Aquatic Interventions Compared with Conventional Land-Based Interventions to Improve Balance and Mobility in Persons with Parkinson’s Disease: A Systematic Review

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Overview

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2. Purpose
3. Methods
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6. Results
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8. Clinical Relevance
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Parkinson’s Disease (PD)

- ~1 million Americans have PD\(^1\)
- ~60,000 Americans diagnosed with PD each year\(^1\)
- Men are one and a half times more likely to have PD than women\(^1\)
- Persons with PD are three times more likely to sustain a fall\(^2\)
  - Prevalence: 13% weekly, 70% annually\(^2\)
Parkinson’s Disease (PD)

Cardinal Features:\(^3\):
- Rigidity
- Bradykinesia
- Tremor
- Postural instability

Clinical Manifestations:\(^3\):
- Motor performance
- Motor planning
- Gait
- Posture
Aquatic Therapy

Definition⁴:

- Practice of physical therapy in an aquatic environment by a physical therapist
- Includes: treatment, rehabilitation, prevention, health, wellness, and fitness of patient with or without the use of assistive, adaptive, orthotic, protective, or supportive devices
Aquatic Therapy

Designed to improve or maintain:\n
- Function, aerobic capacity, balance, coordination, postural stabilization, flexibility, gait/locomotion, muscle strength/power/endurance
Aquatic Therapy vs. Aquatic Exercise

- **Aquatic Therapy = Hydrotherapy** - Practice of physical therapy in an aquatic environment by a physical therapist⁴

- **Aquatic Exercise = Water-Based Exercise = Ai Chi** - the utilization of water for the improvement of quality of life and achievement of fitness-related or general health-related goals⁴
Purpose

To determine the impact of aquatic interventions compared with conventional land-based interventions on balance and mobility for persons with Parkinson’s Disease
Methods

Databases
- CINAHL
- ProQuest
- Pubmed/MEDLINE
- Science Direct

Search limits
- English language
- Published within past 10 years
- Peer-reviewed
- Human subjects
Search Terms

(aquatic therapy OR aquatic exercise OR aquatherapy OR water based exercise) and (Parkinson* disease)
Selection Criteria

Selection criteria

- Must fit sample population
- Must include both aquatic intervention and land-based exercise intervention

Interventions and comparators

- Comparison of aquatic intervention to a land-based exercise intervention
- Outcome measure of balance and/or mobility

Sample population

- Adults ≥ 18 years
- Confirmed diagnosis of PD (acute or chronic)
- Must be ambulatory (with or without device)
Records identified through database searching (n = 40)
Additional records identified through other sources (n = 1)
Records after duplicates removed (n = 33)
Records screened (n = 33)
Full-text articles assessed for eligibility (n = 10)
Studies included in qualitative synthesis (n = 8)
Records excluded (n = 23)

Full-text articles excluded, with reasons (n = 1)
- Carroll LM, 2017: Did not include a control group which received land-based exercises, patients continued with "usual care"
- Volpe D, 2017: Primarily assessed postural deformities instead of balance and mobility
<table>
<thead>
<tr>
<th>Study</th>
<th>1</th>
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<td>Mean = 6.6</td>
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Study Characteristics

Characteristics of the samples

- Sample sizes ranged from 12-89 subjects (289 total)
- Both males & females were included
- Average age range: 62.41-70.62 years
- H&Y stages: 1-3
Study Characteristics Continued

Programs varied widely

- Length of programs: 4-16 weeks
- Duration of sessions: 45-60 minutes
- Frequency: 1-6 sessions per week
- Pool temperature: 28-34° Celsius
- Pool depth: 0.75-1.5 meters
  - Average of 1.22 meters
Study Characteristics Continued

Various outcomes measures used by the studies

- **5MWT**: 5 Meter Walk Test
- **ABC Scale**: The Activities- specific Balance Confidence Scale
- **BBS**: Berg Balance Scale
- **FES**: Falls Efficacy Scale
- **FOG**: freezing of gait
- **FR**: Functional Reach
- **FTSTS**: Five Times Sit to Stand
- **PDQ-39**: Parkinson’s Disease Questionnaire
- **SPPB**: Short Physical Performance Battery
- **Tinetti POMA**: Tinetti Performance Oriented Mobility Assessment
- **TUG**: Timed Up and Go
- **UPDRS**: Unified Parkinson’s Disease Rating Scale
Aquatic Interventions

