

- *Review Article*

## Effects of practice exercises in water in patients with Parkinson's disease

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**Abstract.** Practiced in therapy purpose, swimming and aquatic activities associated with medication ensure neurological rehabilitation and osteoarticular and helps to delay disease progression and gives the person diagnosed with Parkinson's the chance of independent lives for a longer period of time. For persons in this category of disease, land exercises can be painful, dangerous or unpleasant.

Physical therapy and hydrotherapy is an important therapeutic adjunct in restoring postural balance and in increasing cardiovascular capacity, flexibility and strength, while relaxing in the aquatic environment. Exercising in the water is unique, since it helps a person maintain balance and supports a person's weight while protecting joints from injury. Water offers constant but gentle resistance for the muscles. Exercising to enhance posture control, balance, and muscle function is an important part of the therapy used in the treatment of Parkinson's symptoms. *Conclusions.* Exercising to enhance posture control, balance, coordination and muscle function is one of the parts of the treatment of this disease.

**Key words:** *aquatic rehabilitation, Parkinson's disease, therapy*

### Introduction

Parkinson's disease is not contagious or fatal, but it is chronic and progressive and its symptoms worsen over time and become more numerous. A person found to have the disease should begin an exercise program as soon as possible. Exercise helps to delay disease progression and gives the person diagnosed with Parkinson's only chance in life to be independent for a longer period of time. Worst answer to this diagnosis - inactivity - will lead to muscle atrophy, allowing the disease to progress at a pace faster. Aquatic Exercise is a good way for fitness, an ideal element in which to work because it envelops all of the submerged joints and limbs and acts as a cushion against jarring motions (1). Aquatic exercises will help improve body strength and balance for the person to be less helpless and unable to lead an independent life, active. Parkinson's disease and the Parkinsonian syndrome comprise a group of disorders characterized by tremor and disturbance of voluntary movement, posture and balance (2). People who have disabilities experience a lack of endurance, strength, balance, and flexibility. These physical conditions can be improved with endurance exercises, strength exercises, and stretching. Endurance exercises are aerobic and improve the health of the heart, lungs, and circulatory system by increasing the heart and breathing rate for extended periods of time.

Strength training helps to maintain the integrity of the muscles so they remain strong enough for people to remain mobile and independent. A combination of endurance and strength exercises that focus on posture and walking, along with abdominal exercises, will improve balance and poise thus helping to prevent falls. Stretching keeps the body limber and flexible. All of these basic exercises can be performed easily and comfortably in the water.

People with physical disabilities often suffer from low self-esteem and insecurity about their appearance. Exercise helps people suffering from depression, low self-esteem, and insecurity by releasing a class of neurotransmitters called endorphins, as well as reducing the levels of the stress-depression hormone, cortisol.

Endorphins are neurotransmitters that are formed in the body by the pituitary gland and act like morphine to relieve pain. Endorphins regulate the concentration of the intestinal wall and help the body to cope with stress, pain, and emotions. Exercise releases endorphins in the body giving the exerciser a euphoric feeling. Exercise also helps a person suffering from depression regain feelings of accomplishment, which leads to improved self-esteem and ultimately a more positive perspective on life.

### **Complexity of the task of coordination in fluid environment**

Neuro-muscular coordination is that relationship between synergistic and antagonistic muscles. By coordinating the movement phase means swimming or partial movements such as movements of arms and legs. In the process of adjustment and control of swimming movements it is a plus in the muscle antagonistic forces: gravity, friction, water resistance, air. As these forces become active in driving actions are always changing in intensity, direction and point of application, the task of coordination is complicated.

Swimming, as a means of moving through water is done in a environment more dense than air parameter that differs depending on the concentration of water. These features of the aquatic environment generates other characteristics of proprioceptive reception, leading to changing conditions of practice of anti-gravity muscles. When a practitioner entering the water to the neck, the force of gravity is greatly reduced. Coordination is more difficult due to reduced possibilities to maintain the body in a certain position from the center of gravity, balance is maintained with difficulty.

Assembly of psychomotor skills in water-controlled, namely the development of coordinating capacities, it is a crucial component of the process of organizing and regulating movement.

Water balance is maintained based on sensory information taken from the central nervous system that takes the impressions offered by the vestibular analyzer and optical and adjusts the position of head, trunk and body segments.

