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Aquatic Exercise and Potential Health Effects

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Abstract

This review addresses the potential effects of aquatic exercise on human health through a comprehensive literature review and examines its effects on a variety of health conditions in terms of its impact on cardiovascular health, a range of diseases, mental health, muscular strength, flexibility and endurance, as well as the benefits that aquatic exercise offers in terms of pain management and improving functional capacity in chronic health conditions such as osteoarthritis, fibromyalgia and certain cardiopulmonary conditions and many diseases. This research is a systematic review. We searched the Pubmed, Google Scholar and SPORT Discus databases for published clinical and randomized controlled trials on "Aquatic Exercise and Potential Health Effects". A total of 150 studies were found. A total of 50 studies with a high level of evidence, including non-surgical methods, were systematically analyzed. This wide range of research shows that aquatic exercises and its various applications can be adapted to different health conditions and rehabilitation needs. Aquatic exercise programs for specific health conditions have the potential to improve an individual's quality of life by providing both physical and functional improvements. The review of these studies demonstrates how aquatic exercises can be evaluated in health and rehabilitation with a multidisciplinary approach. Aquatic exercises is a powerful tool for the treatment of various health conditions and provides a safe and effective form of exercise suitable for people of all ages. The positive effects of these exercises on health are supported by an extensive body of scientific literature.

Keywords: *Aquatic Exercise, Health Effects, Rehabilitation*

INTRODUCTION

Aquatic exercises are physical activity that makes use of the physical properties of water. These properties include buoyancy, hydrostatic pressure and viscous resistance. The buoyancy of the water supports part of the body weight, which reduces the strain on the joints. This makes aquatic exercises particularly suitable for rehabilitation and the treatment of chronic pain. (Becker, 2009).

Exercise in water offers significant benefits for cardiovascular health, muscle strength and flexibility and is ideal for older, obese or chronically ill people as it is more effective compared to exercise on land (Mattos et al., 2016). In addition, aquatic exercise can effectively reduce symptoms of anxiety and depression, as the calming effect of water and group activities promote social interaction (Martinsen, 2014). This type of exercise has been practiced in various forms for centuries and is now considered an effective means of rehabilitation, improving physical fitness and treating chronic illness. The buoyancy of the water allows people to move through the water with less effort, making exercise more accessible, especially for people with physical limitations (Becker, 2009). In addition, the resistance of the water engages the muscles in a different way than land-based exercises, making aquatic exercise a viable option for a variety of fitness goals (Mattos et al., 2016). These exercises can provide significant benefits for cardiovascular health, muscle strength, flexibility and overall physical endurance (Martinsen, 2014). Acute exercise is known to have many benefits for human health. This study was designed to comprehensively examine these benefits and present the available scientific evidence for the health effects of aquatic exercise programs. This review is intended to be useful to researchers in the fields of sports science, physiotherapy and rehabilitation, health professionals and anyone interested in aquatic exercise in general.

MATERIALS AND METHODS

Research Model

This research is a systematic review.

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Research Design

We searched the Pubmed, Google Scholar and SPORT Discus databases for published clinical and randomized controlled trials on "Aquatic Exercise and Potential Health Effects". A total of 150 studies were found. A total of 50 studies with a high level of evidence, including non-surgical methods, were systematically analyzed.

RELATED LITERATURE

Effect of Water Temperature

Body temperature depends on the balance between heat production and heat loss. The body temperature of people moving in underwater environments can change, as can the body temperature of water sports enthusiasts at the edge of swimming pools. When entering water, body heat is lost mainly through conduction and convection. Water has about 26 times the thermal conductivity of air and body heat is lost four times faster at the same temperature (Wilmore and Costill, 1994). When you move in water, such as during underwater exercises, heat loss is further increased by convection (Data et al., 2006). Heat loss in water is linearly related to water temperature and immersion time (Craig, 1983). Cold water (e.g. 14 ºC) leads to a decrease in rectal temperature and an increase in heart rate by 5%, systolic blood pressure by 7% and diastolic blood pressure by 8 compared to controls at air temperature (Srámek et al., 2000). The physiological adaptations are mediated by humoral control mechanisms, with the effect of cold water mainly increasing the activity of the sympathetic nervous system (Srámek et al., 2000). at a temperature of 40 ºC, the heart rate increased during and after exercise, while the index of the parasympathetic system of the heart decreased during exercise (Nahimura et al, 2008). During exercise, slowed enzymatic processes and nerve conduction, which impair force development, reduce muscular endurance during dynamic contractions (Drinkwater, 2008). Water temperatures around 27 ºC appear to be suitable for appropriate acute physiological responses during aquatic exercise. However, different aquatic exercise programs result in different exercise intensities, so appropriate water temperatures are required to feel comfortable and/or avoid thermoregulatory stress (Drinkwater, 2008). For example, if the goal of the activity is relaxation, range of motion improvement and/or flexibility training, the water temperature should be increased to a thermoneutral value. The appropriate water temperature should also take into account the different characteristics of the populations. The water temperature should be adapted to the individual from the start of the training session. Older people, for example, require a higher water temperature than younger adults. With this in mind, the Aquatic Exercise Association (2008) states in its water temperature standards and guidelines that the water temperature for aqua fitness programs should be between 28-30 ºC.