- All included warm up and cool down
- Variety of aerobic, balance, motor skills, coordination, joint mobility exercises
Aquatic Therapy Program Example

General Exercises (35 minutes)
- Lower limb (coordination, balance, strength)
  - Jogging with rowing movements: toward/forward
  - Displacements raising knees
  - Stepping movements (rising & lowering on an aquatic step)
  - Vertical position push-up against the wall
  - Half-squat & split-squat
- Upper limb (the swim board)
  - Arm flex/ext & abd/add
  - Bring arms together in front of chest
  - Opening & closing hands
  - Lateral trunk flex
  - Holding onto a swim board with two hands, water is pushed from the chest outwards
- Perceptual (5 minutes)
  - Throwing balls into hoops
## Results

*With respect to the aquatic intervention groups*

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Statistically significant improvements within groups</th>
<th>Statistically significant improvements between groups</th>
<th>Nonsignificant improvements within groups</th>
<th>Nonsignificant improvements between groups</th>
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</thead>
<tbody>
<tr>
<td>BBS</td>
<td>4 out of 5 studies</td>
<td>4 out of 5 studies</td>
<td>1 out of 5 studies</td>
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<tr>
<td>TUG</td>
<td>3 out of 5 studies</td>
<td>1 out of 5 studies</td>
<td>2 out of 5 studies</td>
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<tr>
<td>UPDRS</td>
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<td>PDQ-39</td>
<td>1 out of 2 studies</td>
<td>1 out of 2 studies</td>
<td>1 out of 2 studies</td>
<td>1 out of 2 studies</td>
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<tr>
<td>Gait speed</td>
<td>1 out of 2 studies</td>
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</table>
## Conclusions

<table>
<thead>
<tr>
<th>Study</th>
<th>Accepted aquatic intervention as “as good or better than” land-based intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vivas J et al ('11)</td>
<td>As good</td>
</tr>
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<td>Cancela J et al ('15)</td>
<td>As good</td>
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<tr>
<td>Ayan C et al ('14)</td>
<td>As good</td>
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<tr>
<td>Sage M et al ('11)</td>
<td>NOT as good</td>
</tr>
<tr>
<td>Kurt EE et al ('17)</td>
<td>Better</td>
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<td>Perez-de la Cruz S ('17)</td>
<td>Better</td>
</tr>
</tbody>
</table>
Conclusions

There is moderate to high evidence for aquatic-based interventions as an adjunct treatment to improve balance and mobility for persons with Parkinson’s Disease
Clinical Relevance

- Aquatic therapy is another beneficial physical therapy intervention for persons with PD
  - Aquatic exercise may be utilized as a maintenance program
- Feasibility
- Safety
- Reduction in pain
Limitations of the Study

- Varied protocols/measures
- Interventions impossible to blind to participants/providers
- Databases searched
- Small sample sizes
- Lack of long-term follow-up
Future Research

With regards to persons with PD

- Explore effects of aquatic intervention for those who are not taking medications for PD
- Determine optimal training parameters for aquatic intervention
- Determine effects of aquatic intervention on quality of life
- Explore specific effects of aquatic intervention on gait
- Include long-term follow-up with larger sample sizes
Take Home Message

- Introducing a treatment option that is both enjoyable and feasible for long-term care is important due to the progressive nature of PD
- Aquatic interventions can be performed individually, under the supervision of a PT, or in a group exercise class, which can have social benefits
- Clinicians should consider implementation or referral, as aquatic intervention is a safe and effective option to improve balance and mobility in persons with PD
Acknowledgements

Thank you!

- Dr. Renée Hakim, PT, PhD, NCS
- Dr. Tracey Collins, PT, PhD, MBA, GCS
- Dr. John Sanko, PT, EdD
- DPT faculty & students
References


References Continued


Appendix
## Hoehn-Yahr Classification of Disability

<table>
<thead>
<tr>
<th>Stage</th>
<th>Character of Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Minimal or absent; unilateral if present.</td>
</tr>
<tr>
<td>II</td>
<td>Minimal bilateral or midline involvement. Balance not impaired.</td>
</tr>
<tr>
<td>III</td>
<td>Impaired righting reflexes Unsteadiness when turning or rising from chair. Some activities are restricted, but patient can live independently &amp; continue some forms of employment</td>
</tr>
<tr>
<td>IV</td>
<td>All symptoms present &amp; severe. Standing &amp; walking possible only with assistance.</td>
</tr>
<tr>
<td>V</td>
<td>Confined to bed or wheelchair.</td>
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Questions?