Balancing in the fluid environment the homogeneous bodies takes place by overlapping the center of gravity with the press. The human body has difficulty in achieving balance through specific particularity of the lower body than compared to the rest of the body. In obtaining a balanced position on the water, a major role is especially of the proprioceptive sensors (vestibular and kinesthetic). In the framework of coordination exercises, an important role is to processing of these sensory components.

Development and improvement of vestibular-kinesthetic reception is the primary tasks for a rapid and accurate balancing body fluid environment.

Coordinating abilities are influenced by: receiving and processing information quickly of sensory

motor experience; coordinating intra- and intermuscular; ability to transfer motor skills; fatigue and other associated factors, age and sex.

Ability to balance cancel the asymmetrical dynamic forces that acting on the body after extensive movements. These include changing the position or, more precisely, the center of gravity shift. Balancing it requires precise differentiation of the signals about changes in character movement. This psychomotor skill ensures: keeping lateral alignment, movement can be done in a straight line, position the body balanced and high in water; heading right back to approximately horizontal surface.

### **Basic principles of exercise**

Physical activities meet the needs of people with Parkinson's disease, with symptoms that do not diminish, thus focusing on the benefits of aquatic exercise. People who have experienced these conditions felt no resistance, strength, balance and mobility.

These physical conditions can be improved with resistance exercises, strength and stretching. Exercises are aerobic and improve heart health, lungs and circulatory system by increasing heart rate and breathing for extended periods of time. Strength training helps maintain muscle integrity to maintain mobility and independence. A combination between strength and power exercises that focus on the posture and walking, associated with abdominal exercises, improve balance and posture, thus helping to prevent falls. Extent of flexibility and efficiency helps the body. All these basic exercises can be performed easily and comfortable in the water. Water is an ideal element in the developing area of motion in all joints and limbs submerged area and acts as protection against vibration movements. Floating on the water offers help to support body weight and improve balance. How the water is a heavy fluid, constantly meets resistance. The body tends to float and movements such as walking through the water helps the body to resist the temptation to float. This requires greater muscle effort to meet. As the body moves through the water in all directions, the muscles are active on both sides of the joint in a balanced position. The water pressure makes it easier to maintain stable body center in an upright position. The density of water allows movement in a wide variety of plans: vertical or sagittal, frontal or coronal and transverse or horizontal.

Aquatic activity facilitates the movement of the body in multiple planes.

Water movement is similar to the action of lifting weights. As he works hard to move through the water, the more resistance it encounters. This form of muscle activity is different from that in use they stabilize body weights, except for muscle groups that are in action. Weights are stabilizing the abdominal region while the water sets the abdomen in an upright position. This is because this region acts as a stabilizing force in the water, the body does not rely on stabilizing factor of the loads. The abdominal muscles that work in water are used to help maintain fair and balanced position in various exercises.

The types of exercises recommended for Parkinson's disease are those that help maintain the capacity of the tasks necessary daily living independently. These exercises include mobility and elasticity of the region like back, shoulders and neck. Other exercises emphasize leg strength and elasticity to improve balance, posture and walking. Walking exercises in water provides increased strength while imitating moves used in everyday life.

There are many activities that are good forms of exercise. Among these are walking, swimming, running and cycling. However, when people with Parkinson practice running exercises on land, they often demand too much and causing pain, causing cessation of exercising. Stiff joints become stiffer and independent movements become more difficult.

The benefits of exercising in water are numerous and aquatic therapy has been shown to help people with Parkinson's. Water exercises are actually safe. Joints, muscles, bones are not forced, pulled or broken due to the damping effect of water. If a person practicing in water, only 10% of body weight is exerted on the joints, compared with 3 times higher than if they run on land. When practice in water up to 90% in body neck floats.

Due to floating in water, body weight is supported allowing more freedom of movement joints. Water and floating support reduces pressure on the bones and muscles impact exercises performed on land than the same exercises performed in water safer. Therefore, a person with Parkinson's may run, walk and lie down without risk of injury and claim that the exercises performed on land programs.

Aquatic therapy program is based on four principles:

- Float. Pushing water up acting in opposition to the force of gravity down. This interdependence allows a person to practice with low force to joints, bones and muscles.