Application Methods and Diversity

Aquatic exercise programs can include different types of exercises, such as water aerobics, resistance, swimming and underwater walking. These programs can be adapted according to the age, health and physical ability of the participants. The equipment used in aquatic exercises (e.g., water weights, swim boards) maximizes the effectiveness of the exercises by increasing resistance (Martinsen, 2014; Jones et al., 2016; Thompson, 2017). Trainers should continuously monitor the fitness and exercise intensity of participants and adjust as necessary (Thompson, 2017).

Water aerobics: Water aerobics is a series of exercises designed to increase cardiovascular endurance through the resistance of water. These exercises are usually performed in a group with musical accompaniment and can be performed on the water surface or in deep water (Martinsen, 2014).

In-water walking and running: Walking and running in water: Walking and running in water is less strenuous than similar activities on land and reduces stress on the joints due to the buoyancy of the water. This type of exercise is particularly recommended for people undergoing rehabilitation (Jones et al., 2016).

Swimming: Swimming is a form of aquatic exercise that increases general fitness and improves cardiovascular health through different swimming styles. Swimming is an effective workout for the whole body and is suitable for different age groups (Martinsen, 2014).

***Hydrotherapy*:** Hydrotherapy, which is used specifically for rehabilitation purposes, involves customized exercise programs that take advantage of the therapeutic properties of water. These exercises are usually prescribed by physiotherapists to treat specific health conditions.

Health Effects of Aquatic Exercise

The possible health effects of water sports include improved musculoskeletal health, a lower risk of chronic diseases and an improved quality of life. For example, people with chronic pain conditions such as osteoarthritis and fibromyalgia can reduce their pain and increase their functional capacity through regular exercise in water (Jones et al., 2016). The potential health effects of aquatic exercise offer a variety of physical and mental health benefits. This review article examines the effects of aquatic exercises on health and highlights the importance of aquatic exercises for health based on key studies and evidence in the field.

Effects on Cardiovascular Health

Water aerobics offers considerable benefits for the cardiovascular system. Regular physical activity in water helps to lower heart rate and blood pressure and increase cardiovascular endurance (Martinsen, 2014). These effects are achieved by both the resistance and the cooling effect of the water, which allows individuals to exercise for longer and thus improve their cardiovascular health more effectively. There are studies that show that water exercise has positive effects on cardiovascular health. For example, improvements in heart rate, blood pressure and overall cardiovascular endurance have been observed in people who do water aerobics (Tanaka, 2009).

Muscle Strength and Flexibility

Aquatic exercises are also effective for increasing muscle strength and flexibility. The water resistance challenges the muscles in a different way than exercises on land, which helps to strengthen different muscle groups (Jones et al., 2016). In addition, buoyancy in water allows for a greater range of motion, which contributes to greater overall flexibility and mobility.

There is evidence that resistance training in water increases muscle strength and flexibility. The resistance of water provides an alternative strength training to land-based exercises and places less stress on the joints (Colado and Borreani, 2013).

Pain Management and Rehabilitation

Aquatic exercises have an important role in pain management and rehabilitation. The buoyancy of the water supports the body and reduces pressure on painful joints and muscles. This is particularly beneficial for people with chronic pain conditions such as osteoarthritis and fibromyalgia (Thompson, 2017). In addition, aquatic exercises can speed up the healing process after injuries and can be an effective method of post-operative rehabilitation.

Effects on Psychological Health

Aquatic exercises also has positive effects on mental health. Physical activity in water can help to reduce stress and anxiety, improve mood and increase overall mental wellbeing. The relaxing nature of water and the fact that exercising in a group encourages social interaction underpin these psychological benefits (Martinsen, 2014).

Quality of Life: Studies on people with chronic illnesses show that water aerobics can significantly improve quality of life. These exercises have positive effects on pain management, physical function and general well-being (Li et al., 2012).

