULTS

List key findings based on study objectives

Include statistical significance where appropriate ($p < 0.05$)
Include effect size if reported

The improvement in balance scores on both the BBS and the TUGT did not significantly differ between the land-based and water-based groups ($p > 0.05$). For posttest BBS scores, there was no significant different between the land-based group ($M \pm SD = 55.07 \pm 0.91$) and the water-based group ($M \pm SD = 55.10 \pm 1.32$), with $p = 0.910$. Similarly, no statistical difference was revealed in the posttest scores on the TUGT between the land-based group ($M \pm SD = 9.17 \pm 1.00$) and the water-based group ($M \pm SD = 9.10 \pm 1.19$), with $p = 0.805$. However, a significant improvement in

balance scores from the pretest to posttest on both the BBS and TUGT were identified in both the land-based group (BBS posttest, $M \pm SD = 55.07 \pm 0.91$; pretest, $M \pm SD = 51.53 \pm 1.20$, p = 0.00; TUGT posttest, $M \pm SD = 9.17 \pm 1.00$; pretest, $M \pm SD = 11.01 \pm 1.08$, p = 0.00) and the water-based group (BBS posttest, $M \pm SD = 55.10 \pm 1.32$; pretest, $M \pm SD = 50.97 \pm 3.09$, p = 0.00; TUGT posttest, $M \pm SD = 9.10 \pm 1.19$; pretest, $M \pm SD = 11.01 \pm 1.21$, p = 0.00).

Was this study adequately powered (large enough to show a difference)? *Check yes, no, or NR, and if **no**, explain*.

YES ☐ NO ☒ NR ☐	It cannot be determined if the sample is adequately powered. A power analysis would have helped to determine if the study was adequately powered.

Were appropriate analytic methods used? *Check yes, no, or NR, and if **no**, explain*.

YES ☒ NO ☐ NR ☐	*Comment:*

Were statistics appropriately reported (in written or table format)? *Check yes or no, and if **no**, explain*.

YES ☒ NO ☐	*Comment:*

Was the percent/number of subjects/participants who dropped out of the study reported?

YES ☒ NO ☐

Limitations:

What are the overall study limitations?

Limitations of the study are a program with short duration (2 weeks) and a small sample size ($n = 60$) that limits the statistical power of the study. Additionally, because the participants of this study were from the same community and were active prior to intervention, the results of this study cannot be generalized to other older adults. Specifically, generalization may not be applicable to adults who are frail or institutionalized and who may not perform as well or present safety concerns in land-based balance training.

CONCLUSIONS

State the authors' conclusions related to the research objectives.

This study concluded that both land-based and water-based balance training exercise programs can equally help to improve balance in healthy and active community-dwelling older adults. Following 2 weeks of either land-based or water-based balance training exercises, both groups demonstrated significant improvement in balance, suggesting that balance performance in healthy community-dwelling older adults can improve with balance

training exercises regardless of the medium in which the exercises are performed. For future study, a larger sample size with a more diverse population may increase the generalizability to a larger older adult population. Longer intervention duration as well as more frequent reassessments may provide more information on where gains are made in the land-based and water-based balance training regimen.

This work is based on the evidence-based literature review completed by Sara Pro, OTS; Rajvinder Bains, OTS; and Kitsum Li, OTD, OTR/L, Faculty Advisor, Dominican University of California.