- The force of resistance. Water offers resistance to movement in all directions, supports muscle balance and stretch muscles antagonists and agonists pairs. Depending on the speed of movement, water resistance is an area of 4 to 42 times greater than air resistance.

- Hydrostatic pressure. Hydrostatic pressure exerted on the surface of the sank body helps blood flow from extremities back to the heart. Hydrostatic pressure helps to increase resistance against the chest capacity, forcing the respiratory muscles to work stronger and becoming more developed. Hydrostatic pressure to the extremities helps improve blood pressure heart rate during water exercise.

- Heat. Most therapeutic pools are kept at a temperature of 34-35<sup>0</sup> C. The hot water helps to relax muscles, increase circulation and reduce joint stiffness. This allows joints to move a greater range of motion.

Only knowledge of the examiner, clinical experience and diagnostic testing followed by treatment can conclusively define the problem (3). For a person with Parkinson's to benefit fully from aquatic exercise is important for the participant and caregiver to follow certain criteria:

- People with Parkinson's should carry out an exercise program of 15 to 20 minutes daily. In addition they need sufficient time for equipment, heating and allow the body to recover. The actual time for the entire activity can be increased depending on the participant's capacity, medication and physical strength.

- Heating should be done for at least 5 minutes before starting any exercise. The heating can be a combination of light and gentle stretches for arms and legs in place. Adequate heating encourages blood flow to muscles and helps prevent injuries.

- The full potential of each person can be achieved through proper execution of exercises. Partner or trainer is designed to assist, by means of an effective, positive, visually and verbally and monitor progresses.

- Before increasing the intensity or number of repetitions of each exercise, exercises must be performed at a constant level for 4-5 days. After that, if exercises are not as demanding and can be performed without difficulty, can increase the intensity or number of repetitions.

- Heating is important to start exercise program and is essential in maintaining and improving mobility. After each meeting is to be performed deep breathing exercises.

- Stretching is to prepare the inferior and then the upper body to prevent injuries and to stimulate circulation to the muscle. The exercises can be performed in sitting by the pool or in water up to chest level.

With more options, exercise programs can vary: more exercise out of the water, practicing only in water, especially when the water gives the sensation of cooling and quiet.

An extremely important component of rehabilitation programs for patients with Parkinson's disease is represented by aerobic exercises. These are activities that increase heart rate and breathing for a period of time, involving large muscle groups moving and buttocks muscles, the thighs and calves. People with Parkinson's cardiovascular program should perform aerobic exercises or other large muscle groups working at least 10-15 minutes per lesson. Aerobic exercise is also known as cardiovascular or cardio exercises because they increase the amount of oxygen used by the body, improving cardiovascular and respiratory adaptation to effort.

In the initial phase of the disease would be appropriate to run continuously for 20 minutes or more aerobic exercise. However, people who get more advanced stage of disease may be exhausted after 15 minutes.

Individual capacity and the resistance varies from day to day. As the exercises become more demanding due to disease progression, it becomes necessary to reduce the intensity of exercise to maintain the same duration of time. Thus, strength and effort levels will remain the same.

Aerobic exercise should not be performed until exhaustion. Breathing should be done easily, being able to carry on a conversation during the execution of aerobic activity. Patient and partner should be aware when he crossed the threshold of cardiovascular. When is the inability to formulate complete sentences, means that its intensity exceeded cardiovascular exercise should be reduced.

For diversification program runs one of aerobic exercises all the time and two, three or four different aerobic exercises will take place on equal time periods. If aerobic phase of lesson is divided between different exercises, the companion must ensure that the transitions

between exercises are short, so that the benefits of aerobic exercise is not lost.

*The use stretching.* Maintained stretches should be performed 20 to 30 seconds for the muscles to relax completely. Inspiral phase occurs on stretching and exhale on the relaxation. Extent not cause pain or discomfort. It will be done during these stretches deep diving for heart rate to fall to the rhythm of rest. The benefits of stretching both the beginning and end of exercise program are represented by the improvement of cardiovascular and respiratory function, improve joint mobility, reduce muscle tension, decreased risk of traumatic osteoarticular pathology, improving mood.