Stress and Anxiety: There are studies that show that water exercises effectively reduces stress and anxiety. The relaxing effect of water and its contribution to physical and general mental well-being play an important role in these results (Biolsi et all, 2023).

Balance and Coordination: - Balance and coordination: It has been observed that aquatic exercise programs improve balance and coordination in older people and reduce the risk of falls. This is due to the buoyancy of the water, which provides a safe environment to work on balance (Wayne & Kaptchuk, 2008).

DISCUSSION

Aquatic exercises is an exercise programme designed to improve the physical and mental health of the individual through the properties of water. By utilising the buoyancy, resistance and hydrostatic pressure of water, these exercises aim to effectively develop muscular strength, endurance, flexibility and cardiovascular health while reducing the stress and risk of injury caused by land-based exercises and can be performed in different depths of water, with a variety of equipment and at different intensities. As noted by Becker (2009) and Smith & Jones (2015), aquatic exercises offer an exercise alternative that is not particularly stressful on the joints, thanks to the buoyancy of the water, and is therefore ideal for people with chronic conditions such as osteoarthritis. This review examined the existing academic literature on the topic, focusing on the application methods and variety of aquatic exercises and discussing the various health effects of these exercises.

Research on aquatic exercise shows that it can improve physical function and quality of life, especially in people with conditions such as chronic pain, fibromyalgia and postural dysfunction, cardiovascular diseases, some physiological parameters, depression, anxiety, chronic pain and spinal problems. For example, a study published by Sova and Konno (2000) documented a significant reduction in stress levels and an improvement in quality of life when Ai Chi was practiced in water.

The focus on the effects of aquatic exercises on depression, fibromyalgia, physiological parameters and general disease management underlines the multidisciplinary nature of this therapeutic approach and its potential in the health sector. For example: "A literature review shows that the buoyancy and resistance of water reduces pain, relieves symptoms of depression and improves overall physiological health parameters in fibromyalgia patients. Aquatic exercises utilizes the unique properties of water to reduce gravity-induced pressure and increase joint range of motion, making it particularly valuable for individuals with chronic pain and patients undergoing rehabilitation. This study shows that aquatic exercises has the potential to improve overall health and quality of life and can be used as an effective rehabilitation tool for certain health problems (Zamuner et al., 2019).

Silva et al (2019) found that aquatic exercises performed twice a week for 12 weeks in depressed older people provided significant benefits such as reducing depression and anxiety, improving functional autonomy and reducing oxidative stress. These results highlight the effectiveness of aquatic exercises in promoting physical and mental health by utilizing the unique properties of water. On the other hand, the study by Dunn et al. (2005) showed that five different aerobic exercise programmes performed three to five times a week over a 12-week period led to a similar reduction in depression scores in adults diagnosed with depression. Both studies demonstrate the positive effects of different types of physical activity on depression and overall improvement in quality of life. These findings reinforce the role of physical activity in the treatment of depression and anxiety and emphasise the therapeutic value of a wide range of forms of physical activity. In this context, the study by Silva et al. (2019) highlights the specific benefits of aquatic exercise, while the research by Dunn et al. (2005) suggests that aerobic exercise provides similar health benefits from a broader perspective. Taken together, these two studies suggest that the variety of exercise types and frequency of exercise can have positive effects on physical health as well as mental health conditions such as depression and anxiety.

The meta-analysis by Bidonde et al. (1996) analyzed the results of 16 studies on 881 people with fibromyalgia and showed that in comparisons between aquatic exercise (AE), land training and control groups in terms of pain, stiffness, muscle strength and physical functioning, AE achieved better results in all parameters compared to the control group. However, it was found that there was no significant difference between aquatic exercise and land exercises and that land exercises was only more effective than aquatic exercise in increasing muscle strength. These results suggest that aerobic and land exercises play an important role in the treatment of fibromyalgia and that land exercises may be more beneficial especially in increasing muscle strength. (Evcik et al. (2008) found that aquatic exercises had long-term effects on pain management in fibromyalgia patients who exercised three times a week for 60 minutes each time for 5 weeks. This finding suggests that aquatic exercises

may be an effective means of pain management for fibromyalgia patients and an alternative treatment for certain conditions. Different types of exercise have been shown to provide significant benefits in the treatment of fibromyalgia. Aerobic and land exercises appear to have a positive effect on general physical performance and muscle strength, while water exercises offer long-term benefits, particularly in pain management. These results underline the importance of a comprehensive exercise programme in the treatment of fibromyalgia patients and show that different types of exercise can improve patients' quality of life through their complementary effects. Therefore, integrating these types of exercise in a combination according to patients' individual needs and preferences into treatment plans can help to achieve the best results.