Aquatic activities can be made depending on the intensity of exercise and stage of disease. As the disease progresses, modifications and variations can be made to do exercises. Physical capabilities of a person with Parkinson's varies greatly from day to day. From this point of view it is important to remain active on a regular basis, only concerned with the daily progress.

#### **Effects of practice exercises in water in patients with Parkinson's disease**

Aquatic therapy program goals are to reduce pain, increase range of motion and mobility, maintain or improve muscle strength, maintain or improve balance, maintaining or improving cardio-respiratory condition.

The main reasons for resort to aquatic exercise are progressive bradykinesia, rigidity, tremors and imbalance. Bradykinesia is manifested by slowing and limiting the movements significantly. Swimming and aquatic exercises help alleviate symptoms and stiffness, because joints and muscles are free from tension and load. Therefore, it is easier to achieve a full range of motion in water.

Most painful symptom of the disease is tremor. Tremor occurs in a person's ability to engage in voluntary movements and affects mainly the upper body. Aquatic Exercise helps reduce symptoms of tremor, allowing development in an environment that helps control muscle. Smooth and deliberate movement is facilitated by water due to floating, resistance and hydrostatic pressure.

The balance is a problem in the beginning. Water is the ideal environment for compensation because it surrounds the person offering increased support. There are many exercises that can be performed in water, which increases the balance.

As a person moves through the water and moving their limbs through the water, have water resistance. When muscles are moving, working in pairs in opposition but sync. When a muscle contracts, the opposite muscle relaxes. Muscles performing the movement are called agonists. When the agonist muscle contracts, the muscle opposite antagonist relaxes, allowing the continuation of the movement. The return movement, the roles are changed. All pairs of muscles have a specific correlation of force one another. When that relationship is out of balance, possibly due to involvement of only a pair of muscles, the body works effectively and without risk of injury.

When a person with Parkinson's disease equilibrium is disturbed by the effects of agonist muscles and stiffness. To be effective, training must be done both for the muscle agonists and antagonists. Exercising in water forces the muscles to work in pairs.

The physical properties of water change water exercise intensity. Two of these properties are drag and speed. Drag resistance is the force that opposes motion in water. Speed is the time with which an object moves. When braking is coupled with increased speed, increased aquatic resistance occurs. Water resistance is proportional to the need for speed, to move through it. Other properties of water which increases water resistance and hydrostatic pressure are floating. Float is the force exerted on a submerged object. An example of a floating force is demonstrated by holding a Styrofoam dumbbells underwater. How Styrofoam material is lighter than water, body weights Styrofoam take-up. By using muscle to force the dumbbell to remain under water resistance is achieved.

Hydrostatic pressure provides a pressure equal to the whole body. Helps lower limb with swelling and increase circulation. Hydrostatic pressure does not affect the intensity of water resistance as the body reacts to the intensity of water resistance. Muscle balance helps to decrease problems of posture. Aquatic resistance allows the muscles to move more slowly and the reaction time is slower, thus improving balance.

Another benefit of aquatic exercise is weight control. Aerobic exercise in water can burn 460 calories on average per hour. Although land exercises can burn up to 600 calories per hour, aquatic exercises burn fat 77% of calories. Aerobic exercises on land 43% of fat burn. The water activities are done more easily as both

aerobic and anaerobic training. Preparation takes place by moving moderate aerobic, continuous large muscle groups over a longer period of time. Anaerobic preparation is done when the resistance exceeds the usual and use a lot of energy in a short period of time. Resistance training is important in stressing the cardiovascular system, which improves general function recovery process (4). An example of exercise that provides improved aerobic capacity and anaerobic exercise in water is running through the water. Walking through water at high speed can push beyond the threshold aerobic effort.

For people with Parkinson's, an aquatic exercise program improves the confidence level and extended functional independence (5).

Maintain normal muscle tone and function is an important part of Parkinson's disease. With a specific exercise program, it can compensate deficiency disease caused by movement, so much improved mobility and independence. If necessary daily living skills are enhanced by some specific forms of exercise, it is important to maintain these exercises.

Through the benefits of aquatic exercise is include the physiological ones and improve circulation, mobility, strength, coordination, range of motion, lung function ventilatory muscle weakness of neuropathic origin (6), spatial awareness and perception. Among psychological benefits are improved tone psycho/emotional, self-esteem and body image on. Physical activity for people with Parkinson help maintain the independence of physically for a while longer. However, a person with this condition should consult her physician and so that physical capabilities are assessed by a physical trainer or therapist before starting an exercise program.

One of the many fears that people with Parkinson's disease is the loss of their independence. People affected by this disease suffer from a condition known as „freezing“. If this occurs when a person is in water and can drown because muscles contract and locks. They can also present an acute fatigue requiring assistance to exit the pool. For people with Parkinson's is important for safety reasons, to be continuously monitored during the practice by the trained staff. Proprioceptive neuromuscular facilitation techniques are defined as methods of promoting and accelerating the response by stimulating the proprioceptive neuromuscular mechanism (7) - these methods can be applied to

different structures of exercises to enhance strength and mobility.

For patients with Parkinson's, aquatic exercises may be included as part of comprehensive treatment program, in addition to diet and medication, as it helps to improve balance, coordination, muscle tonus, muscle strength and flexibility. Exercising in water also helps to improve driving: floating support body, creating the possibility of larger steps in water, and improving walking and on land.

Many patients with various diseases, including those with Parkinson says that movement is not only easier in the water but less painful, increased relaxation, a decrease in muscle spasm and pain, and an increase in range motion and strenght during aquatic therapy sessions (8).

Aquatic exercise helps maintain body posture. Setup requires a hydrostatic pressure of the bust. Abdominal and back muscles balance the trunk. The water has the effect of reduction of trunk stiffness. Going with a step stronger, long and safe, center of gravity changes in the body and facilitates progress in the right position. Working against the water resistance results in strengthening muscles. Float provides a cushioning effect. Bent posture can also help by directing the look forward and not down at his feet. By keeping the shoulders, chest, back and upper part of the strained neck muscles will get a better posture.

Aquatic exercises have an effect on speech. Impairment of muscle that controls breathing and vocal cords causes speech problems. Therefore, the ability to articulate, intonation and rhythm of speech are affected. The best therapy is to achieve speech dysfunction facial exercises and speech therapy initiation.

Exercise forces the person to breathe deeply and regularly. While practicing with a partner, the person with Parkinson's may engage in conversation using speech as a means of rehabilitation, exaggerated gestures, speaking in short sentences with a focus on concise articulation of words.

Aquatic exercises can help increase self confidence through social interaction. By improving posture, gait, strength and flexibility it is create more confidence. The person is able to demonstrate that lead an active life, self, will feel even better. Practice not only improves physical abilities, but helps to increase self-esteem of the person and psycho-emotional tone improves.

## Conclusions

Value aquatic therapy physiological and psychological perspectives is a topical issue in the rehabilitation of subjects diagnosed with Parkinson's disease. In the limited research that examined the benefits of aquatic physical therapy professionals say that uses empirical observations of this form of treatment. Physical elements of the float, the density of water, hydrostatic pressure and high temperature of the water have the effect of relaxation, reduce pain, improve circulation and increase tolerance execution of the exercise, making performance in the pool the best treatment option for recovery. Water quality of support and resistance are possible starting strength and resistance exercises after hours or days after injury or surgery.

The same qualities that allow early motion, make able to participate in physical training programs such as walking or running in shallow or deep. Physiological benefits of these activities have been documented by several researchers. Maintaining physical training may be the critical factor in extending a normal everyday life.

Force growth is an advantage. Water resistance is much higher than the air (about 12 times), the exercises performed in the aquatic environment engage more muscles and are more difficult. Exercises in water, in an unstable environment require participation of all muscle groups in an attempt to maintain posture.

To maintain flexibility and increase joint movement, stretching in water is the best way (9). As the body relaxes best in hot water and proper breathing is rhythmic and regular, can be done exercises for stretching. Aquatic fitness stimulates blood circulation, increasing blood volume in areas with lesions.

Participation in a regular program of exercise is an effective intervention to prevent or reduce functional declines associated with the general aging process. Endurance training can help maintain and improve various aspects of cardiovascular function. Strength training helps offset loss of muscle mass and strength typically associated with normal aging. If exercises are performed in water, the resistance of water can be used for strength training. Regular exercise improves bone health and postural stability, increases flexibility and range of motion (10).

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