The effects of aquatic aerobics on health and physical parameters have been investigated in a large number of studies. The study by Çağlar (2022) documented that regular Zumba and aquatic aerobics three days a week led to statistically significant improvements in various physical parameters such as body weight, body mass index, lean body mass, flexibility, balance, fat mass, chest, hip and waist circumference and body fat percentage. These results suggest that aquatic activities have the potential to improve body composition and overall physical health.

Türkmen & Çağlar (2022) demonstrated the positive effects of aquatic and step aerobic exercises on flexibility in an 8-week study of sedentary individuals and observed significant improvements in all flexibility parameters. This study underlines the effectiveness of aquatic aerobics in supporting physical functionality and increasing flexibility.

Ochoa Martinez et al. (2014) showed that a 12-week aquatic exercise programme improved functional autonomy in older women, suggesting that aquatic exercises can improve the quality of independent living in the older population. Wang et al (2007) also found that aquatic exercises in adults with hip or knee osteoarthritis resulted in statistically significant improvements in physical fitness (flexibility, strength and aerobic fitness), but had no effect on reported physical functioning and pain. This suggests that aquatic exercises may be a valuable tool for rehabilitation strategies tailored to specific conditions.

Studies on the health effects of Tai Chi have demonstrated that this discipline provides a variety of health benefits, particularly reducing stiffness, improving balance and reducing the risk of falls in older people, and improving cardiovascular health in people with heart disease (Wayne and Kaptchuk, 2008; Li et al., 2012). This suggests that Tai Chi has positive effects on both physical and mental health.

Aidar et al (2006) found evidence that physical exercises performed in water for 12 weeks can increase functional independence. Taken together, these findings suggest that aquatic exercises and Tai Chi are valuable methods for promoting and improving physical health in a range of health conditions and populations. These studies underscore that aquatic exercises and Tai Chi should be considered important components of comprehensive health and rehabilitation programs.

Exercises performed in water offer unique benefits for rehabilitation and the development of physical health. The study by Kutzner et al (2017) has shown that exercises performed in water reduce the load on the joints by 30-32% of the body weight, while the load on the joints increases by 59% during dynamic exercises due to the frictional resistance generated by the water. This suggests that exercises in water can provide various benefits in the rehabilitation process by personalizing them through the use of exercise equipment that provides speed of movement and additional resistance. In particular, the use of dynamic lower limb exercises in a swirling environment in water improves the neuromuscular function of the quadriceps and hamstring muscles by strengthening the agonist muscles and weakening the antagonist muscles (Pöyhönen et al., 2001; Kelly et al., 2000), while shoulder rehabilitation studies suggest that aquatic activities require 25% less muscle activation than land-based exercises, which is beneficial for shoulder movements.

Heywood et al (2017) have shown that the strength-enhancing effect of exercises in water on the hip and knee muscles is limited, but provides a safe space. This is important to reduce the risk of falls and provide the opportunity to be active early in the rehabilitation process.

The study by Roostaei et al. (2017) emphasized that swimming can improve spinal stabilization, especially in the supine position, while the study by Bressel (2012) showed that stabilization of the abdominal muscles and

exercises with an exercise ball in water are more effective than exercises performed on land. Similarly, tai chi studies have also shown the superiority of aquatic exercises in reducing stiffness (Calandre et al., 2009).

Studies in patients with ankylosing spondylitis and postmenopausal osteoporosis have shown that aquatic exercises has positive effects on pain, spinal mobility, disease activity, dysfunction and quality of life and may provide some benefits in maintaining and increasing bone density (Dundar et al., 2014; Simas et al., 2017).

Studies comparing the Halliwick method and the Bobath technique have shown that aquatic exercises improves postural stability and respiratory function in people with spinal problems and in children with spinal problems, and that Ai Chi reduces pain, fatigue and muscle spasms and improves quality of life in patients with multiple sclerosis (Oppenheim-Gluckman et al., 2005; Hutzler et al., 1998; Castro-Sanchez, 2012).

CONCLUSION

This wide range of research shows that aquatic exercises and its various applications can be adapted to different health conditions and rehabilitation needs. Aquatic exercise programs for specific health conditions have the potential to improve an individual's quality of life by providing both physical and functional improvements. The review of these studies demonstrates how aquatic exercises can be evaluated in health and rehabilitation with a multidisciplinary approach.

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